



CARE OF SUSPECT/CONFIRMED COVID-19 NEWBORNS
Interim Guidelines
Version 4, September 25, 2020

Abbreviation	HCW – health worker
AAP - American Academy of Pediatrics	LDH - serum lactic dehydrogenase
ABG - arterial blood gas	MOM - mother’s own milk
AGP - aerosol generating procedures	MV - mechanical ventilation
ALT - alanine aminotransferase	NBS - newborn screen
AOG - age of gestation	NICU - Neonatal Intensive Care Unit
ARDS - acute respiratory distress syndrome	NIPPV - non-invasive positive pressure ventilation
AST - aspartate aminotransferase	NPS - nasopharyngeal swab
CBC - complete blood count	PCT - procalcitonin
CBG - capillary blood glucose	PPE - personal protective equipment
CPAP - continuous positive airway pressure	RCPH - Royal College of Pediatric Health
CRP - C Reactive protein	ROP - retinopathy of prematurity
CT scan - computerized tomography	RT-PCR - reverse transcriptase–polymerase chain reaction
CXR - chest radiograph	SIN - Italian Society of Neonatology
GGO - ground-glass opacity	TPN - total parenteral nutrition
HEPA filter - High-efficiency particulate air filter	WHO - World Health Organization

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INTRODUCTION

COVID-19, caused by the novel coronavirus named ‘severe acute respiratory syndrome coronavirus ¹ (SARS-CoV-2),’ wreaked havoc in about 215 countries since December 2019. Why ‘novel’? Because it is just recently recognized among humans. While numbers refer more to the adults, so little is known about its impact on the pregnant woman and her fetus/newborn. In fact, only about 2-5% of newborns born to confirmed COVID-19 mothers have tested positive in the first 24-96 hours after birth.

This interim guidance purports to clear up the uncertainty about the impact of SARS-CoV-2 on the newborn and delineate strategies in the care of newborns of suspect/confirmed COVID-19 mothers based on review of guidelines, consensus, case series and articles on the COVID-19 newborn.

OPERATIONAL DEFINITIONS

Table 1. Definition of the New COVID-19 Classification	
Classification	Definition²
Suspect (PUI mild, severe, critical)	1. person with influenza-like illness. (ILI) with a. no other etiology to explain clinical presentation AND history of travel during the 14 days prior to illness b. contact to a confirmed or probable COVID-19 case in the two days prior to illness until the case became negative upon repeat testing 2. person with severe acute respiratory infection (SARI) 3. person with fever and respiratory signs and symptoms with a co-morbidity or high-risk pregnancy
Probable (PUI mild, severe, critical)	Any of the following: 1. suspect case for whom testing for COVID-19 is inconclusive 2. suspect case for whom testing done was positive but inadequate (not done in an accredited national, subnational or COVID laboratory confirmatory center)
Confirmed (Positive)	Person with laboratory confirmation of COVID-19 infection, irrespective of clinical signs and symptoms in an accredited national, subnational and DOH certified laboratory testing center.

Table 2. DEFINITION of COVID-19 NEWBORN CLASSIFICATION³

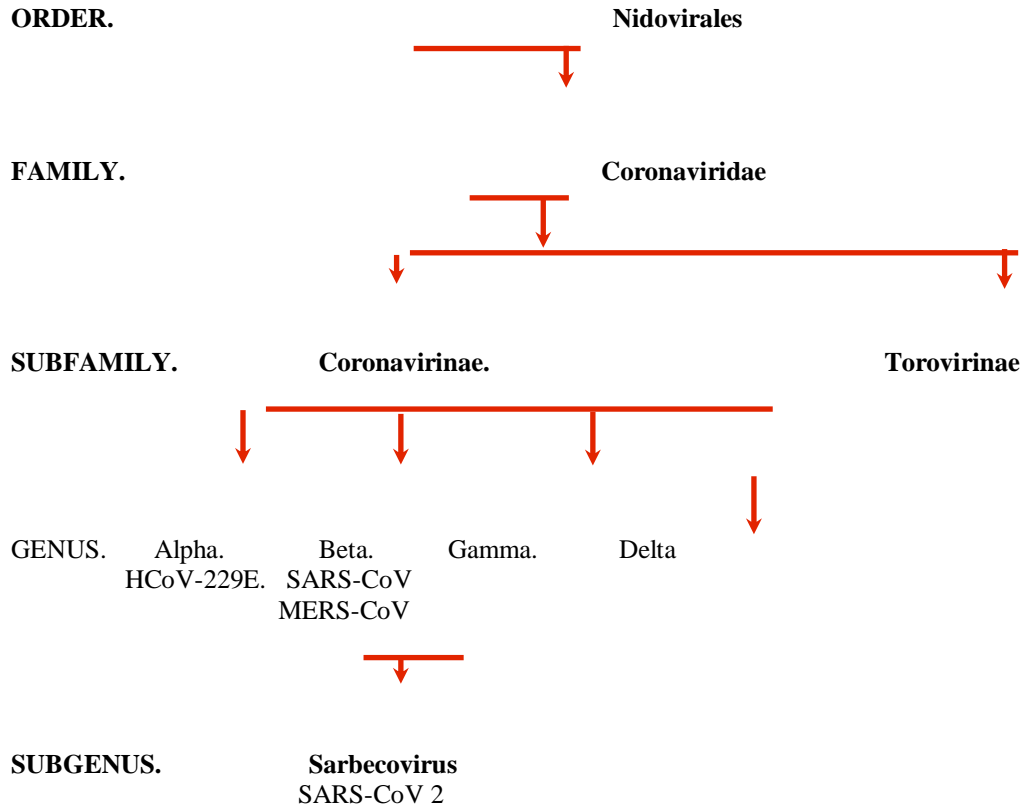
<p>Suspected COVID-19 Newborn</p>	<ul style="list-style-type: none"> > Newborn born to mother with a history of COVID-19 <u>between 14 days before delivery and 28 days after delivery.</u> > Newborn <u>directly exposed to positive cases (including family members, caregivers, medical staff, and visitors);</u> related to cluster outbreak > Newborn showing lymphocytopenia or typical chest imaging findings
<p>Confirmed COVID-19 Newborn</p>	<p>Newborns with confirmed COVID-19 infection <u>if one of the following etiological criteria is met:</u></p> <ul style="list-style-type: none"> a) Respiratory tract or blood specimens tested RT-PCR are positive for SARS CoV-2 viral RNA; b) Virus gene sequencing of the respiratory tract or blood specimens is highly homologous to that of the known COVID-19 specimens

VIROLOGY OF SARS CoV-2

SARS-CoV-2 is an enveloped positive-sense, single-stranded RNA virus that enters its host cell by binding to the angiotensin-converting enzyme 2 receptor. It belongs to subgenus Sarbecovirus of the genus Betacoronavirus, the same subgenus as the severe acute respiratory syndrome (SARS) virus and Middle East Respiratory Syndrome (MERS), as well as several bat coronaviruses, but in a different clade.⁴ The Coronavirus Study Group of the International Committee on Taxonomy of Viruses has labelled virus as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).¹

It possesses 88–96% sequence identity to three bat-derived SARS-like coronaviruses (bat-SL-CoVZC45, bat-SLCoVZXC21, RaTG13) and to coronavirus strains isolated in pangolins - a scaly, ant-eating mammal highly trafficked for its presumed medicinal virtues and clandestinely sold in live animal markets as in Wuhan, China. The lineage giving rise to SARS-CoV-2 has been circulating unnoticed for decades in bats (primary host) and pangolins (intermediate host). The occurrence of a third significant coronavirus emergence in 17 years together with the high prevalence and virus diversity in bats implies that these viruses are likely to cross species boundaries again.⁴⁻⁶ Like SARS-CoV, SARS-CoV-2 is highly recombinant, but its lineage is not a recombinant of any viruses detected to date.⁶

Figure 1. The Coronavirus Sars-CoV 2 Lineage⁴



The host receptor for SARS-CoV-2 cell entry is the same as for SARS-CoV, the **angiotensin-converting enzyme 2 (ACE2)**. The cellular protease TMPRSS2 also appears important for SARS-CoV-2 cell entry [9]. SARS-CoV-2 binds to ACE2 through the receptor-binding gene region of its spike protein.

The maturity binding ability and function of ACE-2-receptors required by the virus to enter the cells are lower in the newborn resulting in minimal injury.¹ Furthermore, the cytokine storm that results in inflammation and fluid build-up seen in the older population is not well developed with a higher T cell amount and lower inflammatory factors, the latter seen in newborns.⁷ Newborns also have fetal hemoglobin without beta chains rendering them less susceptible.⁸

It has a crown-like appearance under an electron microscope due to the presence of spike glycoproteins on the envelope. Virions are spherical, oval, or pleomorphic with diameters of approximately 60 to 140 nm. There are two types, namely, type L (accounting for 70 percent of the strains) and type S (accounting for 30 percent). The former predominated during the early Wuhan epidemic, but accounted for a lower proportion of strains outside of China.^{1,4}

SARS-CoV-2 has weak resistance, 56°C for 30 minutes, to 75% ethanol, chlorine-containing disinfectant, and peracetic acid which can inactivate it.⁹

COVID-19 was originally seen in Wuhan City, Hubei Province, China, causing an influenza-like illness with pneumonia that rapidly evolved and proved fatal. The WHO reported its outbreak on December 31, 2019 and declared it as a global health emergency a month later. On March 11, 2020, the WHO Director-General declared COVID-19 a global pandemic.¹

TRANSMISSION

Although rare, newborns are infected with SARS-CoV-2 during childbirth or by exposure to sick caregivers after delivery. This may be due to their immature immune systems and smaller airways predisposing them to respiratory viral infections.¹⁰

Airborne transmission:

Airborne transmission occurs when the virus is present in the droplet core. The virus can remain in the air for several hours and spread to people within a distance of about one meter.¹¹⁻¹²

Particles less than 5 microns in diameter are more likely to bypass the anatomic obstacles of the upper airway (such as nasal turbinates and the cilia) and travel directly to the mucous membranes of the distal lower respiratory tract.

Recent studies underscored the need for extreme caution in performing aerosol-producing procedures (such as positive pressure ventilation, endotracheal intubation, NIPPV, CPAP) or supportive treatments (nebulization, open tracheal suctioning and cardiopulmonary resuscitation) The use of PPE level 3 or 4 in a room that has negative pressure or HEPAfilter is mandatory.¹³

Droplet transmission:

Droplet transmission occurs primarily through respiratory droplets during the postnatal period.

Respiratory droplets greater than 5 microns in diameter are recognized to be the major mode of transmission of SARS-CoV-2 and are unlikely to travel more than one meter. They are likely to settle rapidly due to gravitational pull within a 1-meter radius of the index person.

A susceptible person who is not wearing personal protective equipment and is within this distance (close contact) is at risk of becoming infected. During the neonatal period, the newborns are exposed to mothers, other caregivers, visitors, or healthcare personnel with COVID-19 who are coughing, sneezing, and talking.^{10,14-16}

The newborn carries the risk of having his oral and nasal mucosa and conjunctiva contaminated with infective respiratory droplets especially from his mother.¹

Contact transmission:

Transmission likewise occurs through 'fomites' in the immediate environment around the infected mother.¹¹

As such, transmission of the SARS-CoV-2 occurs either by direct contact with the infected mother or indirect contact with surfaces in immediate environment or with objects used on the infected person.¹¹

Oral-fecal transmission:

While non-respiratory specimens like the stool, blood, ocular secretions, and semen were implicated, the role of these sites in transmission is uncertain. Fecal-oral transmission was not a significant factor in the spread of infection.¹⁶ However, a number of case series of Wuhan examined anal swabs, which if negative, was one of the bases for hospital discharge.¹⁶⁻¹⁷

Breastmilk transmission:

Based on current literature on COVID-19, breastmilk is not considered a ‘transmission vehicle.’. The present SARS-CoV-2 pandemic requires the promotion of breastfeeding with proper health and hygiene approach. With breastfeeding, there is a need to limit the contagion by air and by contact with the respiratory secretions of infected mothers who should be wearing face mask at all times and be observing hand hygiene before and after each feeding.^{6,16}

Vertical transmission:

Transmission of SARS-CoV-2 from an infected mother to her fetus or newborn before, during or immediately after delivery is documented by positive RT-PCR test of the amniotic fluid, cord blood, placenta, vaginal secretions, gastric fluid and anal swab as well as early-onset of manifestations of fever, respiratory distress and poor feeding.⁹ However, these were not documented. The study of Schwartz with 38 COVID-19 pregnant women from China showed no SARS-CoV-2 detected in amniotic fluid, breastmilk, or umbilical cord blood samples tested. In another report describing clinical outcomes in 10 neonates born to mothers with SARS-CoV-2 pneumonia, some babies developed symptoms of dyspnea (6), cyanosis (3), gastric bleeding(2), multiple organ failure (1) and disseminated intravascular coagulation (1). However, the throat swabs of those infants were negative for SARS-CoV-2, ruling out intrauterine transmission of SARS-CoV-2.^{1,11,16-20}

While Dong reported the presence of elevated antibody levels and abnormal cytokine levels in the newborn of a COVID-19 mother, Kimberlin and Stagno, in an editorial, refuted claims of intrauterine transmission based on antibody levels, pointing out that IgM assays are prone to false positive and false negative results, along with cross-reactivity and testing challenges.²¹

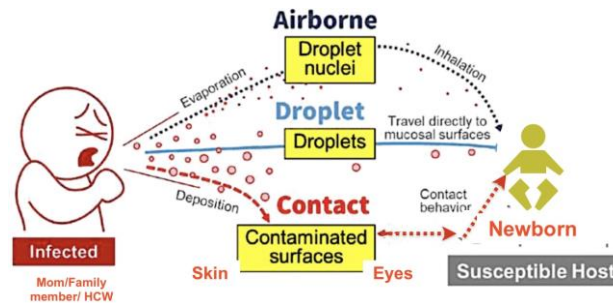


Figure 2. Modes of Transmission of COVID-19

Therefore, the current recognized modes of transmission are airborne, droplet and contact transmission. (Figure 2). The newborns are susceptible to person-to-person horizontal transmission post-delivery through close contact with respiratory secretions from an infected symptomatic/asymptomatic caregiver (including mother) & HCW.

The risk of transmission from a person with SARS-CoV-2 infection varies by the type and duration of exposure, use of preventive measures, and likely individual factors (for example, viral load in respiratory secretions).

SARS-CoV-2 can be transmitted even before the development of symptoms and throughout the course of illness. Transmission of SARS-CoV-2 may occur from the asymptomatic individuals (or individuals still within the incubation period of 14 days) in about 6 percent of cases. The exposures occur mostly one to three days prior to the development of symptoms.^{1,4-5}

Based on current evidence, persons with mild to moderate COVID-19 may shed replication-competent SARS-CoV-2 for up to **10 days** following symptom onset, while a small fraction of persons with severe COVID-19, including immunocompromised persons, may shed replication-competent virus for up to **20 days**. Nonetheless, detection of

viral RNA does not necessarily mean that infectious virus is present. The incubation period for COVID-19 is thought to be 2 to 14 days, with a median time of 4-5 days from exposure to symptoms onset.²²

From Outbreak to Pandemic

The beginning of the outbreak is traced back to an initial association with a seafood market in Wuhan, China that sold live exotic animals, where several patients had worked or visited - animal to human transmission. However, as the outbreak rapidly evolved to a pandemic, person-to-person spread became the main mode of transmission. As of September 26, 2020, SARS CoV-2 has wreaked havoc in 215 countries and territories with a steady rise in 73 countries reaching approximately 32.5M cases. The Philippines, presently ranked number 21, reached a total of about 301,000 cases.²³ In Europe, the newborn comprises less than seven percent of the COVID-19 population.²⁴

The most up-to-date source for the epidemiology of this pandemic can be found at the following sources:

- The WHO Novel Coronavirus (COVID-19) Situation Board.
- The Johns Hopkins Center for Systems Science and Engineering site for Coronavirus Global Cases COVID-19, which uses openly public sources to track the spread of the epidemic.

Of 929 infants less than one year old reported by the Department of Health last August 24, 179 (19%) are less than one month old. Positive COVID-19 newborns are only **0.08%** of confirmed cases in the Philippines. Regions with highest number of COVID-19 newborns are NCR, Regions 4A and 7. (See Table 3

CHARACTERISTICS OF NEWBORNS OF SUSPECT/CONFIRMED COVID-19 MOTHERS

Adverse infant outcomes, such as prematurity, have been reported among infants born to COVID-19 positive women during pregnancy. In the studies of Breslin, Chen H, Dong, Zeng and Zhu, 15.5 percent are preterm.^{21, 25-28}

The systematic review of di Mascio²⁹ and colleagues on 41 COVID-19 positive pregnant patients identified the rates of sequelae, in **decreasing order**:

- preterm birth <37 weeks (41.1 percent),
- preterm premature rupture of membranes (18.8 percent),

Table 3. Total number of COVID-19 Positive Newborns in the Philippines (August 24, 2020)		
REGION	TOTAL	PERCENT(%)
1	1	0.56
2	0	0.00
3	5	2.79
4A	14	7.82
4B	0	0.00
5	0	0.00
6	0	0.00
7	13	7.26
8	1	0.56
9	3	1.68
10	0	0.00
11	1	0.56
12	0	0.00
BARMM	0	0.00
CAR	2	1.12
Caraga	0	0.00
NCR	139	77.65
TOTAL	179	100
REFERENCE: Department of Health, August 24, 2020		

- preeclampsia (13.6 percent), and
 - cesarean delivery (9.1 percent);
- For the baby:

- admission to a neonatal ICU (10 percent),
- stillbirth (2.4 percent), and
- neonatal death (2.4 percent).

Update on his systematic review of 19 studies on MERS, SARS and COVID-19 showed that despite the low mortality, a main concern is the development of ARDS requiring invasive ventilation, the ‘clinical epiphenomenon’ of the viral pneumonia.²⁹

Zhu²⁸ pointed out the perinatal impact of COVID-19 on the fetus and newborn, as follows:

- premature labor
- fetal distress
- respiratory distress

Among the studied 47 COVID-19 positive newborns of Wuhan, Zhu²⁸ reported one mortality (2.1 percent) due to **multi-organ failure**. There was no death among the New York City newborns studied.

CLINICAL FEATURES OF NEWBORNS OF SUSPECT/CONFIRMED COVID-19 MOTHERS

The Chinese Perinatal-Neonatal 2019-nCoV Committee reviewed the **clinical features** of **newborns** of Suspect/Confirmed COVID-19 mothers and their infants. The newborns may be asymptomatic^{3,9} mild, or severe,^{8-10,19,28,30-35}. As in Figure 3, they may present with insidious and non-specific symptoms as lethargy and dehydration. In a review of 11 studies including 25 newborns, Liguoro et al³¹ pointed out that 20% of newborns were asymptomatic, 48% had mild and 20% had moderate signs of clinical infection. However, about 12% was severely ill. Dyspnea (40%) was the most common sign. The majority has favorable outcome. The onset of symptoms occurred as early as Day1 and as late as Day14.^{19,28,30}



Figure 3. Clinical features of COVID-19 newborn

The clinical findings, especially of premature infants, were not specific.^{19,27-28,30-35} They were as follows:

1. Respiratory and cardiovascular symptoms: **dyspnea**, **tachypnea**, grunting, nasal flaring, increased work of breathing, apnea, cough, or **tachycardia**.
2. Temperature instability: **fever**, hypothermia or normal temperature.
3. Others: **poor feeding** or ‘milk refusal’, lethargy, **vomiting**, **diarrhea**, and **abdominal distention**.

However, a few develop critical illness like respiratory failure, septic shock and even multi-organ failure.³⁴

LABORATORY FEATURES OF NEWBORNS OF SUSPECT/CONFIRMED COVID-19 MOTHERS

Laboratory examinations were also non-specific. Liguoro ³¹ described the laboratory findings: unremarkable complete blood count with less than one fifth (17.1%) showing leucopenia and lympho- or neutropenia (13.3%). elevated inflammatory indexes such as C-reactive protein (CRP) and procalcitonin (PCT) in 31.1% of cases, altered creatine kinase (CPK) and liver enzymes, as shown in 14.5% and 12.4% of all patients, respectively.

2019-nCoV can be detected in the upper respiratory tract (URT; nasopharyngeal and oropharyngeal), the lower respiratory tract (LRT; endotracheal aspirate, or bronchoalveolar lavage), the blood and the stool.^{19,27-28,30-35} All nasopharyngeal and anal swabs in the symptomatic newborns of Zhu ²⁸ tested negative for COVID-19 but the authors could not discount the possibility of false negative results.

The reports of Breslin and Salvatore on New York City hospitals showed negative COVID-19 tests for all 18 neonates and 120 neonates of COVID-19 mothers, respectively.^{25,36} Only about 2-5% of newborns born to confirmed COVID-19 mothers have tested positive in the first 24-96 hours after birth³⁸.

RADIOLOGIC FINDINGS OF NEWBORNS OF SUSPECT/CONFIRMED COVID-19 MOTHERS

Chest radiograph/ultrasound revealed pneumonia in about half of cases reviewed by Liguoro. Abdominal films may demonstrate intestinal ileus. ²⁸ Those who developed respiratory distress had chest radiograph showing pneumonia and ground-glass opacities (GGO).^{19,27-28,30-35} The ten neonates reported by Zhu were all symptomatic with significant chest findings initially blurred, granular patchy lesions then ground-glass opacities. ²⁸

GENERAL GUIDELINES ON THE CARE OF THE INBORN OF SUSPECT/CONFIRMED MOTHER

DELIVERY OF NEWBORN OF SUSPECT/CONFIRMED MOTHER

Shared decision-making prior to Delivery

Several factors including setting of maternal care, severity of maternal infection, colocation versus temporary separation and availability of hospital resources (rooms, PPE and HCW) should be discussed in the antenatal counseling or birth plan during the COVID-19 pandemic. This should also include direct breastfeeding and provision of MOM or pasteurized donor milk including the nutritional, immunological, and developmental advantages (emotional bonding) of breastfeeding, and the risk of COVID-19 infection to the newborn and HCW³⁸⁻⁴⁰.

The risks and benefits of skin-to-skin care, kangaroo mother care and separation, as well as the risks of exposure to both the neonate and to HCW **should be thoroughly discussed with the mother/family members before delivery** ^{18,40}

For all HCW who come in contact with COVID-19 women and infants who are both asymptomatic, **droplet and contact precautions** should be observed. ^{10,14}

Table 4. Delivery room management for newborns born to mothers with suspect/confirmed COVID-19^{19,30,38-40}

Mother	Suspect, Probable	Confirmed
Site of delivery	Deliver in hospital; preferably in negative pressure delivery room	
OB notify Neo Admission of the neonate SHARED DECISION	At least 30 min prior to delivery. After delivery, transport in a closed incubator - Admit to isolation room COVID-19 newborn if maternal testing positive for treatment of mother unless mother opted colocation - Room-in/discharge with mother if maternal testing negative - NICU Isolation for infant requiring additional intensive care.	- Rooming-in area for mother-baby dyad. Discharge healthy newborn with caregiver designated by mother while mother is undergoing treatment. - If mother opts for separation, admit to Isolation Room for COVID-19 infants - NICU Isolation for infant requiring additional ICU care.
Duration of neonatal observation	At least 14 days from time of birth unless maternal infection is ruled out	At least 14 days from time of birth.

DIAGNOSTIC PROCEDURES

1. COVID-19 RT-PCR^{10,41}

This is a real-time reverse transcription polymerase chain reaction (RT-PCR) test for the qualitative detection of nucleic acid from SARS-CoV-2 in upper and lower respiratory specimens (such as nasal, nasopharyngeal or oropharyngeal swabs, sputum, lower respiratory tract aspirates, bronchoalveolar lavage, and nasopharyngeal wash/aspirate or nasal aspirate)

RT-PCR test is recommended for all neonates born to mothers with suspect or confirmed COVID-19, regardless of whether there are signs of infection in the neonate²². If tests are available, perform the testing of the suspect COVID-19 infant at 24 hours of life and preferably repeat at 48 hours of life.^{10,41}

Should the baby not be tested, the waiting period is 14 days from birth or seven days from the time of symptoms. Poupolo underscored the need to treat babies **not tested** as positive for the duration of 14-day observation.¹⁰

2. Serologic test to qualitatively identify immunoglobulin IgM and IgG antibodies against SARS-CoV-2²¹

This confirms the presence of IgM and IgG antibodies reflecting a protective immune response. This will be a good serologic screening tool to determine population immunity and to distinguish individuals who are at lower risk for reinfection. Positive results for both IgG and IgM could occur after infection and can be an indication of recent infection.

STABLE SUSPECT/CONFIRMED COVID-19 INBORNS

Suspect or confirmed COVID-19 mothers can room-in with their newborns when appropriate precautions (respiratory and hand hygiene) are taken to protect their infants from infectious respiratory secretions^{38-39,42-43}

1. ISOLATION ROOM

The **Suspect/Confirmed** COVID-19 dyad is best admitted in an Isolation Room with negative pressure or in a room with exhaust fan driving air away from the room. HEPAfilter may be in place. The mother and baby should be positioned **1 meter** apart. Should the mother opt for temporary separation, they may be admitted to separate Isolation Rooms.^{38-39,42-43}

2. COLOCATION VERSUS TEMPORARY ISOLATION

During early months of COVID-19, little was known about the transmission and infectivity of this novel virus, thus, the initial recommendation of China, Japan, South Korea, Thailand, Canada and the United States was temporary separation of the Confirmed and Suspect COVID-19 mother and her baby until the release of the COVID-19 test of the infant to reduce the risk of transmission of the virus that causes COVID-19 from the mother to the newborn and HCW.^{3,10-11,40,44} Once with concordant results, the mother-baby dyad may room-in.

However, rooming-in or colocation of the mother-baby dyad not requiring additional care in the immediate postpartum period was and still is recommended by the Academy of Breastfeeding Medicine (ABM), the Royal College of Obstetrics and Gynecology (RCOG) and Royal College of Pediatric Healthcare RCPH) of the United Kingdom (UK), WHO and the UNICEF. They opined that precautionary separation of a stable mother and her healthy baby should not be taken lightly, given the possible detrimental effects on breastfeeding.^{18,39,42,45-47}

The AAP⁴⁸ now recommends rooming-in with direct breastfeeding. After months of national and international experience with newborns born to mothers who have tested positive for SARS-CoV-2, **no published report has identified an infant who has died** during the initial birth hospitalization as a direct result of SARS-CoV-2 infection.

Among the over 1,500 mother-infant dyads in the National Registry for Surveillance and Epidemiology, the **likelihood** that an infant has a positive RT-PCR test for SARS-CoV-2 is **similar for infants who are separated from their mothers and for infants who room-in** with mothers using infection prevention measures. Based on these two months experience since April 2, 2020, AAP updated its interim guidance on care of the infant of the COVID-19 mother, as follows:

1. Suspect or confirmed COVID-19 mothers can **NOW room-in** with their newborns when precautions are taken to protect the infants from their infectious respiratory secretions, (from the previous temporary separation)
2. The NICU Visitor recommendations have been updated

An observational study³⁶. in four Presbyterian hospitals in New York City, New York Presbyterian—Komansky Children's Hospital, Weill Cornell Medicine, New York Presbyterian—Lower Manhattan Hospital, and New York Presbyterian—Queens in New York City on 120 neonates born to COVID-19 positive mothers done between March 22 and May 17, 2020 showed that among the 120 neonates delivered from 116 COVID-19 positive mothers, all neonates tested at 24 h of life were negative for SARS-CoV-2. 82 (68%) neonates completed follow-up at day 5–7 of life and were asymptomatic.

Conclusion:

- a. **Perinatal transmission is unlikely** to occur with appropriate hygiene precautions.
- b. **Rooming-in and breastfeeding are safe** procedures when paired with effective parental education of infant protective strategies.

India (NNF)⁴⁹. presented two scenarios:

First, should resources for isolation of normal, suspected to be infected and infected mothers be unavailable OR healthcare facilities are inadequate OR community spread is evident, the healthy neonate may be **roomed-in** with mother with appropriate respiratory and hand hygiene

Second, should the opposite occur, that is, resources for isolation of normal, suspected to be infected and infected mothers are available AND community spread is not present, the newborn can be temporarily **separated** from the mother, should be cared for by a non-infected family member, and should be given expressed MOM.

The **Royal College of Obstetrics and Gynecology of the United Kingdom, Italian Society of Neonatology (SIN)** endorsed by the Union of European Neonatal & Perinatal Societies **WHO, UNICEF, DOH and now AAP** recommend **non-separation or colocation** of stable mothers and their healthy infants with **direct breastfeeding** with **strict measures of infection prevention and control**.^{18,38-39,42,45-48}

The **SIN**⁴²⁻⁴³ elaborated on these IPC measures, as follows:

- **PHYSICAL DISTANCING OF AT LEAST 1 METER WHICH IS STRONGLY ASSOCIATED WITH PROTECTION, BUT DISTANCES OF UP TO 2 METERS MIGHT BE MORE EFFECTIVE.**
- **OPTIMUM USE OF FACE MASKS, IN PARTICULAR N95 OR SIMILAR RESPIRATORS IN HEALTH-CARE SETTINGS AND 12–16-LAYER COTTON OR SURGICAL MASKS IN THE COMMUNITY, DEPENDING ON CONTEXTUAL FACTORS.**
- **EYE PROTECTION WITH ADDED BENEFITS.**

Most hospitals in the Philippines lack adequate facilities such as single negative pressure rooms, HCW and PPE. The stable newborn is best roomed-in with the mother in a COVID Isolation Room, The stable mother can breastfeed her baby with strict compliance to droplet and contact precautions. But when the mother is unstable, she can be assisted to express her own breastmilk for her baby, with appropriate precautions.³⁹

3. BREASTFEEDING

Breastmilk is the elixir of life.

Separation of the mother and baby causes maternal stress, infant stress, stress in the family, decreased breastfeeding success, and postnatal infection from the family members/community, burden on the health system.

The SIN, RCOG and RCPH of the United Kingdom, AAP, DOH, WHO and Unicef promote breastfeeding in a rooming-in regimen, under strict measures of infection control of an asymptomatic and paucisymptomatic COVID-19 positive mother.^{18,38-39,42,45-48}

Breastfeeding should be encouraged, especially since its benefits outweigh the risks of COVID-19.

UNSTABLE COVID-19 NEWBORNS REQUIRING NICU CARE

1. NICU ENVIRONMENT

The NICU Isolation Room should preferably have negative pressure. If not, the infant should be placed inside an incubator. If there is no single room, the infant should be in a cohort with other infants but should be 1 meter distanced from the rest.^{10,40,44}

As shown in Table 5, the **recommendations for the stable newborn of a stable Suspect/Confirmed COVID mother** are:

1. Shared decision between the mother/family and the clinical team
2. Standard of care: Immediate thorough drying
 - Skin-to-skin contact
 - Delayed cord clamping
 - Colocation (Rooming-in) or Temporary Separation depending on Shared Decision
 with appropriate wearing of PPE including respiratory/hand hygiene and physical distancing of 1 m.
3. Breastfeeding with utmost respiratory and hand hygiene..
4. BCG & Hepatitis B vaccine
4. RT-PCR at 24hrs of life
5. Screen for critical congenital heart disease (CCHD) by pulse oximeter
6. Newborn screen after 24 hours or before discharge
7. Hearing screen prior to discharge
8. Early discharge with stable mother or caregiver designated by the mother (when mother is continuing treatment)

TABLE 5. PROTOCOL OF STABLE INBORN OF SUSPECT/CONFIRMED COVID-19 MOTHER³⁸⁻³⁹

ACCOMMODATION	Room type: Isolation room for mother-baby dyad ideally with negative pressure or HEPAfilter or separate isolation rooms for mother and baby
DIAGNOSIS and MONITORING	RT-PCR at 24 hours and, ideally repeat at 48 hours. Monitor for fever, cough/respiratory distress, diarrhea/vomiting
GENERAL THERAPEUTICS	<ul style="list-style-type: none"> • Standard care: With strict appropriate precautions (PPE, double gloves, face mask preferably N95, goggles, face shield) including respiratory and hand hygiene <ul style="list-style-type: none"> Immediate thorough drying Skin-to-skin contact Delayed cord clamping Colocation (Rooming-in) or Temporary Separation depending on Shared Decision between Mother and Clinician • Breastfeed with appropriate respiratory and hand hygiene. If mother opted temporary separation, may give mother's own milk (MOM) or pasteurized donor milk. • Screen for critical congenital heart disease (CCHD) by pulse oximeter • Newborn screen after 24 hours before discharge • Hearing screen prior to discharge
MEDICATIONS	<ul style="list-style-type: none"> • Vitamin K 1mg IM • Erythromycin ophthalmic ointment • BCG and Hepatitis B prior to discharge

2. ISOLATION ROOM

The newborn, who requires additional care such as respiratory support or continuous monitoring, should be admitted to the NICU Isolation Room specifically dedicated to the COVID-19 with trained HCW wearing PPE. Since aerosol-producing procedures are done in the NICU with the admitted infant needing respiratory support, **airborne, contact and droplet precautions** should be in place. The HCW should wear the appropriate attire - gown, gloves, N95 respiratory mask with eye protection, or air-purifying respirator (powered air-purifying respirator [PAPR] or controlled air-purifying respirator [CAPR], both of which provide eye protection). Staff taking care of the baby should be tested for SARS-CoV-2 every two to three weeks.¹⁰

Should a COVID-19 mother or her baby be **too sick to care**, the neonate will be **managed separately and fed expressed breast milk (MOM)** without need to pasteurize it, as human milk is not believed to be a vehicle of COVID-19.⁴²⁻⁴³ One dedicated breast-pump and one healthcare worker per shift for COVID-19 NICU should be available..^{10,42-43}

3. AIRWAY MANAGEMENT

Aerosol-producing operations are essential in the management of newborns in respiratory distress; namely, bag mask ventilation, endotracheal intubation, tracheal suctioning, cardiorespiratory resuscitation, non-invasive positive pressure ventilation (NIPPV) or nasal cannula oxygen at a flow ≥ 2 LPM/kilogram.¹⁰

All these procedures require the preparation¹⁰ of the following:

- a. Negative pressure room that is well-ventilated, If none, a room in which a room exhaust is filtered through high-efficiency particulate air filters may do.
- b. Personnel protective equipment (PPE) which include triple layer mask/N95 respirator and face shield for respiratory precautions, goggles to protect the eyes, double gloves and long-sleeved protective suits to block body fluids
- c. Bag mask devices with viral filters
- d. Minimal number of medical/nursing staff (two for high risk, one for normal)

The revised Neonatal Resuscitation of Philippine Society of Newborn Medicine (NRPhplus 2020) is adapted with utmost airborne, droplet and contact precautions.

Furthermore, Terheggen¹³ suggested the following measures of managing AGPs:

- a. Consider early intubation to avoid crash intubation.
- b. Have a low threshold for intubation to minimize the risk of aerosol spread during NIV.
- c. Consider using cuffed endotracheal and tracheostomy tubes to avoid aerosol spread by air leak.
- d. Have the most experienced person handle the airway.
- e. If available, use video-laryngoscopy
- f. Reduce the amount of hand-bagging as much as possible.
- g. Avoid open suctioning after intubation; use closed suction circuits instead.
- h. Discard all not-for-single-use airway management equipment in plastic bags for decontamination.
- i. Place newborn in a closed incubator for transport and admission in NICU. If not available, place in a bassinet

4. CLASSIFICATION OF SYMPTOMATIC COVID-19 CASES BASED ON SYMPTOMS (Table 6)

Illness can range from mild to moderate with mild symptoms up to mild pneumonia (81%), severe with dyspnea, hypoxia, or >50% lung involvement on imaging) (14%) and critical with critical with respiratory failure, shock, or multiorgan system dysfunction (5%)

Terheggen and Wang described the signs and symptoms to identify suspected COVID-19 newborns, as follows:

- a. Newborn isolated at the referring hospital for suspected or confirmed COVID-19 especially:
 - 1). Newborns who have had contact with suspect or confirmed COVID-19 patients at home or in hospital within the last 14 days

- 2). Newborn of mothers with suspect or confirmed COVID-19
- b. A **newborn** needing hospital admission AND showing any of the following symptoms:
- 1). Respiratory distress (tachypnea, difficulty of breathing)
 - 2). Nasal discharge/congestion
 - 3). Cough
 - 4). Fever
- c. A **newborn** needing hospital admission for an unexplained multi-system inflammatory condition (persistent fever, raised inflammatory markers and cardiac involvement) fitting the case description from the CDC, WHO and/or UK RCOG and RCPH

Table 6. Classification of Symptoms.^{3,35,38-39}

CLASS	DEFINITION
MILD	Symptoms of an upper respiratory tract viral infection, including mild fever, cough (dry), nasal congestion, poor suck. Non-pneumonia. If with pneumonia, not oxygen requiring Hook to pulse oximeter.
MODERATE	Respiratory symptoms such as cough and dyspnea (or tachypnea with RR >60bpm) O2 Sat 90-94% at room air
SEVERE	<ol style="list-style-type: none"> 1. Fever associated with severe dyspnea, respiratory distress, tachypnea (>60bpm) and hypoxia (cyanosis, SpO2 < 90% on room air). 2. Heart rate > 160 beats/min or <100 beats/min, obvious arrhythmia 3. Blood gas analysis: PaO2 < 60 mmHg, PaCO2 > 50 mmHg. 4. CNS: irritability, lethargy, coma, convulsion, etc. 5. Poor feeding and even dehydration 6. Others: coagulation disorders (prolonged PT and elevated level of D-dimer, FDP), myocardial damage (increased level of myocardial enzyme, ECG ST-T changes, cardiomegaly and cardiac insufficiency), GI dysfunction, elevated liver enzyme and rhabdomyolysis
CRITICAL	<ol style="list-style-type: none"> 1. Respiratory failure 2. Septic shock 3. Multi-organ failure

TABLE 7. PROTOCOL OF UNSTABLE INBORN (MILD).^{3,18-19,38-39}

ACCOMMODATION	Room type: NICU preferably with hepafilter. If not available, place inside incubator
DIAGNOSIS and MONITORING	<p>Within 6-12 hours Arterial blood gas, if available Complete blood count Blood culture, if available Chest radiograph Hook to pulse oximeter Monitor for progression of respiratory distress RT-PCR at 24 hours If premature, monitor co-morbid conditions like PDA and PPHN with 2D echocardiography.</p>
GENERAL THERAPEUTICS	<ul style="list-style-type: none"> • Standard care: With strict appropriate precautions (PPE, double gloves, face mask preferably N95, goggles face shield). Respiratory and hand hygiene <ul style="list-style-type: none"> Immediate thorough drying Skin-to-skin contact Delayed cord clamping • Insert IV line and rehydrate as needed • May give mother’s own milk (MOM) or pasteurized donor milk, if tolerate enteral feeding • Newborn screen after 24 hours/before discharge • Hearing screen prior to discharge
MEDICATIONS	<ul style="list-style-type: none"> • Vitamin K 1mg IM • Erythromycin ophthalmic ointment • Ampicillin and Gentamicin, if consider bacterial pneumonia/sepsis. May give appropriate antimicrobial for bacterial pneumonia/sepsis based on culture, chest radiograph or antibiogram of facility • BCG and Hepatitis B prior to discharge

Table 8. Protocol of Unstable Inborn (Moderate to Severe)^{3,18-19,22,38}

	MODERATE	SEVERE
ACCOMMODATION	Room type: COVID NICU preferably with HEPAfilter. If not available, place inside incubator	Room type: COVID NICU ideally with negative pressure or HEPAfilter. If not available, place inside incubator
DIAGNOSIS and MONITORING	<p>Within 6-12 hours</p> <p>Arterial blood gas, if available</p> <p>Complete blood count</p> <p>Blood culture, if available</p> <p>Chest radiograph</p> <p>Hook to pulse oximeter</p> <p>Monitor for progression of respiratory distress</p> <p>RT-PCR at 24 hours</p> <p>If premature, monitor co-morbid conditions like PDA and PPHN with 2D echocardiography, if available</p>	<p>Within 6-12 hours</p> <p>Arterial blood gas, if available</p> <p>Complete blood count</p> <p>Blood culture, if available</p> <p>Chest radiograph</p> <p>Hook to cardiac monitor with pulse oximeter</p> <p>Monitor for progression of respiratory distress and onset of other symptoms. The following laboratory examinations may be done, if available:</p> <ol style="list-style-type: none"> 1. CRP/Procalcitonin, which, if increased, usually indicates bacterial infection 2. Serum electrolytes 3. Glucose monitoring, if on NPO 4. Liver function test (liver enzymes, protime, serum albumin) 5. BUN/Creatinine 6. Muscle enzymes, D-dimer, LDH, serum ferritin <p>RT-PCR at 24 hours</p> <p>If premature, monitor co-morbid conditions like PDA and PPHN with 2D echocardiography.</p>
GENERAL THERAPEUTICS	<ul style="list-style-type: none"> • Standard care: With strict appropriate precautions (PPE, double gloves, face mask preferably N95, goggles face shield) <ul style="list-style-type: none"> Immediate thorough drying Skin-to-skin contact, if feasible Delayed cord clamping • Oxygen therapy via nasal cannula or nasal CPAP • Insert IV line and rehydrate as needed • May give mother's own milk (MOM) or pasteurized donor milk, if tolerate enteral feeding • Newborn screen after 24 hours before discharge • Hearing screen prior to discharge 	<ul style="list-style-type: none"> • Standard care: With strict appropriate precautions (PPE, double gloves, face mask preferably N95, goggles face shield) <ul style="list-style-type: none"> Immediate thorough drying Delayed cord clamping • Intubate and hook to ventilator • Insert IV line and rehydrate as needed • Start total parenteral solution, as needed. once tolerate, start enteral feed with mother's own milk (MOM) or pasteurized donor milk • Newborn screen after 24 hours before discharge • Hearing screen prior to discharge
MEDICATIONS	<ul style="list-style-type: none"> • Vitamin K 1mg IM • Surfactant, if preterm with moderate to severe respiratory distress syndrome (RDS) • Ampicillin 100 mg/k/day and Gentamicin 5mg/k/day, if consider bacterial pneumonia/sepsis • BCG and Hepatitis B prior to discharge 	<ul style="list-style-type: none"> • Vitamin K 1mg IM • Surfactant, if preterm with respiratory distress syndrome (RDS) • Appropriate antimicrobial for bacterial pneumonia/sepsis based on culture, chest radiograph or antibiogram of facility • Inotropic support as warranted. • BCG and Hepatitis B prior to discharge

Table 9. Protocol of Unstable Inborn (Critical)^{3,6,18-19,22,38}

<p>ACCOMMODATION</p>	<p>Room type: NICU preferably with hepafilter. If not available, place inside incubator</p>
<p>DIAGNOSIS and MONITORING</p>	<p>Place inside incubator not radiant warmer Hook to cardiac monitor with pulse oximeter Arterial blood gas, if available Complete blood count Blood culture, if available Chest radiograph/ chest CT/ultrasound RT-PCR at 24 hours of life Monitor for progression of respiratory distress and onset of complications . The following laboratory examinations, if available, are recommended</p> <ol style="list-style-type: none"> 1. CRP/Procalcitonin , which, if increased, usually indicates bacterial infection 2. Serum electrolytes 3. Glucose monitoring, if on NPO 4. Liver function test (liver enzymes, protime, serum albumin) 5. BUN/Creatinine 6. Muscle enzymes, D-dimer, LDH, serum ferritin <p>2D echocardiography to rule out persistent pulmonary hypertension, if available</p>
<p>GENERAL THERAPEUTICS</p> <p>1. Respiratory Failure requiring ventilatory support</p> <p>2. Septic shock</p> <p>3. Multi-organ failure</p>	<ul style="list-style-type: none"> • Standard care: With strict appropriate precautions (PPE, double gloves, face mask preferably N95, goggles face shield) <p style="text-align: center;">Immediate thorough drying Delayed cord clamping</p> <ul style="list-style-type: none"> • Intubate and hook to ventilator. Repeat blood gas daily for first five days • Insert IV line and rehydrate as needed • Start total parenteral solution, as needed. • If premature, monitor underlying conditions like PDA and PPHN - If with ARDS, need to <ul style="list-style-type: none"> * restrict fluid, maintaining negative fluid balance * hook to conventional mechanical ventilator, if no response, hook to HFOV - Fluid resuscitation with crystalloids (PNSS) or colloids as needed - Component transfusions - Peritoneal dialysis, if available - Last resort: ECMO • Hearing screen prior to discharge • BCG and Hepatitis B prior to discharge
<p>MEDICATIONS</p> <p>1. Respiratory Failure requiring ventilatory support</p> <p>2. Septic shock</p> <p>3. Multi-organ failure</p>	<ul style="list-style-type: none"> - If preterm with moderate to severe respiratory distress syndrome (RDS). administer surfactant. Treat underlying conditions like PDA with Paracetamol - If with ARDS, need to <ul style="list-style-type: none"> * administer high-dose surfactant (every 6-8 hrs) - Appropriate antimicrobial based on culture, radiograph & antibiogram - Gammaglobulin 1g per kg for two days or 400mg/k/day for 5 days - Vitamin K - Start inotropes

As shown in Tables 7-9, the recommendations for the unstable newborn of a Suspected/Confirmed COVID mother are:

1. Shared decision between the mother/family and the clinical team
2. Standard of care: Immediate thorough drying
Delayed cord clamping
3. Counselling of mother re: Admission of her newborn to COVID NICU for additional care (respiratory support, intravenous fluids and medication and close monitoring)
4. Laboratory examinations, as warranted
 - a. ABG
 - b. CBC platelet
 - c. blood culture
 - d. chest radiograph/CT scan
 - e. CBG monitoring while on NPO
 - f. CRP/Procalcitonin , which, if increased, usually indicates bacterial infection
 - g. Serum electrolytes
 - h. Liver function test (ALT,AST, prothrombin time, serum albumin)
 - i. BUN/Creatinine
 - j. Muscle enzymes, D-dimer, LDH, serum ferritin
 - k. 2D-echocardiography
5. Enteral feeding of the baby with mother's expressed milk. If not tolerated, give total parenteral nutrition. (TPN)
6. BCG & Hepatitis B vaccine
7. **RT-PCR at 24hrs of life**
8. Fluid resuscitation with crystalloids (PNSS) or colloids, as needed
9. Oxygen support via nasal cannula, CPAP or mechanical ventilator
10. Surfactant for RDS or ARDS
11. Appropriate antimicrobial based on culture, radiograph & antibiogram of the facility
12. Gammaglobulin 1g per kg for two days or 400mg/kg/day for 5 days
13. Vitamin K
14. Inotropic support
15. Screen for critical congenital heart disease (CCHD) by pulse oximeter
16. Newborn screen after 24 hours or before discharge
17. Hearing screen prior to discharge
18. ROP screen for the premature ≤ 35 weeks
18. For critical cases, last resort: continuous renal replacement therapy (CRRT)
extracorporeal membrane oxygenation (ECMO)

THE SUSPECT/CONFIRMED COVID-19 OUTBORN

The suspect/confirmed COVID-19 outborn with mild illness should be isolated to contain virus transmission according to the established national COVID-19 care pathway. This can be done at a **designated COVID-19 health facility, community facility or at home (self-isolation) with the mother.** However, these facilities lack doctors to monitor the babies. The newborn is best brought to the Emergency Room for proper assessment and possible admission.. He should be given symptomatic treatment, advised adequate nutrition - breastfeeding and given appropriate rehydration.

Should he have poor suck and activity, vomiting and diarrhea, he is best admitted and observed further.

TABLE 10. PROTOCOL OF SUSPECT/CONFIRMED OUTBORN (MILD)^{3,18-19,22,38-39}

ACCOMMODATION	Room type: COVID WARD preferably with hepafilter. If not available, place inside incubator
DIAGNOSIS and MONITORING	RT-PCR upon admission of suspect COVID Newborn (>24hrs of life) Arterial blood gas, if available Complete blood count Blood culture, if available Chest radiograph Hook to pulse oximeter Monitor for progression of respiratory distress
GENERAL THERAPEUTICS	<ul style="list-style-type: none">• Insert IV line and rehydrate as needed• May give mother's own milk (MOM) or pasteurized donor milk, if tolerate enteral feeding• Newborn screen, if not yet done• Hearing screen prior to discharge
MEDICATIONS	<ul style="list-style-type: none">• Vitamin K 1mg IM• Ampicillin 100 mg/k/day and Gentamicin 5mg/k/day, if consider bacterial pneumonia/sepsis. May give appropriate antimicrobial for bacterial pneumonia/sepsis based on culture, chest radiograph or antibiogram of facility• BCG and Hepatitis B, if not yet given

Table 11. Protocol of Suspect/Confirmed Outborn (Moderate to Severe)^{3,6,18-19,22,38}

	MODERATE	SEVERE
ACCOMMODATION	Room type: COVID NICU preferably with HEPAfilter. If not available, place inside incubator	Room type: COVID NICU ideally with negative pressure or HEPAfilter. If not available, place inside incubator
DIAGNOSIS and MONITORING	<p>RT-PCR upon admission of suspect COVID Newborn (>24hrs of life)</p> <p>Arterial blood gas, if available Complete blood count Blood culture, if available Chest radiograph Hook to pulse oximeter Monitor for progression of respiratory distress and onset of complications Monitor blood sugar while on NPO Get baseline serum electrolytes, if feasible If premature, monitor co-morbid conditions like PDA and PPHN with 2D echocardiography, if available</p>	<p>RT-PCR upon admission of suspect COVID Newborn (>24hrs of life)</p> <p>Arterial blood gas, if available Complete blood count Blood culture, if available Chest radiograph Hook to cardiac monitor with pulse oximeter Monitor for progression of respiratory distress and onset of other symptoms . The following laboratory examinations may be done, if available:</p> <ol style="list-style-type: none"> 1. CRP/Procalcitonin , which, if increased, usually indicates bacterial infection 2. Serum electrolytes 3. Glucose monitoring, if on NPO 4. Liver function test (liver enzymes, protime, serum albumin) 5. BUN/Creatinine 6. Muscle enzymes, D-dimer, LDH, serum ferritin <p>If premature, monitor co-morbid conditions like PDA and PPHN with 2D echocardiography.</p>
GENERAL THERAPEUTICS	<ul style="list-style-type: none"> • Oxygen therapy via nasal cannula or nasal CPAP • Insert IV line and rehydrate as needed • May give mother’s own milk (MOM) or pasteurized donor milk, if tolerate enteral feeding • Newborn screen after 24 hours/before discharge • Hearing screen prior to discharge 	<ul style="list-style-type: none"> • Intubate and hook to ventilator • Insert IV line and rehydrate as needed • Start total parenteral solution, as needed. Once tolerate, start enteral feed with mother’s own milk (MOM) or pasteurized donor milk • Newborn screen after 24 hours/before discharge • Hearing screen prior to discharge
MEDICATIONS	<ul style="list-style-type: none"> • Surfactant, if preterm with moderate to severe respiratory distress syndrome (RDS) • Appropriate antimicrobial, as needed. Ampicillin and Gentamicin, if consider bacterial pneumonia • Inotropic support as warranted. • Vitamin K 1mg IM while on antibiotics • BCG and Hepatitis B prior to discharge 	<ul style="list-style-type: none"> • Surfactant, if preterm with moderate to severe respiratory distress syndrome (RDS) • Appropriate antimicrobial for bacterial pneumonia/sepsis depending on culture, chest radiograph or antibiogram of facility • Inotropic support as warranted. • Vitamin K 1mg IM while on antibiotics • BCG and Hepatitis B prior to discharge

MANAGEMENT OF COMPLICATIONS

There is absolute need to address the **complications**^{3,6,18-19,22,38} that may be related to COVID-19 or to its co-morbidities like prematurity, asphyxia, or bacterial sepsis.

Table 12. Protocol of Suspect/Confirmed Outborn (Critical)^{3,6,18-19,22,38}

ACCOMMODATION	Room type: NICU preferably with hepafilter. If not available, place inside incubator
DIAGNOSIS and MONITORING	<p>RT-PCR upon admission of suspect COVID Newborn (>24hrs of life)</p> <p>Place inside incubator not radiant warmer Hook to cardiac monitor with pulse oximeter Arterial blood gas, if available Complete blood count Blood culture, if available Chest radiograph/ chest CT/ultrasound 2D echocardiography to rule out persistent pulmonary hypertension, if available</p> <p>Monitor for progression of respiratory distress and onset of complications . The following laboratory examinations, if available, are recommended</p> <ol style="list-style-type: none"> 1. CRP/Procalcitonin , which, if increased, usually indicates bacterial infection 2. Serum electrolytes 3. Glucose monitoring, if on NPO 4. Liver function test (liver enzymes, protime, serum albumin) 5. BUN/Creatinine 6. Muscle enzymes, D-dimer, LDH, serum ferritin
<p>GENERAL THERAPEUTICS</p> <p>1. Respiratory Failure</p> <p>2. Septic shock</p> <p>3. Multi-organ failure</p>	<ul style="list-style-type: none"> • Intubate using acrylic box then hook to ventilator. Add viral filter in the ambubag. Place HEPAfilter in expiratory limb of the ventilator. • Repeat blood gas daily for first five days • Insert IV line and rehydrate as needed • Start total parenteral solution, as needed. • If premature, monitor underlying conditions like PDA and PPHN - If with ARDS, need to <ul style="list-style-type: none"> * restrict fluid, maintaining negative fluid balance * hook to conventional mechanical ventilator, if no response, hook to HFOV - Resuscitate with crystalloids (PNSS) or colloids as needed - Give albumin if hypoalbuminemic. Hold if with AKI - Transfuse Packed RBC, fresh frozen plasma, cryoprecipitate, platelet concentrate as indicated - Peritoneal dialysis, if available - Last resort: ECMO • Hearing screen prior to discharge • BCG and Hepatitis B prior to discharge
<p>MEDICATIONS</p> <p>1. Respiratory Failure</p> <p>2. Septic shock</p> <p>3. Multi-organ failure</p>	<ul style="list-style-type: none"> - If preterm with moderate to severe respiratory distress syndrome (RDS). administer surfactant. Treat underlying conditions like PDA with Paracetamol - If with ARDS, need to <ul style="list-style-type: none"> * administer high-dose surfactant (every 6-8 hrs) - Appropriate antimicrobial based on culture, radiograph & antibiogram - IVIG 1g per kg for two days or 400mg/kg/day for 5 days - Vitamin K - Start inotropes

As shown in Tables 10-12, the recommendations for the Suspect/Confirmed COVID outborn are similar to those in the inborn, except that RT-PCR is done upon admission and standard of care is not done. Mother is discouraged to visit her baby who is admitted in the NICU

1. Counselling of the mother/family re: Admission of her newborn to COVID NICU for intensive care (respiratory support, intravenous fluids and medication and close monitoring
- 2. RT -PCR upon admission**
3. Laboratory examinations, as warranted
 - a. ABG
 - b. CBC platelet
 - c. blood culture
 - d. chest radiograph/CT scan
 - e. CBG monitoring while on NPO
 - f. CRP/Procalcitonin , which, if increased, usually indicates bacterial infection
 - g. Serum electrolytes
 - h. Liver function test (ALT,AST, prothrombin time, serum albumin)
 - i. BUN/Creatinine
 - j. Muscle enzymes, D-dimer, LDH, serum ferritin
 - k. 2D-echocardiography
4. Oxygen support via nasal cannula, CPAP or mechanical ventilator
5. Fluid resuscitation with crystalloids (PNSS) or colloids, as needed
6. Enteral feeding of the baby with mother's expressed milk. If not tolerated, give total parenteral nutrition. (TPN)
7. Monitoring with cardiac monitor & pulse oximeter
8. Surfactant for RDS or ARDS
9. Appropriate antimicrobial based on culture, radiograph & antibiogram of the facility
10. Gammaglobulin 1g per kg for two days or 400mg/kg/day for 5 days
11. Vitamin K
12. Inotropic support
13. BCG & Hepatitis B vaccine
14. Screen for critical congenital heart disease (CCHD) by pulse oximeter
15. Newborn screen after 24 hours or before discharge
16. Hearing screen prior to discharge
17. ROP screen for the premature ≤ 35 weeks
18. For critical cases, last resort: continuous renal replacement therapy (CRRT)
extracorporeal membrane oxygenator

Italian, 2 were Iranian, and the rest were from Spain, Belgium or South Korea, Of these 25 babies, 16 were born via Caesarean section (CS). The average gestational age of the babies was 37.4 weeks, and the average birth weight was 3,041 grams. The ratio of male babies to females was 2.8. About 32 percent needed intensive care, and there were no deaths. Complications included **pneumonia, respiratory distress, sepsis, and pneumothorax.**

a. Respiratory distress: Respiratory distress syndrome (RDS):

The major adverse outcome of COVID-19 pregnancy is prematurity. Surfactant replacement therapy and invasive ventilation or even high frequency oscillatory ventilation should be available to address the resultant RDS. Complications such as air leak (pneumothorax), persistent pulmonary hypertension (PPHN), patent ductus arteriosus (PDA) should be anticipated.

b. Fluid and acid-base imbalance:

The supplement of water and electrolyte should be appropriate to prevent aggravating the pulmonary edema and reduced oxygenation in babies on ventilators. Bicarbonate should be administered judiciously.

c. Hypotension/shock:

Hypotension may be due to bleeding, sepsis and PDA in preterm. An infant in shock will have production of chemical mediators that may initiate disseminated intravascular coagulopathy (DIC). There is need to monitor the coagulation profile and to administer crystalloids and colloids (fresh frozen plasma, platelet and/or cryoprecipitate) accordingly. Use of inotropes is essential especially with congestive heart failure. Likewise, there is need to rule out myocarditis with determination of creatine kinase.

d. Gastrointestinal hemorrhage

Babies with COVID-19 may have GI hemorrhage from deranged or COVID-19 related liver pathology (elevated aminotransferases and prolonged prothrombin time) which would necessitate red cell transfusion and correction of underlying coagulopathy or liver dysfunction. Proton pump inhibitor may also be used.

e. Secondary bacterial infection/sepsis:

In as much as the presentation of COVID-19 newborns mimics sepsis, especially late-onset sepsis, septic work-up (including CRP/procalcitonin, if available) and initiation of antibiotics are recommended. For those in the NICU on ventilatory support, healthcare-associated infection (HCAI) and central line-associated bloodstream infection (CLABSI) should be monitored.

f. Nutrition needs:

While separated from the mother, these infants should be started on expressed MOM or pasteurized breastmilk. If enteral feed is not tolerated, total parenteral nutrition must be started.

g. Acute kidney injury (AKI):

Continuous renal replacement therapy (CRRT) and extracorporeal membrane lung (ECMO) therapy can be done.

h. Acute Respiratory Distress Syndrome (ARDS):

For ARDS, the mechanism is surfactant dysfunction and pulmonary hypertension with the underlying COVID-19 disease. ARDS in newborns is manifested by opacification of the lungs. The function of exogenous surfactant may be decreased after a certain time period depending on the severity. In newborns with severe acute respiratory distress syndrome (ARDS), high-dose pulmonary surfactant (given every six hours), inhaled nitric oxide and high-frequency oscillatory ventilation may be utilized. Extracorporeal membrane lung (ECMO) should be used as a last resort. A higher PEEP is important to increase the lung volume. Prone positioning may be implemented.

OTHER TREATMENT OPTIONS

At present, there is **NO** evidence supporting the efficacy of interferon, remdesivir, or hormone therapy in newborns. The relatively immature immune system in newborns may contribute to their milder clinical manifestation in comparison with adults, thus, iatrogenic suppression of immunity should be done with caution in neonates.^{3,18-19,30}

A multi-disciplinary team (MDT) approach is recommended for critically ill neonates. The team includes the neonatologist, infectious disease specialist, nephrologist, specialist nurses, midwives and respiratory therapist.^{3,30}

DISCHARGE PLAN^{3,10,11,22}

COVID-19 positive newborns who meet clinical discharge criteria do **not require** the results of SARS-CoV-2 testing for discharge. Once available, results from the neonate's test should be communicated to the family and outpatient quarantine facility.

Criteria for newborn discharge routinely include physiologic stability, family preparedness and competence to provide newborn care at home, availability of social support, and access to the health care system and resources. The decision to send the patient home should be made in consultation with the patient's **clinical care team** and ideally with the local health units. It should include considerations of the home's suitability for and patient's ability to adhere to home isolation recommendations.

CDC^{3,22} cautions that meeting the criteria for discontinuation of Transmission-Based Precautions is NOT a prerequisite for discharge from a healthcare facility. The test-based strategy is no longer generally recommended because it often results in prolonged hospital stay of patients who continue to shed detectable SARS-CoV-2 RNA but are no longer infectious.

The symptom-based strategy renders the discontinuation of precautionary measures in the following types of patients:

- a. Patients who are not severely immunocompromised and were asymptomatic:
 - At least 10 days and up to 20 days have passed since the date of their first positive viral diagnostic test.
 - At least 24 hours have passed since last fever without the use of antipyretics and
 - Symptoms (e.g., cough, difficulty of breathing) have improved
- b. Patients who are severely immunocompromised but were asymptomatic:
 - At least 10 days and up to 20 days have passed since the date of their first positive viral diagnostic test.
 - At least 24 hours have passed since last fever without the use of antipyretics and
 - Symptoms (e.g., cough, difficulty of breathing) have improved
- c. Patients with mild to moderate illness who are not severely immunocompromised:
 - At least 10 days have passed since symptoms first appeared and
 - At least 24 hours have passed since last fever without the use of fever-reducing medications and
 - Symptoms (e.g., cough, difficulty of breathing) have improved
- d. Patients with severe to critical illness or who are severely immunocompromised:
 - At least 10 days and up to 20 days have passed since symptoms first appeared and
 - At least 24 hours have passed since last fever without the use of fever-reducing medications and
 - Symptoms (e.g., cough, difficulty of breathing) have improved
 - Consider consultation with infection control experts

Note:

Should Transmission-Based Precautions still be required, the mother-baby dyad should go to a community quarantine facility with an ability to adhere to infection prevention and control recommendations for the care of residents with SARS-CoV-2 infection. Preferably, the patient would be placed in a location designated to care for residents with SARS-CoV-2 infection.

Prior to Discharge:^{3,10,11,22,41}

1. Give BCG and Hepatitis B immunization.
2. Make sure the following screening procedures are done:
 - a. Newborn screening, if feasible,
 - b. Hearing screen
 - c. Pulse oximetry screening for Critical Cyanitic Heart Disease (CCHD)
 - d. ROP screen for preterms
3. Give the following instructions to the mother or caregiver designated by the mother:^{7,21}
 - a. Should both mother and baby be COVID-19 positive, the mother-baby dyad should stay in a separate bedroom/area with good ventilation, like opened window or an air conditioner. Perform hand hygiene frequently. Wash hands often with soap and water for at least 20 seconds or use an alcohol-based hand sanitizer that contains 60 to 95% alcohol, covering all surfaces of hands and rubbing them together until they feel dry. Soap and water should be used if hands get dirty.

- b. Mother or caregiver should observe respiratory hygiene, that is, wear a face mask at all times.**20-21**
- c. Mother should wash her hands before and after breastfeeding her infant.
- d. Mother or caregiver should monitor the baby for clinical signs or symptoms like fever, respiratory distress, poor feeding or 'milk refusal' and vomiting until 14 days from the time of birth. **28,30,34**
- e. Should the baby of a COVID-19 positive mother test negative, the mother should maintain both respiratory, breast and hand hygiene as much as possible, until EITHER (1) she has been afebrile for 3 days without antipyretics, and (2) she reached 7 days from the time her symptoms first appeared; OR she has negative tests.
- f. Mother or caregiver should **follow-up baby after 24 to 48 hours** initially by phone until 14 days after birth. The infant who was admitted in the NICU should also follow-up with other sub specialists of the multidisciplinary team, as needed.

Neonates with suspected or confirmed COVID-19, or ongoing exposure, require close outpatient follow-up after discharge.

The CDC released a media statement ²² ' There have been more than 15 international and U.S.-based studies recently published looking at length of infection, duration of viral shed, asymptomatic spread and risk of spread among various patient groups. Researchers have found that the amount of live virus in the nose and throat drops significantly soon after COVID-19 symptoms develop. Additionally, the duration of infectiousness in most people with COVID-19 is no longer than 10 days after symptoms begin and no longer than 20 days in people with severe illness or those who are severely immunocompromised.'
Thus, discontinuation of isolation is safe at ten days for the mild to moderate cases and up to 20 days for the severe to critical cases. ²²

HOME CARE ²²

Environmental supplies:

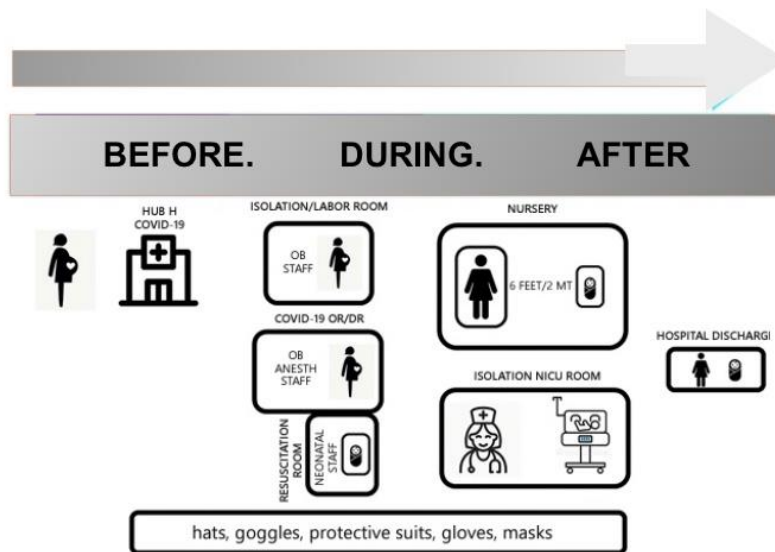
- Maintain room for mother-baby dyad clean, fresh air, suitable temperature and humidity
- Newborns should have personal towels and utensils
- Daily necessities should be clean,
- Non-caregivers should refrain from entering the room.

Nutrition:

- Promote breastfeeding per demand > 10-12 times / day
- Encourage kangaroo mother care
- Prescribe vitamin D supplement
- Advise balanced mother's diet and sufficient sleep

Care

- Keep warm and prevent overheating
- Monitor body temperature, skin color, breathing, breastfeeding, and bowel movements
- Keep baby skin clean,
- Change diapers when wet
- Keep the umbilicus dry, no need to put binder



INFECTION PREVENTION AND CONTROL ^{10,22,50-}
Figure 3. Pathway from TRIAGE to DR to COLOCATION to DISCHARGE

WARD PATHWAY

Mothers, who opted colocation, can now room in with their newborns, provided that all HCWs should always practice infection prevention and control measures before and while caring for the neonate. There remains a potential risk of COVID-19 transmission via contact with respiratory secretions from the mother, caregiver, or other person with COVID-19 infection, including just before the individual develops symptoms when viral replication may be high

During hospital stay

- The mother should maintain a reasonable distance (one meter) from her infant when possible. When mother provides hands-on care to her newborn, she should wear a face mask and perform hand-hygiene. Use of an incubator may facilitate distancing and provide the infant an added measure of protection from respiratory droplets. If using an incubator, care should be taken to properly latch doors to prevent infant falls.
- Healthcare workers should use gowns, gloves, standard procedural masks, and eye protection (face shields or goggles) when providing care for well infants. When this care is provided in the same room as a mother with COVID-19, healthcare workers may opt to use N95 respirators in place of standard procedural masks, if available.
- If non-infected partners or other family members are present during the birth hospitalization, they should use masks and hand hygiene when providing hands-on care to the infant.

Recommended PPE:

1. Respirator or Facemask (Cloth face coverings are NOT PPE and should not be worn for the care of patients with suspected or confirmed COVID-19 or other situations where use of a respirator or facemask is recommended.)
 - Put on an N95 respirator (or equivalent or higher-level respirator) or facemask (if a respirator is not available) before entry into the patient room or care area, if not already wearing one as part of extended use strategies to optimize

PPE supply. Other respirators include other disposable filtering facepiece respirators, powered air purifying respirators (PAPRs), or elastomeric respirators.

- N95 respirators or respirators that offer a higher level of protection should be used instead of a facemask when performing or present for an aerosol generating procedure. See appendix for respirator definition.
- Disposable respirators and facemasks should be removed and discarded after exiting the patient's room or care area and closing the door unless implementing extended use or reuse. Perform hand hygiene after removing the respirator or facemask.
 - o If reusable respirators (e.g., powered air-purifying respirators [PAPRs] or elastomeric respirators) are used, they should also be removed after exiting the patient's room or care area. They must be cleaned and disinfected according to manufacturer's reprocessing instructions prior to re-use.
- When the supply chain is restored, facilities with a respiratory protection program should return to use of respirators for patients with suspected or confirmed SARS-CoV-2 infection. Those that do not currently have a respiratory protection program, but care for patients with pathogens for which a respirator is recommended, should implement a respiratory protection program.

2. Eye Protection

- Put on eye protection (i.e., goggles or a face shield that covers the front and sides of the face) upon entry to the patient room or care area, if not already wearing as part of extended use strategies to optimize PPE supply.
 - o Protective eyewear (e.g., safety glasses, trauma glasses) with gaps between glasses and the face likely do not protect eyes from all splashes and sprays.
- Ensure that eye protection is compatible with the respirator so there is not interference with proper positioning of the eye protection or with the fit or seal of the respirator.
- Remove eye protection after leaving the patient room or care area, unless implementing extended use.
- Reusable eye protection (e.g., goggles) must be cleaned and disinfected according to manufacturer's reprocessing instructions prior to re-use. Disposable eye protection should be discarded after use unless following protocols for extended use or reuse.

3. Gloves

- Put on clean, non-sterile gloves upon entry into the patient room or care area.
 - o Change gloves if they become torn or heavily contaminated.
- Remove and discard gloves before leaving the patient room or care area, and immediately perform hand hygiene.

4. Gowns

- Put on a clean isolation gown upon entry into the patient room or area. Change the gown if it becomes soiled. Remove and discard the gown in a dedicated container for waste or linen before leaving the patient room or care area. Disposable gowns should be discarded after use. Cloth gowns should be laundered after each use.

NICU PATHWAY

Every newly born baby should have a skilled attendant prepared to resuscitate regardless of COVID-19 status. While the newborn COVID status is still unknown, providers should don appropriate PPE. The mother is a potential source of aerosolization for the neonatal team.

- Initial steps: Routine neonatal care and the initial steps of placement into a plastic bag or wrap, assessment of heart rate, placement of pulse oximetry and electrocardiograph leads.
- Suction: 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 medications: 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 (with appropriate distancing) should be used for neonatal intensive care patients when possible but do not protect from aerosolization of virus.

Strategies during neonatal resuscitation

A. Reduce provider exposure to COVID-19

Strategies:

1. Before entering the scene, all rescuers should don PPE to guard against contact with both airborne and droplet particles. Consult individual health or emergency medical services (EMS) system standards because PPE recommendations may vary considerably on the basis of current epidemiological data and availability.
2. Limit personnel in the room or on the scene to only those essential for patient care.
3. In settings with protocols in place and expertise in their use, consider **replacing manual chest compressions with mechanical CPR devices** to reduce the number of rescuers required for adults and adolescents who meet the manufacturer's height and weight criteria.
4. Clearly communicate COVID-19 status to any new providers before their arrival on the scene or receipt of the patient when transferring to a second setting.

B. Prioritize oxygenation and ventilation strategies with lower aerosolization risk.

Strategies:

5. Attach a **HEPA filter** securely, if available, to any manual or mechanical ventilation device in the path of exhaled gas before administering any breaths.
6. After healthcare providers assess the rhythm and defibrillate any ventricular arrhythmias, patients in cardiac arrest should be **intubated with a cuffed tube** at the earliest feasible opportunity. Connect the endotracheal tube to a ventilator with a HEPA filter when available.
7. Minimize the likelihood of failed intubation attempts by the following:
 - a. Assigning the provider and approach with the best chance of first-pass success to intubate
 - b. Pausing chest compressions to intubate
8. **Video laryngoscopy** may reduce intubator exposure to aerosolized particles and should be considered if available.
9. Before intubation, use a bag-mask device (or T piece in neonates) with a HEPA filter and a tight seal, or, for adults, consider passive oxygenation with a nonbreathing face mask covered by a surgical mask.
10. If intubation is delayed, consider manual ventilation with a supraglottic airway or bag-mask device with a HEPA filter.
11. Once on a closed circuit, **minimize disconnections** to reduce aerosolization.

C. Consider the Appropriateness of Starting and Continuing Resuscitation

Strategies:

12. Address goals of care with patients with COVID-19 (or proxy) in anticipation of the potential need for increased levels of care.
13. Healthcare systems and EMS agencies should institute policies to guide frontline providers in determining the appropriateness of starting and terminating CPR for patients with COVID-19, taking into account patient risk factors to estimate the likelihood of survival. Risk stratification and policies should be communicated to patients (or proxy) during discussions of goals of care.

SPECIAL CONSIDERATIONS

Pre-Arrest

- Address advanced care directives and goals of care with all patients with suspected or confirmed COVID-19 (or proxy) on hospital arrival and with any significant change in clinical status such as an increase in level of care.
- Closely monitor for signs and symptoms of clinical deterioration to minimize the need for emergency intubations that put patients and providers at higher risk.
- If the patient is at risk for cardiac arrest, consider proactively moving the patient to a negative-pressure room/unit, if available, to minimize risk of exposure to rescuers during a resuscitation.
- Close the door when possible to prevent airborne contamination of adjacent indoor space.

DELIVERY ROOM PATHWAY

Intubated Patients at the Time of Cardiac Arrest

- Consider leaving the patient on a mechanical ventilator with a HEPA filter to maintain a closed circuit and to reduce aerosolization.
- Adjust the ventilator settings to allow **asynchronous ventilation** (time chest compressions with ventilation in newborns). Consider the following suggestions:
 - Increase the Fio₂ to 1.0.
 - Use either pressure or volume control ventilation and limit pressure or tidal volume to generate adequate chest rise (4-6 mL/kg ideal body weight is often targeted [6mL/kg for adults]).
 - Adjust the trigger to “off” to prevent the ventilator from auto-triggering with chest compressions and possibly prevent hyperventilation and air trapping.
 - Adjust respiratory rate to 30 breaths/min for neonates.
 - Assess the need to adjust the positive end-expiratory pressure level to balance lung volumes and venous return.
 - Adjust alarms to deliver full breaths with asynchronous chest compressions.
 - Ensure endotracheal tube/tracheostomy and ventilator circuit security to prevent unplanned extubation.
- If return of spontaneous circulation is achieved, set ventilator settings as appropriate to patients’ clinical condition.

Use of Aerosol Box

Recently, the US FDA revoked the umbrella emergency use authorization (EUA) it granted in May for intubation boxes that lack fans or air filters and do not generate negative pressure. Likewise, in one study the use of these boxes had increased intubation times and could cause damage to conventional personal protective equipment. Further research was recommended before these devices can be considered safe for clinical use. (Marcia Fr

DISINFECTION⁵²⁻⁵⁴

Disinfection refers to the use of chemicals to kill microbes on surfaces.

DISINFECTANTS	
Alcohol	Commonly used for hand hygiene, fast onset, Easily flammable,
Quaternary ammonium compounds	Tensical capacity combines cleaning and disinfection, Not work on non-enveloped viruses, thus combined with alcohol and aldehydes
Peroxides	Broad-spectrum including non-enveloped viruses and bacterial spores
Chlorides	Broad spectrum in high concentration. Can affect surfaces
Bleach	High level disinfectants with high range of efficiency Stringent and can irritate respiratory tract

1. General Guidelines.

- a. The sodium hypochlorite solution at 0.5% (equivalent to 5000 ppm) using a ratio of 1:10) shall be used for disinfecting surfaces including soiled clothes, toilets, body fluid spilled on the floors, vehicles, roads, disposed PPEs and similar healthcare wastes, and others.
- b. If other options for handwashing (e.g. alcohol-based rub, soap and water) are not available, sodium hypochlorite solution at 0.05% (equivalent to 500 ppm) using a ratio of 1:100) may be used for handwashing.
- c. Other types of chemical disinfectants such as ammonium chloride, phenols and hydrogen peroxide shall be used according to manufacturer's requirements.
- d. All individuals dealing with the disinfection process shall wear appropriate personal protective equipment (PPE).
- e. Proper hand hygiene shall be practiced before and after the disinfection activity.

2. Specific Guidelines

- a. Preparation of 0.5% sodium hypochlorite solution (1:10 solution) for surface disinfection
 - 1) Using commercially available household bleach at 5% active chlorine, dilute 1 part of bleach to 9 parts of clean water; or
 - 2) Using chlorine powder/granules/tablet at 60%-70% active chlorine, dissolve 1 tablespoon of chlorine (equivalent to 10 grams) to 2 liters of clean water. Mix the solution thoroughly using a stick.
- b. Preparation of the 0.05% sodium hypochlorite solution for hand-washing (1:100 solution)
 - 1) Using the 0.5% solution of household bleach, add 1 part of the solution to 9 parts of clean water. For example, add 100mL of solution (7 tablespoons) to 1 liter of clean water

3. When disinfecting the room

- a. Cleaning and disinfecting the room
 - 1) Wear disposable or impermeable gloves and gowns for all tasks in the cleaning process, including handling trash.

- 2) Have additional personal protective equipment (PPE) while cleaning/disinfectant products are being used to protect from splash.
- 3) Remove the gloves and gowns carefully to avoid contamination of the wearer and the surrounding area.
- 4) If there is a shortage of PPEs available, wash hands often with soap and water for at least 20 seconds. Change clothes immediately after the cleaning and disinfecting activity.
- 5) Always wash hands immediately after removing gloves.
- 6) If soap and water are not available and hands are not visibly dirty, use an alcohol-based hand sanitizer that contains at least 70% alcohol. However, if hands are visibly dirty, always wash hands with soap and water.

b. For hard surfaces (floors), first clean then disinfect at least daily:

- 1) Clean surfaces using soap and water to remove visible dirt.
- 2) Practice routine cleaning of frequently touched surfaces. High or frequently touched surfaces which include tables, doorknobs, light switches, countertops, handles, desks, phones, keyboards, toilets, faucets, sinks, etc.
- 3) Disinfection can be done using household cleaners and disinfectants, diluted household bleach solutions or alcohol solutions with at least 70% alcohol – as appropriate for the surface. Check to ensure the product is not past its expiration date.
- 4) Mop the floors with regular household detergent and water at least daily.
- 5) Directly mopping or wiping surfaces is also advisable. However, spraying of cleaning or disinfectant solution on a surface can also be applied with caution, and only when no other option is available.
- 6) Follow manufacturer's instructions to ensure safe and effective use of the product. Many products recommend:

Note: Keep the surface wet for several minutes to ensure microbes are killed.
Practice caution in wearing gloves and having adequate ventilation during use
Never mix household bleach with ammonia or any other cleanser.

c. For soft surfaces (such as carpeted floor, rugs, and drapes):

- 1) Clean the surface using soap and water or with cleaners appropriate for use on these surfaces at least weekly.
- 2) Launder items (if possible) according to the manufacturer's instructions. Use the warmest appropriate water setting and dry items completely; Do not "hug" or shake dirty laundry before washing to avoid spreading the virus or other dirt and bacteria. Laundry from a person who is sick can be washed with other people's items. Disinfect with an FDA-registered household disinfectant.
- 3) For clothing, towels, linens and other items that go in the laundry, wash at the warmest possible settings with your usual detergent and then dry completely.
- 4) For other soft items (for example, drapes, upholstered sofas and rugs), follow the manufacturer's instructions or use a cleaning product specifically for that item.
- 5) Mop heads, cloths and other cleaning tools should be washed with soap and water, and sanitized with a registered disinfectant or bleach solution and allowed to dry prior to reuse. A new or cleaned and sanitized mop or cloth should be used to clean and disinfect each area. Use single-use, disposable mop heads or cloths as an alternative.

d. For electronics (tablets, touch screens, keyboards, remote controls, incubators, ventilators and oximeters)

- 1) Consider putting a wipeable cover on electronics.
- 2) Follow manufacturer's instruction for cleaning and disinfecting. If no guidance, use alcohol-based wipes or solutions containing at least 70% alcohol. Dry surface thoroughly.

e. For trash can

- 1). Use double-layer infectious medical waste bags to line the trash can.

2) Apply chlorine-containing solution for more than 10 minutes and dispose the waste according to infectious medical waste protocol.

3) Collect the non-disposable medical fabrics of the patient by the bedside - disinfected with chlorine-containing solution for more than 10 minutes and then be disposed of according to protocols of infectious medical fabric.

f. The **final disinfection** of the room should involve hydrogen peroxide atomization or gasification, or chlorine-containing solution spray disinfection.

ETHICAL ISSUES IN CARE OF SUSPECTED/CONFIRMED COVID-19 NEWBORN^{22,57}

GENERAL ETHICAL GUIDELINES IN NEONATAL CARE DURING THE COVID 19 PANDEMIC

1. Competent, timely, compassionate and ethical care shall be made available to all neonates (COVID and non COVID).
2. All duly recommended protective measures for health care workers caring for COVID suspect/confirmed neonates shall be provided whenever feasible.
3. Equitable allocation of such resources shall be facilitated. Allocation decisions shall be made on the basis of evenly applied practices, as fairly as possible, across the spectrum of patients, without turning to biased quality-of-life assessments.
4. Consideration of withdrawing/withholding further critical care interventions shall be based on medical futility, burden of care and shared decision making with parents/guardians and the attending medical staff with the Ethics committee in advisory capacity. Alternative palliative care interventions shall be made available.
5. Ethical standards and their application to research conducted during public health emergencies shall be adhered to. Particular attention shall be placed on the research scientific validity, social value, respect for dignity of life and protection of newborns from undue risk.

From the standpoint of Ethics, there are two important things⁵⁷ to consider in the management of COVID -19 newborns:

1. "even in a pandemic, the first priority remains the provision of **outstanding patient care**"; and
2. "The main goal during "triage" cannot be to "buffer clinicians or soften the blow" "nor is it to save the most lives in a time of unprecedented crisis," "neither is it to favor those with the best prospects for the longest remaining life favoring the strong. But rather, **the decision making process during this pandemic must be made by frontline physicians together with the patients' parents and/or surrogate** and with ethics committees or triage committees serving only in an advisory capacity

SUMMARY OF RECOMMENDATIONS

DISCLAIMER: You can modify in accordance with your hospital policies, available space, manpower, supplies and logistics. May be revised as the need arise

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Confirmed COVID19 but stable	Already done	Yes, at 24 hours	SHARED DECISION. Room-in with baby with utmost precautions OR separate temporarily until baby's test results	SHARED DECISION. Room-in with mother with utmost precautions OR separate temporarily until baby's test results	SHARED DECISION. Breastfeed baby with utmost precautions or give expressed breastmilk or pasteurized breastmilk
Confirmed COVID19 but unstable	Already done	Yes, at 24 hours	Yes	Admit in Isolation Room if stable. May be discharged with caregiver designated by the mother. Admit in NICU Isolation if unstable	Expressed MOM, if feasible, or pasteurized breastmilk
Suspected COVID19 but stable	Yes	Yes, at 24 hours	SHARED DECISION. Room-in with baby with utmost precautions OR separate temporarily until baby's test results	SHARED DECISION. Room-in with mother with utmost precautions OR separate temporarily until baby's test results	SHARED DECISION. Breastfeed baby with utmost precautions or give expressed breastmilk or pasteurized breastmilk
Suspected COVID19 but unstable	Yes	Yes, at 24 hours	Yes, in the ICU Isolation	Admit in Isolation. May be discharged with caregiver designated by the mother	Expressed MOM, if feasible, or pasteurized breastmilk.

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