The following information resources have been selected by the National Health Library and Knowledge Service Evidence Virtual Team in response to your question. The resources are listed in our estimated order of relevance to practicing healthcare professionals confronted with this scenario in an Irish context. In respect of the evolving global situation and rapidly changing evidence base, it is advised to use hyperlinked sources in this document to ensure that the information you are disseminating to the public or applying in clinical practice is the most current, valid and accurate. For further information on the methodology used in the compilation of this document—including a complete list of sources consulted—please see our National Health Library and Knowledge Service Summary of Evidence Protocol.

YOUR QUESTION

What guidance is available for healthcare workers on the provision of CPR for paediatric patients in hospital and community settings during the COVID-19 pandemic?

IN A NUTSHELL

International guidance is available on cardiopulmonary resuscitation for paediatric patients in the context of the COVID-19 pandemic, including guidance in cases of sepsis or septic shock. The management of children with known or suspected COVID-19 requires specific consideration to safety for staff and patients. As in adults, accuracy is critical, and clinicians should avoid unreliable, unfamiliar or repeated techniques during airway management, thus enabling it to be safe, accurate and swift. The basic principles of airway management of children for anaesthesia and critical care are not changed by the presence of COVID-19 but require careful adaptation and application to maintain patient and staff safety.

Children with emergency signs—obstructed or absent breathing, severe respiratory distress, central cyanosis, shock, coma or convulsions—should receive airway management and oxygen therapy during resuscitation to target SpO2 ≥ 94%; otherwise, the target SpO2 is ≥ 90%. Use of nasal prongs or nasal cannula is preferred in young children, as it may be better tolerated. In resuscitation from septic shock in children, give 10–20 mL/kg crystalloid fluid as a bolus in the first 30–60 minutes and reassess for signs of fluid overload after each bolus.

UpToDate includes a section relating to the prevention of transmission of SARS-CoV-2 during cardiopulmonary resuscitation, and refers to the American Academy of Paediatrics guidance.
A search of the international literature resulted in a small number of recently published studies predominantly related to perinatal and neonatal resuscitation.\textsuperscript{12-14}

\section*{INTERNATIONAL GUIDANCE}

**Interim Guidance for Basic and Advanced Life Support in Adults, Children, and Neonates With Suspected or Confirmed COVID-19: From the Emergency Cardiovascular Care Committee and Get With the Guidelines\textsuperscript{®} Resuscitation Adult and Pediatric Task Forces of the American Heart Association in Collaboration with the American Academy of Pediatrics, American Association for Respiratory Care, American College of Emergency Physicians, the Society of Critical Care Anesthesiologists, and American Society of Anesthesiologists: Supporting Organizations: American Association of Critical Care Nurses and National EMS Physicians\textsuperscript{1}**

This statement applies to all adult, paediatric and neonatal resuscitations in patients with suspected or confirmed COVID-19 infection. The statement is based on expert opinion and should be adapted locally. The guidance comprises:

**General Principles for Resuscitation in Suspected and Confirmed COVID-19 Patients**
- Reduce provider exposure to COVID-19
- Prioritize oxygenation and ventilation strategies with lower aerosolization risk
- Consider the appropriateness of starting and continuing resuscitation.

**Situation- and Setting-Specific Considerations**
- Out-of-Hospital Cardiac Arrest (OHCA)
- In-Hospital Cardiac Arrest (IHCA)
- Maternal and Neonatal Considerations

\textbf{Royal College of Paediatrics and Child Health, British Association of Perinatal Medicine: COVID-19 guidance for neonatal settings\textsuperscript{2}}

Section: Maternal Admissions
Commonly used equipment for neonatal resuscitation and stabilisation should be readily available—eg located in disposable grab bags—to avoid taking the full resuscitation trolley into the room unless required. A dedicated pulse oximeter should be located on the resuscitaire to avoid moving equipment in and out of the delivery room unnecessarily. The appropriate PPE must be worn by any person entering the room and only essential staff should be present in the delivery room or theatre. Neonatal resuscitation/stabilisation should proceed as per current NEWBORN LIFE SUPPORT AND ADVANCED RESUSCITATION OF THE NEWBORN INFANT guidance.

**Guidelines from the Association of Anaesthetists, the Difficult Airway Society, the Intensive Care Society, the Faculty of Intensive Care Medicine, the Royal College of Anaesthetists, Paediatric Intensive Care Society and Association of Paediatric Anaesthetists: Consensus guidelines for managing the airway in children with COVID-19**

Summary

Airway management of patients with COVID-19 is high risk to staff and patients. Guidance has been published directed at adult practice. The vast majority of this guidance is also applicable to paediatric patients. This consensus statement provides advice for anaesthetists who undertake airway management in paediatric patients suspected or confirmed to have COVID-19 and seeks to provide clarity where that guidance differs for paediatric patients. It is not directly relevant to neonatal practice in neonatal ICUs. This document does not stand alone as advice but should be read with the adult advice.

Conclusions

“The management of children with known or suspected COVID-19 requires specific consideration to safety for staff and patients. As in adults, accuracy is critical, and clinicians should avoid unreliable, unfamiliar or repeated techniques during airway management, thus enabling it to be safe, accurate and swift. The basic principles of airway management of children for anaesthesia and critical care are not changed by the presence of COVID-19 but require careful adaptation and application to maintain patient and staff safety.”
Resuscitation Council UK: Statement on COVID-19 in relation to CPR and resuscitation in paediatrics

Statement for healthcare professionals performing CPR in a health care setting and for members of the public performing CPR in a community setting.

Section: In Hospital Resuscitation
“Mouth-to-mouth ventilations should not be necessary as equipment is available for bag-mask ventilation/intubation and must be immediately available for any child/infant at risk of deterioration/cardiac arrest in the hospital setting”.

Section: Out of Hospital Resuscitation
“It is likely that the child/infant having an out-of-hospital cardiac arrest will be known to you. We accept that doing rescue breaths will increase the risk of transmitting the COVID-19 virus, either to the rescuer or the child/infant. However, this risk is small compared to the risk of taking no action as this will result in certain cardiac arrest and the death of the child”.

Resuscitation Council UK: Statement on COVID-19 in relation to CPR and resuscitation in first aid and community settings

Paediatric Advice
“We are aware that paediatric cardiac arrest is unlikely to be caused by a cardiac problem and is more likely to be a respiratory one, making ventilations crucial to the child’s chances of survival. However, for those not trained in paediatric resuscitation, the most important thing is to act quickly to ensure the child gets the treatment they need in the critical situation. For out-of-hospital cardiac arrest, the importance of calling an ambulance and taking immediate action cannot be stressed highly enough. If a child is not breathing normally and no actions are taken, their heart will stop and full cardiac arrest will occur. Therefore, if there is any doubt about what to do, this statement should be used.

“It is likely that the child/infant having an out-of-hospital cardiac arrest will be known to you. We accept that doing rescue breaths will increase the risk of transmitting the COVID-19 virus, either to the rescuer or the child/infant. However, this risk is small compared to the risk of taking no action as this will result in certain cardiac arrest and the death of the child.”
**Resuscitation Council UK: Statement on COVID-19 in relation to CPR and resuscitation in acute hospital settings**

**Paediatric Advice**

“We are aware that paediatric cardiac arrest is unlikely to be caused by a cardiac problem and is more likely to be a respiratory one, making ventilations crucial to the child’s chances of survival. However, for those not trained in paediatric resuscitation, the most important thing is to act quickly to ensure the child gets the treatment they need in the critical situation. The Resuscitation Council UK Statement on COVID-19 in relation to CPR and resuscitation in healthcare settings advice for in-hospital cardiac arrest is relevant to all ages. Mouth-to-mouth ventilations should not be necessary as equipment is available for bag-mask ventilation/intubation and must be immediately available for any child/infant at risk of deterioration/cardiac arrest in the hospital setting.”

**International Liaison Committee on Resuscitation (ILCOR): COVID-19 infection risk to rescuers from patients in cardiac arrest**

**Treatment Recommendations**

- We suggest that chest compressions and cardiopulmonary resuscitation have the potential to generate aerosols [weak recommendation, very low certainty evidence]
- We suggest that in the current COVID-19 pandemic lay rescuers consider chest compressions and public access defibrillation [good practice statement]
- We suggest that in the current COVID-19 pandemic, lay rescuers who are willing, trained and able to do so, consider providing rescue breaths to infants and children in addition to chest compressions [good practice statement]
- We suggest that in the current COVID-19 pandemic, healthcare professionals should use personal protective equipment for aerosol generating procedures during resuscitation [weak recommendation, very low certainty evidence]
Government of Canada: Clinical management of patients with moderate to severe COVID-19: interim guidance

Section 6.1 Oxygen Therapy and Monitoring
Give supplemental oxygen therapy immediately to patients with COVID-19 who have severe acute respiratory infection and respiratory distress, hypoxaemia or shock, and target saturations of 90-96% SpO2 during resuscitation.

Children with a worsening clinical presentation — obstructed or absent breathing, severe respiratory distress, central cyanosis, shock, coma or convulsions — should receive airway management and oxygen therapy during resuscitation to target SpO2 ≥ 94%; otherwise, the target SpO2 is ≥ 90%. The use of a nasal cannula is preferred in young children, as it may be better tolerated.

Section 7.2 Septic Shock
Recognize septic shock in children with any hypotension — systolic blood pressure [SBP] < 5th centile or 2 SD below normal for age — or two or more of the following: altered mental state; bradycardia or tachycardia (HR < 90 bpm or > 160 bpm in infants and HR < 70 bpm or > 150 bpm in children); prolonged capillary refill (> 2 sec) or feeble pulses; tachypnea; mottled or cool skin or petechial or purpuric rash; increased lactate; oliguria; hyperthermia or hypothermia.

Recommendations for Resuscitation Strategies for Adult and Paediatric Patients with Septic Shock
In resuscitation for septic shock in children, give 10–20 mL/kg crystalloid fluid as a rapid bolus in the first 30–60 minutes and reassess for signs of fluid overload after each bolus.

Fluid resuscitation may lead to volume overload, including respiratory failure, particularly with ARDS. If there is no response to fluid loading or signs of volume overload appear such as jugular venous distention, crackles on lung auscultation, pulmonary edema on imaging, or hepatomegaly in children, then reduce or discontinue fluid administration. This step is particularly important in patients with hypoxemic respiratory failure.
What does the Health Protection Surveillance Centre (Ireland) say?

**HSE Deteriorating Patient Improvement Programme (9th April 2020) CPR Guidance for Confirmed or Suspected COVID-19 in Community Assessment Hubs**

This guidance has been developed by the HSE Deteriorating Patient Improvement Programme and is categorised as follows:

— recognise cardiopulmonary arrest
— use AED check if shockable rhythm present
— cardiopulmonary resuscitation (CPR): chest compressions and airway management
— reversible causes
— equipment
— doffing PPE
— documentation and debriefing

Accompanying [infographics](#) are also available.
What does the World Health Organization say?
Clinical management of severe acute respiratory infection when COVID-19 is suspected. Interim guidance 13 March 2020

Section 6
Remarks for children: Children with emergency signs — obstructed or absent breathing, severe respiratory distress, central cyanosis, shock, coma or convulsions — should receive airway management and oxygen therapy during resuscitation to target $\text{SpO}_2 \geq 94\%$; otherwise, the target $\text{SpO}_2$ is $\geq 90\%$. Use of nasal prongs or nasal cannula is preferred in young children, as it may be better tolerated.

Section 10
In resuscitation from septic shock in children, give 10–20 mL/kg crystalloid fluid as a bolus in the first 30–60 minutes and reassess for signs of fluid overload after each bolus.

POINT-OF-CARE TOOLS

What does UpToDate say?
Coronavirus Disease 2019 (COVID-19): Considerations in Children

Section: Prevention and Transmission
During cardiopulmonary resuscitation: Prevention of transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) requires changes to algorithms for basic and standard cardiopulmonary resuscitation including:
— Donning personal protective equipment before entering the room and scene
— Limiting personnel in the patient room to four people; video monitors if available can be used for some roles that can be performed outside the room: eg the recorder
— Engaging the intubator who is most likely to succeed on the first pass
— Consideration of using mechanical cardiopulmonary devices for adults and adolescents if they meet weight and height criteria
— Prioritizing oxygenation and ventilation strategies with lower aerosolization risk: eg, using a high-efficiency particulate air [HEPA] filter, if available for all ventilation
Intubating early with a cuffed tube, if possible
— Pausing chest compressions to intubate

Additional interim guidance and updated algorithms are available from the Guidelines-Resuscitation Task Force of the American Heart Association, in collaboration with other specialty societies, and other professional societies.

INTERNATIONAL LITERATURE

What does the international literature say?


How to manage a paediatric cardiac arrest in suspected or confirmed cases of sepsis or septic shock:

— Do not use the hospital cardiac arrest team
— Devise a modified protocol beforehand with identified members of senior paediatric team and ensure all are mask fit tested and able to don and doff PPE
— If the child is intubated and ventilated try not to disconnect from the ventilator when doing CPR
— If the crash trolley is used dispose of all the contents within the isolation room before taking the trolley out of the room to be cleaned with hyperchlorite wipes

Chandrasekharan et al (2020) Neonatal Resuscitation and Postresuscitation Care of Infants Born to Mothers with Suspected or Confirmed SARS-CoV-2 Infection

Designated Resuscitation Team: Hospital facilities could consider the designation of a specific newborn resuscitation team to attend deliveries of mothers with suspected or confirmed COVID-19. A designated team in a high-volume birthing center could potentially minimize exposure and transmission of SARS-CoV-2 among healthcare providers and from infected mothers to non-infected mothers and infants. A minimum number of neonatal resuscitators should be in the room, with the rest of the team being available outside the room.
Stabilization and Resuscitation of the Neonate: The current American Academy Pediatrics (AAP) and Neonatal Resuscitation Programme (NRP) recommendations in the delivery room should be followed. The optimal location for neonatal stabilization and resuscitation is not clear. It can be conducted in an adjacent room or the same place at least 6 feet or 2 m away from the mother with a physical barrier. It is preferable to conduct resuscitation in an isolette with a hood that can be elevated to provide warmth for resuscitation and then lowered for transport. Regardless of gestational age, the newborn should be transported in a closed isolette and maintained in the isolette for post resuscitation care.

Airway Management: A newborn airway should be managed as per NRP recommendations. Clearing the airway by suctioning could generate aerosols. Adequate PPE as mentioned previously will protect the providers present in the delivery room.

Chawla et al (2020) Perinatal-Neonatal Management of COVID-19 Infection - Guidelines of the Federation of Obstetric and Gynecological Societies of India (FOGSI), National Neonatology Forum of India (NNF), and Indian Academy of Pediatrics (IAP)

Recommendation 3
Separate delivery room and operation theatres are required for management of suspected or confirmed COVID-19 mothers. Both should have neonatal resuscitation corners located at least 2 meters away from the delivery table. Resources required include space, equipment, supplies and trained healthcare providers for delivery, caesarean section and neonatal resuscitation. The standards and facilities required for infection control in these areas should be same as that for other adults with suspected or confirmed COVID-19.

Recommendations for Neonatal Resuscitation
If possible, resuscitation of neonate may be done in a physically separate but inter-connected adjacent room earmarked for this purpose. If not feasible, the resuscitation warmer should be physically separated from the mother’s delivery area by a distance of at least 2 meters. A curtain can be used between the two areas to minimize opportunities for close contact.

- Minimum number of personnel should attend — one person in low risk cases and two in high risk cases where extensive resuscitation may be anticipated — and wear a full set of personal protective equipment including N95 mask
- The mother should perform hand hygiene and wear a triple layer mask
The umbilical cord should be clamped promptly and skin to skin contact avoided.

The delivery team member should bring over the neonate to the resuscitation area for assessment by the neonatal team.

Neonatal resuscitation should follow standard guidelines. If positive-pressure ventilation is needed, self-inflating bag and mask may be preferred over T-piece resuscitator.

**Canadian Paediatric Society (2020) Practice Point: Delivery room considerations for infants born to mothers with suspected or proven COVID-19**

Includes precautions at delivery for mothers with suspected or proven COVID-19.
Produced by the members of the National Health Library and Knowledge Service Evidence Team. Current as at 30 April 2020. This evidence summary collates the best available evidence at the time of writing and does not replace clinical judgement or guidance. Emerging literature or subsequent developments in respect of COVID-19 may require amendment to the information or sources listed in the document. Although all reasonable care has been taken in the compilation of content, the National Health Library and Knowledge Service Evidence Team makes no representations or warranties expressed or implied as to the accuracy or suitability of the information or sources listed in the document. This evidence summary is the property of the National Health Library and Knowledge Service and subsequent re-use or distribution in whole or in part should include acknowledgement of the service.

The following PICO(T) was used as a basis for the evidence summary:

- **Population**: PAEDIATRIC PATIENTS
- **Problem**: PROVISION OF CARDIOPULMONARY RESUSCITATION
- **Comparison**: TRANSMISSION OF COVID-19

The following search strategy was used:

**Pubmed**

#1 2019-ncov or 2019ncov or covid-19 or sars-cov-2 or (wuhan and coronavirus)
#2 "cardiopulmonary resuscitation"[mesh terms]
#3 "cpr"[text word] or "resuscitation"[text word] or “resus”[text word] or "cardiopulmonary resuscitation"[text word] or "chest-compression"[text word] or "cardiac arrest"[text word] or "advanced cardiac life support"[text word]
#4 (#2 OR #3)
#5 (#1 AND #4)

Sources searched: Pubmed, Embase, Medline, Google Scholar, Guidelines.

1 Maura Flynn Librarian, Midland Regional Hospital Tullamore [Author]; Anne Madden Anne Assistant Librarian, St. Vincent’s University Hospital, Dublin [Author]; Margaret Morgan Librarian, Midland Regional Hospital Mullingar [Author]; Brendan Leen, Regional Librarian, HSE South, St. Luke’s General Hospital, Kilkenny [Editor].


