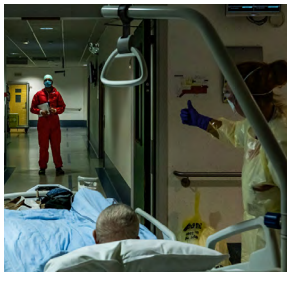
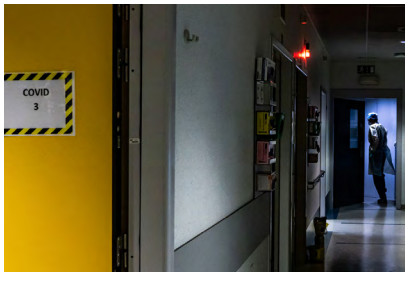
European Resuscitation Council COVID-19 Guidelines





EUROPEAN RESUSCITATION COUNCIL

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European Resuscitation Council COVID-19 Guidelines

Edition 1

Contents

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Section 1

Introduction

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▶ *This guideline was provided on 24 April 2020 and will be subject to evolving knowledge and experience of COVID-19. As countries are at different stages of the pandemic, there may be some international variation in practice.*

Introduction

The World Health Organization has declared COVID-19 a pandemic. The disease is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and is highly contagious. A recent systematic review that included 53,000 patients indicates that 80% of patients have mild disease, 15% have moderate disease and about 5% have severe disease requiring intensive care unit (ICU) admission.[1] In this review the fatality rate was 3.1%. Among 136 patients with severe COVID-19 pneumonia and in-hospital cardiac arrest at a tertiary hospital in Wuhan, China, 119 (87.5%) had a respiratory cause for their cardiac arrest.[2] In this series of patients, the initial cardiac arrest rhythm was asystole in 122 (89.7%), pulseless electrical activity in 6 (4.4%) and ventricular fibrillation/ pulseless ventricular tachycardia (VF/pVT) in 8 (5.9%). In a case series of 138 hospitalised COVID-19 patients, 16.7% of patients developed arrhythmias and 7.2% had acute cardiac injury.[3] Thus, although most cardiac arrests in these patients are likely to present with a non-shockable rhythm caused by hypoxaemia (although dehydration, hypotension and sepsis may also contribute), some will have a shockable rhythm, which may be associated with drugs causing prolonged-QT syndrome (e.g. chloroquine, azithromycin) or caused by myocardial ischaemia. In the series of 136 cardiac arrests from Wuhan, four (2.9%) patients survived for at least 30 days but only one of these had a favourable neurological outcome.[2]

Risks associated with cardiopulmonary resuscitation (CPR) in patients with COVID-19

Mechanisms of transmission of SARS-CoV-2

The main mechanism of disease transmission of SARS-CoV-2 is by respiratory secretions either directly from the patient or by touching contaminated surfaces. Respiratory secretions are called either droplets (> 5–10 microns in diameter) or airborne particles (< 5 microns). Droplets fall onto surfaces within 1–2 metres of the patient's respiratory tract while airborne particles can remain suspended in the air for prolonged periods.[4]

Personal protective equipment (PPE)

The minimum ***droplet-precaution*** personal protective equipment (PPE) comprises:

- Gloves
- Short-sleeved apron
- Fluid-resistant surgical mask
- Eye and face protection (fluid-resistant surgical mask with integrated visor or full-face shield/visor or polycarbonate safety glasses or equivalent).

The minimum ***airborne-precaution*** PPE comprises:

- Gloves
- Long-sleeved gown
- Filtering facepiece 3 (FFP3) or N99 mask/respirator (FFP2 or N95 if FFP3 not available)*
- Eye and face protection (full-face shield/visor or polycarbonate safety glasses or equivalent). Alternatively, powered air purifying respirators (PAPRs) with hoods may be used.

* The European Standard (EN 149:2001) classifies FFP respirators into three classes: FFP1, FFP2, and FFP3 with corresponding minimum filtration efficiencies of 80%, 94%, and 99%. The US National Institute for Occupational Safety and Health (NIOSH) classifies particulate filtering facepiece respirators into nine categories based on their resistance to oil and their efficiency in filtering airborne particles. N indicates not resistant to oil; R is moderately resistant to oil; and P is strongly resistant to oil – 'oil proof'. The letters N, R or P are followed by numerical designations 95, 99, or 100, which indicate the filter's minimum filtration efficiency of 95%, 99%, and 99.97% of airborne particles (<0.5 microns).[5,6]

Some healthcare systems are facing shortages of personnel and equipment, including ventilators, to treat critically ill patients during the COVID-19 pandemic. Decisions on triage and allocation of healthcare resources, including the provision of CPR and other emergency care must be made by individual systems based on their resources, values and preferences. However, the position of the ERC is that it is never acceptable to compromise the safety of healthcare professionals.

The International Liaison Committee on Resuscitation (ILCOR) has undertaken a systematic review addressing 3 questions [7]:

1. Is the delivery of chest compressions or defibrillation an aerosol-generating procedure?
2. Do the delivery of chest compressions, defibrillation or CPR (all CPR interventions that include chest compressions) increase infection transmission?
3. What type of PPE is required by individuals delivering chest compressions, defibrillation or CPR in order to prevent transmission of infection from the patient to the rescuer?

The evidence addressing these questions is scarce and comprises mainly retrospective cohort studies [8,9] and case reports.[10-15]

In most cases, delivery of chest compressions and defibrillation are lumped together with all CPR interventions, which means that there is considerable confounding in these studies. Aerosol generation by chest compressions is plausible because they generate small but measurable tidal volumes.[16] Chest compressions are similar to some chest physiotherapy techniques, which are associated with aerosol generation.[17] Furthermore, the person performing chest compressions is close to the patient's airway.

The ILCOR systematic review did not identify evidence that defibrillation generates aerosols. If it occurs, the duration of an aerosol generating process would be brief. Furthermore, the use of adhesive pads means that defibrillation can be delivered without direct contact between the defibrillator operator and patient.

The **ILCOR treatment recommendations** are:

- 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 compression-only resuscitation 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, may wish to deliver rescue breaths to 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).
- We suggest that it may be reasonable for healthcare providers to consider defibrillation before donning aerosol generating personal protective equipment in situations where the provider assesses the benefits may exceed the risks (good practice statement)

*Comment - it is the view of the ERC that this applies to first responders as well as lay rescuers.

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Section 2

Basic Life Support in Adults

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▶ *This guideline was provided on 24 April 2020 and will be subject to evolving knowledge and experience of COVID-19. As countries are at different stages of the pandemic, there may be some international variation in practice.*

The infection rates with the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) vary across Europe, and general recommendations for the treatment of patients without confirmed COVID-19 may need to be adjusted based on local risk assessments. For patients with confirmed and suspected COVID-19 the European Resuscitation Council recommends the following changes to basic life support (BLS) based on the recent ILCOR evidence review and commentary:[1,2,3]

General recommendations for BLS in adults by lay rescuers for suspected or confirmed COVID-19

- Cardiac arrest is identified if a person is unresponsive and not breathing normally.
- Responsiveness is assessed by shaking the person and shouting. When assessing breathing, look for normal breathing. In order to minimise the risk of infection, do not open the airway and do not place your face next to the victims' mouth / nose.

- Call the emergency medical services if the person is unresponsive and not breathing normally.
- During single-rescuer resuscitation, if possible, use a phone with a hands-free option to communicate with the emergency medical dispatch centre during CPR .
- Lay rescuers should consider placing a cloth/towel over the person's mouth and nose before performing chest compressions and public-access defibrillation. This may reduce the risk of airborne spread of the virus during chest compressions.
- Lay rescuers should follow instructions given by the emergency medical dispatch centre.
- After providing CPR, lay rescuers should, as soon as possible, wash their hands thoroughly with soap and water or disinfect their hands with an alcohol-based hand-gel and contact the local health authorities to enquire about screening after having been in contact with a person with suspected or confirmed COVID-19.

Recommendations for emergency medical dispatch staff for suspected or confirmed COVID-19 in adults

- For untrained rescuers, provide compression-only instructions.
- Guide rescuers to the nearest automated external defibrillator (AED) when available.
- The risk of COVID-19 should be assessed by emergency medical dispatch as early as possible; if there is a risk of infection, the responding healthcare personnel should be alerted immediately to enable them to take precautions such as donning airborne-precaution personal protective equipment (PPE).
- First responders or trained volunteers should be dispatched or alerted to medical emergencies only if they have access to and training in the use of PPE. If first responders or trained volunteers have only droplet-precaution PPE, they should provide only defibrillation (if indicated), and no chest compressions, for patients with suspected or confirmed COVID-19.

Recommendations for BLS in adults by healthcare personnel for suspected or confirmed COVID-19

- Teams responding to cardiac arrest patients (both in- and out-of-hospital) should be comprised only of healthcare workers with access to, and training in the use of airborne-precaution PPE.
- Applying defibrillator pads and delivering a shock from an AED/defibrillator is unlikely to be an aerosol-generating procedure and can be undertaken with the healthcare provider wearing droplet-precaution PPE (fluid-resistant surgical mask, eye protection, short-sleeved apron and gloves.
- Recognise cardiac arrest by looking for the absence of signs of life and the absence of normal breathing.

- Healthcare professionals should always use airborne-precaution PPE for aerosol-generating procedures (chest compressions, airway and ventilation interventions) during resuscitation.
- Perform chest compressions and ventilation with a bag-mask and oxygen at a 30:2 ratio, pausing chest compressions during ventilations to minimise the risk of aerosol. BLS teams less skilled or uncomfortable with bag-mask ventilation should not provide bag-mask ventilation because of the risk of aerosol generation. These teams should place an oxygen mask on the patient's face, give oxygen and provide compression-only CPR.
- Use a high-efficiency particulate air (HEPA) filter or a heat and moisture exchanger (HME) filter between the self-inflating bag and the mask to minimize the risk of virus spread.
- Use two hands to hold the mask and ensure a good seal for bag-mask ventilation. This requires a second rescuer – the person doing compressions can squeeze the bag when they pause after each 30 compressions.
- Apply a defibrillator or an AED and follow any instructions where available.

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Section 3

Advanced Life Support in Adults

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Introduction

The significant risk of transmission of SARS-CoV-2 to healthcare staff mandates changes to Advanced Life Support (ALS) guidelines.[1–3] The guidance may change as more is learnt about COVID-19 – Check the ERC website for the latest guidance (*www.erc.edu*).

Safety is paramount and the safety priorities are: (1) self; (2) colleagues and bystanders; (3) the patient. The time required to achieve safe care is an acceptable part of the resuscitation process.

In-hospital cardiac arrest

1. Identify as early as possible any patients with a COVID-19 like illness, who are at risk of acute deterioration or cardiac arrest. Take appropriate steps to prevent cardiac arrest and avoid unprotected CPR.
2. Use of physiological track-and-trigger systems will enable early detection of acutely ill patients.

3. For those for whom resuscitation would be inappropriate, decisions must be made and communicated. Patients with severe COVID-19 respiratory failure who would not be deemed suitable for tracheal intubation and mechanical ventilation or multiple organ support are extremely unlikely to survive attempted resuscitation after cardiac arrest. For such patients, a do not attempt CPR (DNACPR) decision is likely to be appropriate.

4. Personal Protective Equipment (PPE) must be available to protect staff during resuscitation attempts. It is acknowledged that this may cause a brief delay to starting chest compressions, but the safety of staff is paramount.

5. Chest compressions have the potential to generate aerosols and airway interventions are aerosol-generating procedures (AGPs). Healthcare staff should therefore don (put on) airborne-precaution personal protective equipment (PPE) before starting chest compressions and /or airway interventions; as a minimum a FFP3 mask (FFP2 or N95 if FFP3 not available), eye and face protection, long-sleeved gown, and gloves before undertaking these procedures.

6. Ensure there is a viral filter (heat and moisture exchanger (HME) filter or high-efficiency particulate air (HEPA) filter) between the self-inflating bag and airway (mask, supraglottic airway, tracheal tube) to filter exhaled breaths.

7. Applying defibrillator pads and delivering a shock from an AED/defibrillator is unlikely to be an aerosol-generating procedure and can be undertaken with the healthcare provider wearing a fluid-resistant surgical mask, eye protection, short-sleeved apron and gloves.

Sequence of actions for in-hospital cardiac arrest of a patient with confirmed or suspected COVID-19

1. If a patient is unresponsive and not breathing normally shout for help/pull emergency bell.

2. Check for signs of life/pulse. DO NOT listen for breaths or place your cheek near to the patient's face.

3. Send someone to place a COVID cardiac arrest call (2222 or equivalent local number), and to bring a defibrillator.

4. If a defibrillator is immediately available, switch it on, apply the defibrillator pads and deliver a shock if the rhythm is ventricular fibrillation/ pulseless ventricular tachycardia (VF/pVT). If the patient remains in VF/pVT, and if you are wearing airborne-precaution PPE, start chest compressions. If not, give up to two additional shocks (if indicated) while other healthcare workers are putting on airborne-precaution PPE.

5. If using an AED, follow the prompts and deliver a shock if indicated; do not start chest compressions until you are wearing airborne-precaution PPE for AGPs.

6. Don (put on) airborne-precaution PPE (if not already on).
7. Do not proceed with chest compressions or airway interventions without airborne-precaution PPE.
8. Restrict the number of staff in the room or at the bedside. Allocate a gatekeeper to do this. All personnel not immediately needed should keep their distance from the patient and remain protected.
9. If no signs of life, start chest compressions (continuous until bag-mask device arrives).
10. If not on the patient already, place an oxygen mask and give oxygen. Leave the mask on the patient until a bag-mask device arrives.
11. Once a bag-mask device arrives, proceed with a compression:ventilation ratio of 30:2. Ensure there is a viral filter (HME filter or HEPA filter) between the self-inflating bag and airway (mask, supraglottic airway, tracheal tube) to filter exhaled breaths.
12. Manual ventilation with a bag-mask should be minimised and be performed only by experienced staff using a 2-person technique because an ill-fitting mask/poor seal will generate an aerosol. The person doing compressions can pause to squeeze the bag.
13. Experienced airway staff should insert a supraglottic airway or intubate the trachea early so that the period of bag-mask ventilation is minimised. Consider videolaryngoscopy for tracheal intubation by providers familiar with its use – this will enable the intubator to remain further from the patient's mouth.
14. If a supraglottic airway has been inserted, use a 30:2 chest compression ventilation ratio, pausing the chest compressions to enable ventilation. This will minimise the risk of aerosol generation caused by gas leaking from the seal between the supraglottic airway and larynx.
15. Consider stopping CPR early if treatable reversible causes of cardiac arrest have been addressed.
16. If there is a need for prolonged CPR, consider the use of a mechanical chest compression device in those settings that are familiar with its use.
17. Ensure the safe removal ('doffing') of PPE to prevent self-contamination.
18. Undertake a team debrief.

Resuscitation in intubated patients at the time of cardiac arrest

1. Rescuers should wear airborne-precaution PPE.
2. In the event of cardiac arrest in an intubated and mechanically ventilated patient, to avoid aerosol generation, in general, do not disconnect the ventilator circuit when starting CPR.

3. Increase the FiO_2 to 1.0 and set the ventilator to deliver 10 breaths a minute.
4. Quickly check the ventilator and circuit to ensure that they have not contributed to the cardiac arrest, e.g. blocked filter, breath-stacking with high auto-PEEP, or mechanical failure. Follow local guidance regarding ventilator disconnection to minimise aerosol generation e.g. clamping the tube prior to disconnection, use of viral filters etc.

Resuscitation in patients in the prone position

COVID-19 patients are often managed in the prone position because this can improve oxygenation. Most of these patients will be intubated, but in some cases awake unintubated COVID-19 patients may also be nursed in the prone position. In the event of cardiac arrest in the unintubated, prone patient, whilst wearing the correct PPE, immediately turn the patient supine before starting chest compressions. In the event of cardiac arrest in an intubated patient who is prone, it is possible to deliver chest compressions by pressing the patient's back. This can provide some perfusion of vital organs while a team prepares to turn the patient supine, as follows:

1. Rescuers should wear airborne-precaution PPE.
2. Compress between the scapulae (shoulder blades) at the usual depth and rate (5 to 6 cm at 2 compressions per second).
3. Turn patient supine if:
   a. ineffective compressions – look at arterial line and aim for diastolic pressure greater than 25 mmHg
   b. interventions require the patient supine, e.g. for airway problems
   c. unable to restore a circulation rapidly (minutes)
4. Turning the patient supine requires additional help – plan this early.
5. Defibrillator pad placement options in the prone position include:
   a. Anterior-posterior (front and back), or
   b. Bi-axillary (both armpits).

Out-of-hospital cardiac arrest

Most of the principles described for the management of in-hospital cardiac arrest in adults with confirmed or suspected COVID-19 also apply to ALS for such patients in cardiac arrest out-of-hospital.

In the context of COVID-19, early recognition of cardiac arrest by the dispatcher will enable emergency medical services (EMS) staff to put on airborne-precaution PPE as soon as possible.

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Section 4

Paediatric Basic and Advanced Life Support

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Introduction

Children are susceptible to coronavirus disease 2019 (COVID-19) but often seem to have only mild disease.[1-7] Very young children and children with co-morbid diseases may be more prone to severe illness.8 In the largest, currently-published, paediatric, case-series (Chinese CDC 01/16 – 02/08; n=2143) 5.2% had severe disease (defined as 'dyspnoea, central cyanosis and an oxygen saturation of less than 92%'), and 0.6% had critical disease.[9] However, many other pathogens and/or underlying aetiologies might cause respiratory failure in children and a clear diagnosis may be difficult to obtain.[10]

Taking this into account, the ERC paediatric guideline writing group [pWG] is aware that any changes to resuscitation guidelines might have a significant impact on the management and subsequent outcomes of critically ill children.[11-13]

These 'temporary' adaptations to the existing paediatric guidelines in the setting of COVID-19 should be interpreted within the context of each healthcare system, e.g. considering the degree of COVID-19 spread and evolving disease profile within that region, and the overall impact on available resources. Given the limited evidence, the following guidelines are mainly the result of expert consensus. They are based on the

recent ILCOR systematic review, and on the existing guidelines from other societies and councils, whilst including the data from existing paediatric clinical studies.[8,14-20] Indirect evidence from adult studies or non-clinical papers (on pathophysiology etc.) has also been considered in informing our final insights.

Protection of bystanders and healthcare professionals

a. *Healthcare systems should have procedures and necessary materials available for the proper protection of their providers (healthcare professionals, first responders etc.).* This includes having personal protective equipment [PPE] and guidelines on its use; having clear strategies on cohorting, testing and decontamination; and having written protocols and dedicated teams for high-risk procedures.[21]

   These procedures need to consider the different clinical contexts and associated risks, as well as available resources. Strategies for implementation in all settings, and ongoing (simulation) training is essential.

b. *Healthcare providers should use PPE when treating a critically ill child who has confirmed or suspected COVID-19.* The type of PPE should be defined at 'system' level, proportionate to the presumed risk of transmission.17 To limit the risk of transmission and conserve resources, only essential healthcare providers should be involved on scene / in the room.

c. *Lay bystanders should protect themselves as far as feasible and avoid actions with a high risk of transmission.* Rescuers who are caregivers or household members of the child will probably have already been exposed to the virus, and are likely to be more willing to provide support regardless of the potential increased risk.

d. Lay bystanders and healthcare providers must be aware of potential risks, and the decision on when and how to intervene should be an individual one, but only as far as it does not endanger another provider or bystander.

In approximately 70% of paediatric out-of-hospital cardiac arrests, rescuers are likely to be family members and therefore to have had previous exposure to SARS-CoV-2 (if the child was infected). They might also consider their personal risk far less important than the potential benefit for the child. This is unlikely to be true for random bystanders. Healthcare providers may also value the benefit for the child higher than their personal risk, but they should be aware of their responsibility towards their relatives, colleagues and the wider community as well.[23]

Recognition of the critically ill child

The current advice for the recognition of the seriously ill child still holds, whether or not the child has COVID-19.[24] The ERC emphasises the importance of early recognition of severe illness, initially by means of a quick hands-off observational assessment of behaviour, breathing and bodily colour (e.g. as in the Paediatric Assessment Triangle)

and subsequently, if needed, a comprehensive stepwise pathophysiology-based ABCDE approach *(see also topic 3 for the management of airway and breathing)*.[25] There are no clinical signs or biochemical parameters with good sensitivity or specificity for COVID-19 in isolation.[2,26-28] Providers should have a high level of suspicion for either hypoxia or myocarditis, which can occur without other obvious clinical signs being present. Teamwork is important in the management of any seriously ill or injured child but the team size should be optimised at every stage (in view of effectiveness).

Airway & breathing management of a critically child with potential COVID-19 infection

a. Open and maintain, if needed, the airway by means of positioning and, as far as feasible, head tilt - chin lift *(see also topic 4)* or jaw thrust (in trauma or when performing bag-mask ventilation [BMV]). Regardless of the child's COVID-19 status, proper airway maintenance remains a crucial part of the respiratory management of any critically ill or injured child *(see also below)*.

b. Use supplemental oxygen early to support oxygenation (but avoid unnecessary hyperoxia).[30-31] Oxygen can be given by nasal cannula, a simple oxygen mask or a non-rebreathing mask. Provide the patient with a surgical mask when using any of these devices (in all patients for whom COVID-19 cannot be ruled out). If needed, give medication via MDI/spacer instead of a nebuliser (even if in itself not an aerosol-generating procedure (AGP), the latter may be associated with a higher risk of disease transmission). High-flow nasal cannula oxygen, again combined with a surgical mask, should be considered in those failing initial low-flow oxygen therapy. COVID-19 patients may respond well to continuous positive airways pressure (CPAP), potentially avoiding intubation.

c. Consider timely tracheal intubation to support oxygenation and ventilation in patients that fail NIV, who have decompensated respiratory failure with severe respiratory distress, or who are in cardiac arrest. If temporary bag-mask ventilation (BMV) is required, aim for minimal leak during ventilation and use a viral filter (heat and moisture exchanger (HME) filter or high-efficiency particulate air (HEPA) filter) between mask and bag. If a single rescuer is unable to create a tight mask seal, switch to a two-provider approach (the person doing chest compressions can pause to squeeze the bag). A supraglottic airway (SGA) may be considered by those experienced in their use, however it is important to ensure a proper seal. Prevention of aerosol generation with a SGA is less reliable than with a tracheal tube, but it may provide a better airway seal than a facemask.[31]

d. Airway interventions must be performed by the most competent provider available. Protocols should be in place for emergency and elective intubation of all children potentially having COVID-19.[16] Ideally, dedicated teams should be pre-defined and specific intubation trolleys (with adequate PPE, including face shields for staff involved) made available beforehand.[17] Cuffed tracheal

tubes are advised and providers should take care to inflate to a sufficient cuff pressure (before the first insufflation). Competent providers should consider, if available, the use of videolaryngoscopy instead of direct laryngoscopy, in view of both operator safety and improved visualisation. In the setting of CPR of these children, providers should pause chest compressions during an intubation attempt.

There is a high risk of transmission of virus during all airway procedures including tracheal intubation, inserting a supraglottic airway, performing BMV, non-invasive ventilation, a tracheostomy, disconnecting the ventilatory circuit, in-line suctioning or using an oro- or nasopharyngeal airway. These procedures demand that all providers who are present in the room wear airborne-precaution PPE.[16] Limit aerosol spread by inserting a viral filter (heat and moisture exchanger (HME) filter or high-efficiency particulate absorbing (HEPA) filter) between the patient's airway and breathing circuit, and an additional filter on the expiratory limb of a ventilator; clamp the tube and stop the ventilator before disconnecting; use a neuromuscular blocking drug to prevent coughing; and use closed suction systems.

Recognition of cardiac arrest in children and BLS algorithm

Check for *responsiveness* - in an unresponsive child, assess *breathing* visually (chest rise) and optionally by placing a 'hand on the belly'.[32] Do not approach the victim's mouth or nose at this stage. Cardiac arrest is defined by 'being unresponsive and not breathing normally'. Untrained lay rescuers will likely have called the emergency medical services [EMS] dispatcher (112/national emergency number) at the start; trained providers should do so before starting chest compressions. In cases where there are two or more rescuers, a second rescuer should call the EMS immediately.

Once cardiac arrest is identified, rescuers should *provide at least compression-only CPR*. In such a case, place a surgical mask over the child's mouth and nose before commencing chest compressions. The routine use of a cloth as an alternative is not advised because of the potential risk of airway obstruction and/or restriction of passive air movement (due to compressions); there is also no evidence that a cloth prevents airborne transmission. However, when a surgical mask is not available and this cloth encourages rescuers to provide support where otherwise they would not, they should use it (lightly draped over mouth and nose).

Unless a primary cardiac origin is likely ('sudden witnessed collapse'), those rescuers who are willing and able should also *open the airway and provide rescue breaths,* as per 2015 guidelines, knowing that this is likely to increase the risk of infection (if the child has COVID-19), but can significantly improve the outcome *(see 'Protection of bystanders and healthcare professionals')*.[24, 31]

When an *automated external defibrillator [AED]* is readily available, trained providers should use it as soon as feasible. An AED should primarily be advised as part of dispatcher-assisted CPR in those cases where the likelihood of a primary shockable rhythm is sufficiently high: in cases of sudden witnessed collapse; for children with a specific 'cardiac' history; or for children older than 1y of age without any identifiable non-cardiac cause of arrest, always provided there are at least two bystanders and an AED nearby.

Pre-hospital EMS or in-hospital ALS teams must wear airborne-precaution PPE before arriving at the patient's side, unless COVID-19 has been ruled out, even if it delays commencing or continuing CPR *(see "Protection of bystanders and healthcare professionals")*.[17] Protocols should be in place to facilitate this and to minimise delays. Personnel wearing only droplet-precaution PPE may consider providing initial defibrillation before putting on airborne-precaution PPE in children with an identified shockable rhythm. Once wearing airborne- precaution PPE, perform CPR according to the 2015 algorithms. Do not delay CPR in order to secure an invasive airway. Provide initial ventilations with a bag-mask *(see 'Airway & breathing management of a critically child with potential COVID-19 infection')*.

Communicate the child's COVID-19 status to all providers involved *(see also ERC COVID-19 Guidelines on Ethics)*.

Foreign body airway obstruction (FBAO)

The existing guidelines still hold good for the management of FBAO regardless of the presumed COVID-19 status.[24] Most often, rescuers will be caregivers or household members of the child and thus have only limited risk. In cases where the cough is still considered effective, bystanders or providers should encourage coughing whilst keeping proper distance. Do not put a surgical mask on the child at this stage. Bystanders should call the EMS dispatch centre early on, especially if coughing threatens to become ineffective.

Advanced Life Support

a. In children with confirmed or suspected COVID-19, ALS teams must wear appropriate PPE before arriving at the patient's side. Keep teams as small as possible but without compromising efficacy.

b. If a defibrillator is immediately available, switch it on, apply the defibrillator pads and deliver a shock if the rhythm is ventricular fibrillation/pulseless ventricular tachycardia (VF/pVT). If the child remains in VF/pVT, and if wearing airborne-precaution PPE, start chest compressions. If not wearing airborne-precaution PPE, give up to two additional shocks (if indicated) while other healthcare workers are putting on airborne-precaution PPE.[17,31]

c. Early identification and proper treatment of any reversible causes during CPR is important. Some of these reversible causes demand 'advanced' resuscitation techniques: consider early transport to a centre capable of performing this for children. There is insufficient evidence to advocate for or against the use of extracorporeal life support for children with COVID-19. In settings where this facility is available, providers should balance the use of such advanced resources with the likelihood of a good outcome for the individual patient.

Ethics of resuscitation in children during the COVID pandemic

For this we refer to the dedicated ERC COVID-19 Guidelines on Ethics. The ethical principles and guidance do not differ essentially between adults and children.

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Section 5

Newborn Life Support

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▶ *This guideline was provided on 24 April 2020 and will be subject to evolving knowledge and experience of COVID-19. As countries are at different stages of the pandemic, there may be some international variation in practice.*

Introduction

Case series suggest the risk of vertical transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) at birth is unlikely and that there is a low risk of babies being infected at birth even if born to a confirmed coronavirus disease 2019 (COVID-19) positive mother.[1,2]

Maternal infection with COVID-19 may increase the risk of premature labour and there appears to be a tendency for more deliveries to be via caesarean section with foetal compromise cited as an indication[3]. Concerns about maternal health may also prompt a decision to deliver[4,5]. The necessary obstetric precautions against viral exposure may increase the time taken to deliver compromised babies by caesarean section. However, babies do not appear significantly more compromised at birth in the presence of maternal COVID-19 [3]

The indications for the attendance of a neonatal team in advance, and the clinical factors which might prompt resuscitation remain unchanged whatever the maternal COVID-19 status.

The sequence of assessment and any subsequent resuscitation/stabilisation remain unchanged and follow standard Newborn Life Support (NLS) principles.[6]

Changes to the standard approach should be made to reduce the risk of COVID-19 cross infection for staff and the baby.

Departments should have clear local guidelines on the prevention of COVID-19 transmission and sufficient quantities of suitable personal protective equipment (PPE) must be available in all birthing areas. Staff must be familiar with the guidelines and trained in the appropriate use of PPE.

- Local recommendations may take the regional prevalence of COVID-19 into account.
- Where maternal COVID-19 is not clinically suspected, staff should follow local or national guidelines for PPE, which may include the routine use of droplet-precaution PPE (fluid-resistant surgical mask/visor/short-sleeved gown and gloves) for any attendance.
- Where maternal COVID-19 is suspected/confirmed, staff must attend in full airborne-precaution PPE (FFP3 mask or FFP2 if FFP3 not available/visor/long-sleeved apron and gloves).

As further information becomes available the current ERC recommendations may change.

Delivery area

Significant numbers of asymptomatic mothers may be infected with COVID-19 at birth7. Whilst it is recommended that a designated area be identified for the delivery of mothers with symptoms suggestive of infection or confirmed COVID-19 positive status, it may not be feasible to segregate all such mothers. Therefore, take appropriate precautions and wear PPE when attending all deliveries.

Ideally, delivery of a baby from a COVID-19 suspected/positive mother should take place in a negative-pressure room, but these facilities may not be available in all delivery or operating rooms. As a minimum precaution, resuscitation of the baby should ideally take place at least 2m from the mother in order to minimise the risk of droplet spread (the risk from airborne spread still exists).8 Provision of a mask for the mother may reduce droplet spread, and consideration might be given to having a partition or the resuscitation area in an adjacent room separate from the delivery area if this is possible[5].

Operating rooms are considered to be an area with a higher risk of droplet or airborne spread because of the nature of the procedures carried out on mother (airway management, diathermy etc.).

Pre-delivery discussions with suspected or confirmed COVID-19 positive parents

Depending on hospital policy the mother may be unescorted. Opportunities for pre-delivery discussion of management may be limited. Droplet precaution PPE is required for face-to-face consultation. Video consultation may be an alternative to reduce contact. If the neonatal team is unable to counsel the family then the obstetric/midwifery team may need to undertake such discussions.

Neonatal team attending in advance (for suspected or COVID-19 positive mother)

Check and prepare the resuscitation area before the mother is in the room. Where a neonatal team is called in advance, careful planning is required to minimise the number who enter the room. The team should include someone experienced in newborn resuscitation and interventional procedures. Additional team members may be required to help with PPE. Facilities for safely putting on and taking off PPE need to be in place. Handling PPE may incur delays, especially should urgent extra assistance be required, and this should be considered in the preparation of the team. If the resuscitation area is in the same room as the mother, and it is unclear that intervention will be required, then the neonatal team may choose to wait outside and only enter if needed. Full airborne-precaution PPE will be required for anyone entering the room. Team members should put on PPE in advance although if waiting outside they may choose to leave off their masks/visors until it is clear they are required to attend the baby.

Delivery

There are no changes to the immediate management of the newborn following delivery in the presence of suspected/confirmed COVID-19 infection. Delayed cord clamping should still be considered. Initial assessment of the baby may take place on the perineum provided extra care is taken.[5,9,10]

The baby should only be passed to the neonatal team if intervention is needed, babies doing well stay with mother and the neonatal team may be able to avoid exposure.

Neonatal team called after delivery (of a suspected or confirmed COVID-19 positive mother)

Staff attending any delivery need to be able to successfully initiate the resuscitation of a compromised baby before the neonatal team arrives. Help should be called for early, as the need for the neonatal team to put on full airborne-precaution PPE may cause a delay in being able to attend the baby.

Approach to resuscitation/stabilisation

The approach to resuscitation/stabilisation follows standard NLS recommendations[6].

Take measures to minimise potential COVID-19 exposure. A wet towel must be considered contaminated and removed with care. A high-efficiency particulate air (HEPA) filter might be considered between T-piece/self-inflating bag and mask,[11] although evidence of infection of the respiratory tract at birth and subsequent viral spread from aerosols generated through devices or procedures has not yet been described. Two-person airway support reduces mask leakage and is preferred where sufficient staff with appropriate PPE are available. Minimise potential aerosol generating procedures (AGPs) such as suction and ensure that the most experienced team member carries out any advanced airway manoeuvres.[5]

Post resuscitation care

Decisions to separate a COVID-19 positive mother and her baby should follow local guidance. Generally, a baby should stay with their mother if she is well enough. If observations are required, they may be carried out by midwifery staff. Skin-to-skin care and breast feeding may be possible if adequate precautions are taken including strict hand hygiene and a fluid resistant surgical mask for the mother to reduce the risk of droplet spread.[12,13]

Should the baby require admission we recommend that transfer takes place in a closed incubator. Minimise exposure of the incubator to the contaminated area; it may be kept out of the delivery area/operating room if the resuscitation area is in the same room and the baby carried to it. Staff escorting the baby to the neonatal unit should consider wearing full airborne precaution PPE where they might need to intervene during the transfer although AGPs should be avoided outside controlled areas such as the neonatal unit if at all possible. If the team moving the baby is the same as that attending the delivery, consider changing PPE before moving because that used in the delivery area will be contaminated

Following resuscitation, isolate the baby until its COVID-19 status is known.

A team debrief is suggested to support staff and help improve future performance.

Postnatal deterioration and resuscitation

Where the cause of a deterioration or collapse is unknown, consider the possibility of infection with COVID-19. A high local incidence of disease or confirmed COVID-19 infection in the mother should prompt a higher index of suspicion.

Any resuscitation should take place in a designated area to minimise the risk of cross-infection. Assessment and resuscitation follow standard NLS principles regardless of circumstances.

Those undertaking initial assessment and support should as a minimum use droplet-precaution PPE. Any staff attending subsequently should wear full airborne-precaution PPE as it may be necessary to undertake AGPs. If intubation is necessary, consider videolaryngoscopy.

Level of PPE for postnatal collapse and the provision of respiratory support

Ideally respiratory support should not be delayed. Mask ventilation and cardiac compressions are considered AGPs in all age groups outside the immediate newborn period [14,15]. There is as yet no published evidence that resuscitative measures during postnatal collapse are associated with increased risk of infection. Nevertheless, due to the heightened concerns of cross infection, full airborne-precaution PPE should be used whenever possible if attending a postnatally collapsed baby in these circumstances. Decisions on providing breathing support in the absence of full airborne-precaution PPE need to be made with the understanding that there may be a small but as yet undefined risk of COVID-19 exposure.

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Section 6

Education

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▶ *This guideline was provided on 24 April 2020 and will be subject to evolving knowledge and experience of COVID-19. As countries are at different stages of the pandemic, there may be some international variation in practice.*

The severe acute respiratory distress syndrome coronavirus 2 (SARS-CoV-2) has shifted the focus from patient safety to healthcare worker safety in (peri-) arrest situations. The increased infection risk for the rescuer modifies treatment approaches - this includes suspected and confirmed COVID-19 cases. On the other hand, delays in initiating resuscitation may cost the lives of those patients in cardiac arrest.

High-quality lifesaving CPR is still required during a pandemic and resuscitation training in some form remains important. Education in resuscitation is essential to provide proper treatment for cardiac arrest patients by improving resuscitation knowledge, CPR skills and patient-centred care. The fundamental educational strategies that change the rescuer's behaviour remain valid, especially during the current pandemic [1; 2]. Resuscitation training programmes need to include the emergency management of all patients (COVID-19 and Non-COVID-19 infected) and the application of personal protective equipment (PPE) beyond the standard CPR-measures described in existing ERC educational programmes:

- Basic life Support (P*BLS/BLS)
- Newborn Life Support (NLS)
- Immediate Life Support (EP*ILS) and Advanced Life Support (EP*ALS)
- Basic Instructor Course (BIC) and Generic Instructor Course (GIC)

The well-established interdisciplinary team training in ERC CPR courses remains most important because it is associated with better patient outcomes [3] and may reduce the risk of contamination of providers when performing life support activities in COVID-19 patients.

This educational guidance considers the infection risk for instructors and candidates during a pandemic, especially as most of them are healthcare workers, essential for the system. Therefore, all local and international guidelines and preventive regulations need to be applied with rigor: personal distance, protective use of masks, clothing and gear. The role of distance learning, self-directed learning, augmented and virtual learning will become much more important in CPR teaching.

General guidance for education in CPR during the pandemic

- Education in CPR is crucial for the survival of patients in cardiac arrest; therefore life support teaching programmes need to resume as soon as possible.
- These life support teaching programmes must include specific interventions for COVID-19 patients focusing on infection prevention whilst being adaptable for local needs and requirements.
- Self-protection and measures against infection (equipment and procedures) have to be part of CPR education.
- On-site teaching facilities need to be modified to avoid transmission of SARS-CoV-2 virus:
    - Candidates and instructors who are symptomatic should not attend courses.
    - Strict distance regulations – keep a minimum of 2 m distance between single persons.
    - Candidates and instructors should wear surgical face masks throughout the course.
    - During hands-on sessions when practising on a manikin, candidates and instructors should wear PPE which should be kept throughout the course.
    - Manikins and equipment should be cleaned following every single training session (or scenario) using disinfectant compatible with the materials.
    - Reduce the number of candidates working at one manikin at the same time to the absolute minimum, structuring the teams as in reality.
    - Keep sufficient space (2 m) around the manikin using coloured tape on the ground.

  - Course programmes should be rearranged to avoid simultaneous breaks for different groups.

- Whenever possible, and where applicable, teaching methods such as distance learning, self-directed learning, augmented and virtual learning should be implemented.
- Beyond the current team training (focusing on non-technical skills), specific education on human factors (e.g. briefing and debriefing, restrictions of leadership, and communication wearing PPE) during CPR in the pandemic should be provided as hands-on training in small group teaching sessions.
- During hands-on, small-group teaching, candidates and instructors should use standard PPE (minimum: eye protection, mask, gloves, gown). The specific differences in performing CPR wearing PPE are part of CPR educational programmes and should be practised, including doffing and donning in a "buddy" system.
- Course organisers should provide sufficient PPE to run courses; this will depend on the local availability and circumstances.
- Plenary sessions will initially be replaced by small group workshops, in the long-term e-learning content and webinars should be developed.
- Group size for hands-on training should not exceed 6 candidates and they should remain in the same groups throughout the course. Any social programmes, get togethers, formal and informal break meetings intended to strengthen the team building process, should be suspended during the pandemic.
- Sufficient disinfectant and hand-washing facilities should be made available.
- The validity of all ERC certificates has already been extended for one year to reduce pressure on candidates and instructors.
- Balancing the risk of infection (as CPR is an aerosol-generating procedure spreading the virus) against the benefit of CPR with the chance to save a life, should be part of the educational programmes.
- In case of limited resources for teaching CPR during this COVID-19 pandemic, those with close contact with COVID-19 patients and the risk of cardiac arrest should be trained first, followed by those with the longest gap in CPR teaching.

Basic courses during the COVID-19 pandemic

a) BLS education for laypeople

- During the pandemic, the ERC does not recommend face-to-face, hands-on BLS teaching for laypeople, and especially no mass training.
- During the pandemic, for BLS education for laypeople the ERC recommends individual self-directed learning, apps and Virtual Reality resources for BLS as they are available and proven to be effective to learn chest compressions and the use of an AED. This format is very suitable for BLS education for laypeople who wish to master BLS in cardiac arrest and for keeping up-to-date with refresher training.
- Self-directed learning or distance learning will reduce the infection risk for both candidates and instructors.
- Internet-based tutorials and video instruction are a suitable alternative, but the ERC does not have evidence about its effectiveness in learning BLS.
- The focus of BLS education for laypeople during the pandemic is on chest compressions and the use of an AED while minimising the risk of infection during that lifesaving help. No check of respiration and no ventilation will be taught
- Self-learning stations are intended to teach and test BLS competences without supervision, and should not be used because of the risk of transmitting infection

b) BLS education for professionals (additional to the points before)

- For professionals, self-directed learning or distance learning has the potential to reduce the infection risk for both candidates and instructors. It is feasible and effective.
- The ERC suggests self-directed learning for those professionals who have a duty to respond but who rarely treat cardiac arrest patients. For this group of rescuers, the educational focus is on chest compressions , the proper use of an AED, and the donning (putting-on) PPE as soon as possible.
- Professionals who have to provide BLS regularly should be educated in the donning and doffing of PPE, chest compression, use of an AED, and bag-mask ventilation with a high-efficiency particulate air (HEPA) filter between the mask and bag. Practice in small groups with PPE is possible.
- No check for breathing and no mouth to mouth/nose ventilations should be taught during the pandemic as these skills present an increased risk for infection.
- Face shields do not have sufficiently effective viral filters and should not be used.

Advanced courses during the COVID-19 pandemic (addressing only healthcare professionals with the duty to attend cardiac arrest patients)

- Where available, virtual learning environments should be used to teach advanced life support knowledge, and behavioural- and infection-prevention strategies. This will reduce the duration of hands-on sessions.
- During the pandemic the candidate/instructor ratio in advanced ERC courses may be modified to a maximum of 6:1 (instead of 3:1).
- CPR procedures should be practised with an emphasis on the specific considerations of using PPE
    - Donning (putting on PPE), doffing (taking off PPE)
    - Communication
    - Use of specific equipment
- Special circumstances should include the pandemic, and comprise the management of in-hospital cardiac arrest patients in the prone position.
- In cases when social distancing and overcrowding cannot be guaranteed, continuous assessment may be preferred over summative assessment to avoid pooling of candidates.
- Faculty meetings during advanced life courses should be minimised, keeping sufficient personal distance to minimise the risk of infection. Before and after courses, internet-based faculty meetings are encouraged.

Instructor education during the COVID-19 pandemic

- Instructor education in the form of the ERC Basic Instructor Course (BIC) or Generic Instructor Course (GIC) should be paused during the pandemic, as these courses are not essential for patient care. Instructor-Potential (IP) validity will be extended with one year during the pandemic.
- Information about teaching BLS and ALS during this pandemic will be provided to ERC instructors, course directors and educators in reading and internet-based sessions.
- Instructor-Candidates (ICs) will have an extension of one year to fulfil their requirements to become an ERC instructor.

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Section 7

Ethics and End-of-Life Decisions

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- *This guideline was provided on 24 April 2020 and will be subject to evolving knowledge and experience of COVID-19. As countries are at different stages of the pandemic, there may be some international variation in practice.*

KEY MESSAGES

- Any 'temporary' adaptations to existing guidelines should be interpreted within the context of each healthcare system, taking into consideration the prevalence of COVID-19, the available resources, etc. Our knowledge about COVID-19 is still limited and guidelines may need to be updated as more data become available.
- The general principles of ethics in resuscitation remain valid. Where possible, advance care planning should be considered.[1] This may be particularly challenging in the context of the current COVID-19 pandemic due to knowledge gaps, social distancing measures), etc. We consider cardiopulmonary resuscitation (CPR) to be a 'conditional' treatment and suggest criteria for withholding or withdrawing resuscitation. Implementation of these criteria within a healthcare system will depend on the local context (legal, cultural, and organisational).

KEY MESSAGES

- Healthcare teams should carefully assess for each individual patient their chances of survival and/or 'good' long-term outcome, and their expected use of resources. As these are not static facts, such evaluation should be reviewed on a regular basis. We advise against the use of categorical or 'blanket' criteria (e.g. age thresholds) to determine the 'eligibility' of a patient to receive or not receive certain resources.
- The key challenge with resuscitation during the COVID-19 pandemic is the difficulty of reliably balancing the risk for the provider and the potential benefit for the patient. Whilst doing their best for an individual patient, healthcare providers should equally be aware of their responsibility towards their relatives, colleagues, and the wider community. Healthcare providers (including first responders) should use personal protective equipment (PPE) for all patients with confirmed or suspected COVID-19. The type of PPE should be defined at system level, proportionate to the presumed risk of transmission. Whilst protocols may be adjusted locally to the current reality of the pandemic, if excess morbidity and mortality from delayed CPR is to be avoided, it is imperative that we continue to provide dispatcher-assisted CPR and recruit, train and/or dispatch lay rescuers and first responders to CA.

Introduction

The COVID-19 pandemic presents a worldwide crisis, causing significant morbidity and mortality in many regions. The SARS-CoV-2 virus is highly contagious and, without population immunity, substantially deadlier than seasonal Influenza, especially in those most vulnerable.[2] COVID-19 is a 'new' disease and, despite a lot of recently published studies, our knowledge about it is still very limited.

Many concomitant risks have been identified that might put further pressure on the already strained healthcare system and potentially lead to excess mortality:[3,4]

- When many people become ill at the same time, the demand for resources may significantly exceed resource availability. This includes, among others, critical care beds, ventilators, medicines, test materials and personal protective equipment (PPE).
- Healthcare workers are at an increased risk of contracting COVID-19, creating additional challenges in providing adequate staffing for both direct patient care and support work.

- Disruptions to the healthcare system (because of insufficient resources, decreased delivery of non-COVID related care and, importantly, exaggerated fear) will also affect the care for patients with other medical problems, both acute and chronic. Eventually this could lead to more morbidity and mortality than caused by COVID-19 itself.[5]

In view of the above, the ERC Ethics writing group [WG] identified a clear need for ethical guidance. We are very much aware that important changes to resuscitation guidelines might have a significant and potentially long-lasting impact on subsequent outcomes.

Any 'temporary' adaptations of the existing guidelines should always be interpreted within the context of each healthcare system and take into account factors such as the prevalence of COVID-19 within a region, and the overall impact on available resources. Given the limited evidence available, most of the following statements are the result of expert consensus. They are based on the very recent ILCOR systematic review on the risk of transmission of COVID-19 to rescuers during resuscitation, on existing guidelines from other societies and councils and recent, mostly observational, clinical studies.[4,6-12] Indirect evidence from non-clinical papers, such as those on pathophysiology, also informed our final 'insights'.

Healthcare organisation during the COVID-19 pandemic

Based on the principles of beneficence, justice and equity, each individual patient should have access to the current standard of care. However, the harm-benefit for the individual patient needs to be balanced with those for the whole of society. Especially when demand for healthcare resources exceeds capacity, this may mean providing the best possible medical support to the maximum number of people (distributive justice).[12-13]

Whilst healthcare systems should essentially strive to help all those whom they serve, and be well-prepared to do so, the extent of the crisis is such that it could overwhelm the current existing resources in certain regions.[2,14] When there is a clear imbalance between resource needs and capacity available, policies of resource allocation and distribution should be developed at system level (for example government, national agencies) rather than by individual institutions or healthcare providers.

Such policies should be informed by both healthcare professionals from different background and experts in medical ethics, law, economics and sociology. Special attention should be given to vulnerable populations who, despite a higher risk of contracting the disease, are more at risk of 'unjustified discrimination'.[13, 15-16] The effectiveness of any measure will depend on the trust in, and credibility of public health authorities, political leaders, and institutions.[14, 17-18] In view of this, fully transparent, fact-based communication is crucial.

Ethical decision making when resources are lacking

Ethical decision making in disasters, by definition, demands a specific approach, especially when there is a major imbalance between resource availability and resource needs.[8, 19-21] In such a situation, decisions are typically based upon contextual parameters (safety, accessibility, availability and ability), as well as the expected individual patient outcomes.[14] It is fundamental that all patients receive care according to best standards as long as reasonably possible, but once this can no longer be guaranteed, prioritisation should include all patients needing resources, regardless of whether they became ill or injured as a direct consequence of the disaster or from any other cause.

The initial phase of the current pandemic has shown that the surge capacity of a certain healthcare system at a certain point in time may be overwhelmed and cause a real shortage of ICU beds, ventilators, PPE, and overall resuscitation capacity.2 If and when this happens, decisions will have to be made with regard to resource allocation. Such decisions should be timely (not pre-emptive, but not too late) and consistent. As stated above, these decisions should not be made solely by individual institutions or healthcare providers, but be based on system-level protocols. At different operational levels, 'ethics teams' should be instituted to support and/or relieve individual healthcare providers of the responsibility of making rationing decisions.[22,23] Once decisions have been made, healthcare providers should act accordingly and those who are unable to accept the defined ethical framework should preferably take up clinical support roles in areas where no rationing decisions are needed. At all times, such allocation decisions should be well documented (ideally also in a registry) to allow for transparency and future audit.

The ethical decision making in the context of a pandemic is complex. It should be based on the careful appreciation of different, sometimes conflicting, ethical principles and societal preferences, within the concrete context of resource availability and needs at that time.[2,13] Although we acknowledge the fact that there is no universal 'truth', the ERC ethical WG wants to emphasize some considerations to inform healthcare systems in developing their local guidelines:

- When there is truly an imbalance between the available and needed resources, most authors would argue for some degree of 'distributive justice', meaning 'the greatest good for the greatest number of people', and value the needs of a society higher than that of a single individual. [8,12,19,24]
- This concept is extremely challenging to apply in practice. A primarily 'welfare-based' approach might be reasonable in the context of disaster, but there is difficulty in defining what actually counts as 'welfare' and how to really maximise it. This includes potential conflicts between quantity and quality of life-years, and the challenge of assessing and predicting quality of life.
- Healthcare teams should carefully assess each individual patient's chances of survival and/or 'good' long-term outcome, and their expected use of resources. As these are not static facts, such evaluation should be reviewed on a regular basis. It

is our opinion that there is, in this specific context, no ethical difference between withholding or withdrawing medical support even if one is passive and the other active. While we acknowledge that viewpoints may differ depending on cultural and ethical background, we think withdrawal of medical support ethically differs from active life-ending procedures, which we consider not ethically permissible even during a pandemic.[25,26] Appropriate end-of-life comfort care is always mandatory.

- What limited evidence there is from literature should be carefully considered, rather than just expert opinion.
- There are no ethical grounds to specifically favour distinct groups because of profession, rank, status or similar criteria. Neither should personal characteristics of people, such as ability to pay, lifestyle or merits to society, be counted as ethical criteria in prioritising. Some authors advocate the prioritisation of healthcare workers and other 'critical professions' because of their (difficult to replace) 'instrumental value' and the risks they are willingly taking.[2,23] This argumentation, however, would only be relevant if the identified persons are really playing 'key' roles, which is often challenging to define precisely,, and there is an anticipated long-term shortage in that type of 'key' professional.[13] It is our opinion that categorical inclusion (as in the example above) or exclusion (severe chronic lung disease, severe cognitive impairment, etc.) are ethically flawed.[4,23] Essentially, within the ethical boundaries of autonomy, beneficence and non-maleficence, every life is 'worth saving'. Rather than identifying populations for whom it is no longer needed to evaluate their 'eligibility' to receive certain resources when these resources are scarce, the ethical principles of justice and equity demand unbiased evaluation of each individual patient regardless.
- When patients are truly comparable, some would still rely on the principle of 'first come first served'. Other, however, have the opinion that this leads to unfairness, for example when persons become sick later in the pandemic because they adhered more strictly to recommended public health measures, or when persons have less access to healthcare due to social inequality, and would advocate a more egalitarian approach in these circumstances (e.g. by means of 'lottery').[2,23] One way of dealing with this conundrum is to optimise, within the given ethical framework, the differentiation between individual cases, considering , for example, not only their initial status but also their evolution and how they respond to treatment.
- Criteria are not static and need to be timely adjusted to changes in COVID-19 treatment possibilities, in epidemiology and/or in hospital resources.[4]

Any decision with regard to treatment limitation at any moment in the care trajectory should be communicated, respectfully and empathically, with full transparency and directive, with the patient and/or their next of kin. At all times, proper attention should be given to patient comfort.

Advance care planning

Advance care planning [ACP] should be considered in all patients with an increased risk of cardiac arrest, or predicted poor outcome in the event of cardiac arrest. ACP should include decisions on resuscitation, mechanical ventilation, admission to intensive care, and admission to hospital. For those with a pre-existing ACP, it might be necessary to re-evaluate its appropriateness within the given context. Discussion about ACP should involve the patient (if feasible), their relatives (if the patient agrees), their treating physician and other involved healthcare professionals (e.g., intensivists, nurses, palliative care team). We are aware that this may be challenging in the context of social distancing where much communication is done via telephone or video link.[27,28] Moreover, important knowledge gaps still exist that make prognostication difficult in the context of COVID-19.

Indications to withhold and withdraw CPR

The general principles of ethics in emergencies and resuscitation remain valid during the COVID-19 pandemic.[1,12] Cardiopulmonary resuscitation (CPR) should be considered a 'conditional' treatment and healthcare systems should implement criteria for decision-making about resuscitation, taking into consideration their specific local context, legal, cultural and organisational. Resuscitation should not be started or continued in cases where the safety of the provider cannot be sufficiently assured, when there is obvious mortal injury or irreversible death, or when a valid and relevant advance directive becomes available *(see provider safety below)*.

The outcome of non-shockable rhythm cardiac arrest caused by hypoxaemia from COVID-19 pneumonia is very poor.[17,29] In such a case, healthcare systems (and/or providers) may consider the risk of harm outweighs the anticipated benefit of resuscitation, thus providing a reason for early termination of resuscitation.

Changing CPR procedures in view of provider safety

Rescuer safety is important, be it a bystander or healthcare professional. For resuscitation, there is inevitably a trade-off between risk to the provider and benefit for the patient. Whilst trying to keep it as low as reasonably acceptable, healthcare providers routinely accept a certain risk as part of their profession. To a certain degree, this is also true for lay bystanders, and will depend on their relationship with the victim as well as their perception of risk. The key challenge with resuscitation during the COVID-19 pandemic is that the precise risk to the provider and the true benefit for the patient are both unknown.

Many healthcare professionals consider themselves to have a duty of care to the patient, regardless of risk, to help to the best of their abilities. For physicians, this is reflected in the Hippocratic oath). Whilst doing their best for an individual patient,

healthcare providers should also be aware of their responsibility to their relatives, colleagues, and the wider community.[4] Healthcare professionals underestimating the risk of transmission may spread virus to the rest their team and within the larger community putting further strain on the healthcare system.[30,31]

CPR carries a clear risk of transmission of infectious disease even if it is chest compression-only CPR.[11,32] Healthcare providers should therefore use appropriate PPE (and be knowledgeable about its proper use) in all cases with confirmed or suspected COVID-19. The type of PPE is defined in the introductory section to these guidelines. Lay bystanders or first responders should protect themselves as far as feasible and avoid actions with a high risk of transmission, especially if they themselves are at high-risk of poor outcome in the event of transmission (elderly, chronic lung disease, heart disease).

Rescuers who are caregivers or household members of the victim may have already been exposed and may be more willing to deliver CPR regardless of the potential increased risk.

In the current setting, it is very important to systematically debrief after every resuscitation attempt, to address the team performance, the medical and ethical decision-making process, and potential issues such as personal protection and rescuer safety.

Responsibilities of individual healthcare providers

Despite the considerable stress caused by the current pandemic, healthcare professionals should:

- help to the best of their abilities
- align their practice with guidelines provided
- protect themselves, their patients, and their colleagues from transmission
- steward resources, e.g. avoid wasting or inappropriate use
- properly document and communicate medical (ethical) decisions
- provide continuity of care to patients with acute or chronic problems not directly related to COVID-19
- be compassionate and empathic to the needs, emotional and psychological, of colleagues as well as patients and their relatives. Consider referral and follow-up where needed.

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Section 8

First Aid

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> *This guideline was provided on 24 April 2020 and will be subject to evolving knowledge and experience of COVID-19. As countries are at different stages of the pandemic, there may be some international variation in practice.*

First aid is often a critical part of the management of injuries and sudden illness. Despite the current concerns about coronavirus disease 2019 (COVID-19), and the focus on the prevention of its spread and treatment, injuries and illnesses unrelated to coronavirus still occur. The delivery of prompt first aid management may prevent an additional burden on the health system by managing simple injuries or illnesses on site rather than calling for an ambulance or taking the casualty to hospital. It may also prevent the unnecessary exposure of the casualty to the virus.

Serious injuries and illness will, however, still require medical care and the assessment and treatment of such individuals should not be delayed because of fear of COVID-19.

There are only a few changes to the current recommended first aid protocols, most of which relate to the prevention or minimisation of the risk of virus transfer.

During the COVID-19 pandemic:

- Assume that any casualty has COVID-19 and manage appropriately. The casualty may be asymptomatic and yet still be a virus carrier.
- If the casualty is a household contact of the care provider and infected with COVID-19, that provider has likely already been exposed and may be willing to provide direct first aid.

- If the casualty is not a household contact:
    - Follow national advice on social distancing and the use of personal protective equipment (PPE) wherever possible.
    - The use of PPE (gloves, masks, eye-protection, etc) may not be applicable to all first aid, but care should always be taken to protect the casualty and the first aid provider.
    - Those key workers with a duty of care should put on the appropriate PPE and provide first aid without further delay.
    - If the casualty is **responsive** and able to follow selfcare advice, provide first aid advice from a safe (2m) distance. If the casualty has a face cover/ mask available, encourage them to wear it while being cared for. Family members, if willing, may be coached to provide direct first aid. It may also be necessary to provide dressings, bandages, etc. from outside the immediate contact area.
    - If the casualty is **unresponsive** or unable to provide selfcare then it may be necessary to provide direct care. However, the casualty and the first aid provider must be aware of the risk of virus transfer.
- Sequence of actions for bystander care of a casualty outside of the household:
    - Call for medical assistance immediately.
    - Where possible wear gloves when touching or handling the casualty.
    - Wear a face cover/mask if available and consider placing a face cover/ mask over the face of the casualty.
    - Only handle/touch what is absolutely essential, remembering that all surfaces in and around the casualty may be contaminated by the virus..
    - Only provide essential direct first aid in order to limit your exposure time. This may include controlling significant bleeding, applying a dressing, use of an adrenaline autoinjector, assessing for responsiveness by shaking the person and shouting, and positioning of a casualty.
- Following completion, it is essential to:
    - remove and dispose of any PPE
    - wash your hands thoroughly with soap and hot water for at least 20 seconds
    - wash all your clothing as soon as practicable
    - be prepared to self-isolate and follow national guidance if you develop COVID-19 symptoms after providing direct first aid
- *Recommendations on the provision of cardiopulmonary resuscitation for adults and children has been provided in the respective sections.*

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