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 patients with suspected or confirmed Covid-19 in hospital settings, including community assessment hubs and intermediate care facilities?

IN A NUTSHELL

This Summary of Evidence [Version 2] provides recently released or updated resuscitation guidance from a number of organisations internationally including the Emergency Cardiovascular Care Committee and collaborators (US)[1]; the International Liaison Committee on Resuscitation[2]; and the Resuscitation Council (UK)[3].

Guidance is also provided for specialties such as cardiac electrophysiology[8] and anaesthesiology [6, 11].

Articles sharing the experiences of clinicians and institutions in modifying their resuscitation practices in light of COVID-19 are outlined [18 - 28], as are articles exploring the ethical considerations this pandemic is posing [29-37].

All sources of evidence which did not feature in the first version of this document are prefaced with: [Newly added]. A separate Summary of Evidence has been compiled for resuscitation of paediatric patients in hospital settings.

IRISH AND INTERNATIONAL GUIDANCE

[Newly added] **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® 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**[1]

Released on April 9, this statement applies to all adult, paediatric and neonatal resuscitations in patients with suspected or confirmed COVID-19 infection. It is based on expert opinion and should be adapted locally. The interim guidance contains:

1. 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

2. Situation and Setting-Specific Considerations:

— out-of-hospital cardiac arrest [OHCA]
— in-hospital cardiac arrest [IHCA]
— maternal and neonatal considerations

[Newly added] **International Liaison Committee on Resuscitation (10 April 2020) COVID-19 infection risk to rescuers from patients in cardiac arrest**[2]

Having completed public consultation, the ILCOR have released:

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].
- We suggest it may be reasonable for healthcare providers to consider defibrillation before donning personal protective equipment for aerosol generating procedures in situations where the provider assesses the benefits may exceed the risks [good practice statement].

[Newly added] **Resuscitation Council UK Statement on COVID-19 in relation to CPR and resuscitation in healthcare settings**[3]

This guidance was updated on 6 April 2020. 11 points are listed under Section 2: GUIDANCE ON CPR IN PATIENTS WITH A COVID-19 ILLNESS OR A CONFIRMED CASE OF COVID-19 IN ACUTE HOSPITAL SETTINGS. This encompasses PPE and IPC considerations; early identification of patients at risk of acute deterioration or cardiac arrest; airway interventions and use of equipment; and post-resuscitation debrief.

[Newly added] Alhazzani et al (2020) Surviving Sepsis Campaign: guidelines on the management of critically ill adults with Coronavirus Disease 2019 (COVID-19)[4]

This expert panel released 54 statements including the following on haemodynamics:

HAEMODYNAMICS

8	In adults with **COVID-19 and shock**, we **suggest** using dynamic parameters skin temperature, capillary refilling time, and/or serum lactate measurement over static parameters in order to assess fluid responsiveness	WEAK
9	For the **acute resuscitation** of adults with **COVID-19 and shock**, we **suggest** using a conservative over a liberal fluid strategy	WEAK
10	For the **acute resuscitation** of adults with **COVID-19 and shock**, we **recommend** using crystalloids over colloids	WEAK
11	For the **acute resuscitation** of adults with **COVID-19 and shock**, we **suggest** using buffered/balanced crystalloids over unbalanced crystalloids	WEAK
12	For the **acute resuscitation** of adults with **COVID-19 and shock**, we **recommend against** using hydroxyethyl starches	STRONG
13	For the **acute resuscitation** of adults with **COVID-19 and shock**, we **suggest against** using gelatins	WEAK
14	For the **acute resuscitation** of adults with **COVID-19 and shock**, we **suggest against** using dextrans	WEAK
15	For the **acute resuscitation** of adults with **COVID-19 and shock**, we **suggest against** the routine use of albumin for initial resuscitation	WEAK
16	For adults with **COVID-19 and shock**, we **suggest** using norepinephrine as the first-line vasoactive agent, over other agents	WEAK
17	If norepinephrine is not available, we **suggest** using either vasopressin or epinephrine as the first-line vasoactive agent, over other vasoactive agents, for adults with **COVID-19 and shock**	WEAK
18	For adults with **COVID-19 and shock**, we **recommend against** using dopamine if norepinephrine is available	STRONG
19	For adults with **COVID-19 and shock**, we **suggest** adding vasopressin as a second-line agent, over titrating norepinephrine dose, if target mean arterial pressure (MAP) cannot be achieved by norepinephrine alone	WEAK
20	For adults with **COVID-19 and shock**, we **suggest titrating** vasoactive agents to target a MAP of 60-65 mmHg, rather than higher MAP targets	WEAK
21	For adults with **COVID-19 and shock with evidence of cardiac dysfunction and persistent hypoperfusion despite fluid resuscitation and norepinephrine**, we **suggest** adding dobutamine, over increasing norepinephrine dose	WEAK
22	For adults with **COVID-19 and refractory shock**, we **suggest** using low-dose corticosteroid therapy ["shock-reversal"], over no corticosteroid Remark: A typical corticosteroid regimen in septic shock is intravenous hydrocortisone 200 mg per day administered either as an infusion or intermittent doses	WEAK

Rationale are provided for each recommendation. The panel admit that there is no direct evidence addressing the optimal resuscitation strategy in patients with COVID-19 and shock and that Recommendation 8 is therefore based on indirect evidence drawn from critically ill patients in general.

A letter published in April 2020 — Using the Surviving Sepsis Coronavirus Disease 2019 Guidelines: Anything New Yet?[5] — suggests more tailored COVID-19 guidance is needed: the most current SSC recommendations generally represent recommendations for the treatment of septic shock and ARDS from any infectious etiology and are not overly specific to COVID-19 patients. Given the volatile state of our current guidance, changes in recommendations are almost certain. Guidelines, including those by the SSC, WHO, and Center for Disease Control and Prevention, must be updated regularly to help universally optimize sepsis care due to COVID-19 and help flatten the sharply rising morbidity and mortality curve.

[Newly added] **Cook et al (2020) Consensus guidelines for managing the airway in patients with COVID-19: Guidelines from the Difficult Airway Society, the Association of Anaesthetists the Intensive Care Society, the Faculty of Intensive Care Medicine and the Royal College of Anaesthetists[6]**

AIRWAY MANAGEMENT DURING CARDIAC ARREST

The Resuscitation Council (UK) has published statements on the management of cardiac arrest in patients with COVID- 19. Airway procedures undertaken during management of cardiac arrest may expose the rescuer to a risk of viral transmission. "The minimum PPE requirements to assess a patient, start chest compressions and establish monitoring of the cardiac arrest rhythm are an FFP3 facemask, eye protection, plastic apron and gloves."

- Avoid listening or feeling for breathing by placing your ear and cheek close to the patient's mouth.
- In the presence of a trained airway manager early tracheal intubation with a cuffed tracheal tube should be the aim.
- Before this, insertion of an SGA may enable ventilation of the lungs with less aerosol generation than facemask ventilation.

- In the absence of a trained airway manager, rescuers should use those airway techniques they are trained in. Insertion of an SGA should take priority over facemask ventilation to minimise aerosol generation.
- An SGA with a high seal pressure should be used in preference to one with a low seal. This will usually be a second- generation SGA where available.

[Newly added] **Government of Canada (2020) Clinical management of patients with moderate to severe COVID-19 - Interim guidance**[7]
Released on 2 April 2020, this guidance relates to adults and paediatric patients. Sections relating to resuscitation:

- Section 6.1: Oxygen Therapy and Monitoring
- Section 7.2: Septic Shock

[Newly added] **Lakkireddy et al (2020) Guidance for Cardiac Electrophysiology During the Coronavirus (COVID-19) Pandemic from the Heart Rhythm Society COVID-19 Task Force; Electrophysiology Section of the American College of Cardiology; and the Electrocardiography and Arrhythmias Committee of the Council on Clinical Cardiology, American Heart Association**[8]
Section 9: Cardiopulmonary Resuscitation, Advanced Cardiac Life Support and Arrhythmia Management of COVID-19 Patients.

NICE COVID-19 rapid guideline: critical care in adults[9]
Section 2.4
Sensitively discuss a possible 'do not attempt cardiopulmonary resuscitation' decision with all adults with capacity and an assessment suggestive of increased frailty: eg a CFS score of 5 or more. Include in the discussion:

- the possible benefits of any critical care treatment options
- the possible risks of critical care treatment options
- the possible likely outcomes.

Faculty of Intensive Care Medicine, Intensive Care Society, Association of Anaesthetists and Royal College of Anaesthetists - Critical care preparation and management in the COVID-19 pandemic[10]

Cardiac Arrest

- Appropriate PPE must be worn as with aerosol-generating. procedures. Facemask ventilation should be avoided where possible.
- Compression-only CPR is advised until airway-experienced personnel are available.
- Use of an automated chest compression device may be used.
- Early intubation by an experienced operator is advised.

What does the Health Protection Surveillance Centre (Ireland) say?

Use of PPE to support Infection Prevention and Control Practice when performing aerosol generating procedures on confirmed or clinically suspected Covid-19 cases in a pandemic situation[11]

The guidance states that all staff working in an area where aerosol generating procedures are being performed must wear appropriate PPE. The minimum number of staff required must be present. The guidance includes a table entitled: "Aerosol generating procedures which have been associated with increased risk of transmission of respiratory infection." CPR [pre-intubation due to manual ventilation] has a consistently recognised, AGP-related increased risk of pathogen transmission, and PPE is recommended. Recommended PPE to include: hand hygiene, FFP2 respiratory mask, eye protection, gloves, and long sleeved gown.

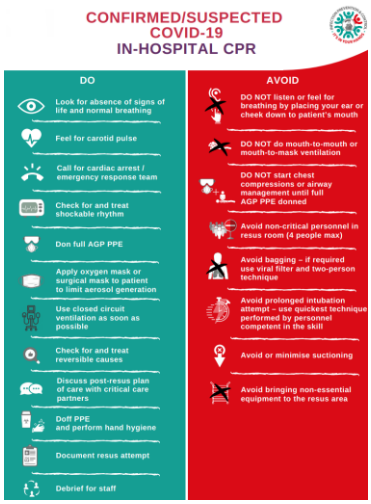
HSE Deteriorating Patient Improvement Programme (9th April 2020) CPR Guidance for Confirmed or Suspected COVID-19 in Community Assessment Hubs[12]

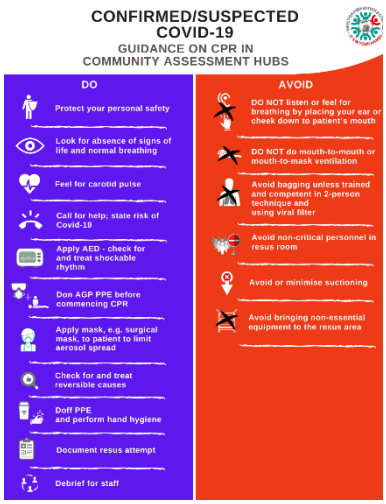
This guidance has been developed by the HSE Deteriorating Patient Improvement Programme and is categorised as follows:

- 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 do WHO, ECDC and CDC say?
As CPR is an aerosol-generating procedure, the guidance from these organisations is as follows:

— WHO: Infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected[13] [Section 3.2]

— ECDC: Infection prevention and control and preparedness for COVID-19 in healthcare settings[14] [Aerosol Generating Procedures]

— CDC: Interim Infection Prevention and Control Recommendations for Patients with Suspected or Confirmed Coronavirus Disease 2019 (COVID-19) in Healthcare Settings[15] [Section 4]

Derived from CDC guidance, the American Heart Association has produced:

— Interim Guidance for Healthcare Providers Caring for Pediatric Patients CPR Emergency and Vascular Care

— Interim guidance for healthcare providers CPR Emergency and Vascular Care

POINT-OF-CARE TOOLS

What does UpToDate say?

Coronavirus Disease 2019 (COVID-19)[16]

Interventions
In the event of a cardiac arrest, cardiopulmonary resuscitation should proceed with all members of the team wearing appropriate PPE. Practicing a test run of a COVID-19 patient cardiac arrest is prudent. Bag-mask ventilation should be avoided if feasible and the ventilator can be used instead to deliver a respiratory rate of 10 bpm.

INTERNATIONAL LITERATURE

[Newly added] Griffin et al (2020) Hospital Preparedness for COVID-19: A Practical Guide from a Critical Care Perspective[17]
Staff from an American hospital provide the approach they have used to increase preparedness:

Cardiac Arrests
Given the highly infective nature of the novel coronavirus, approaches to resuscitation have evolved. As such, institutional cardiac arrest policies were instituted limiting the number of responders to cardiac arrests outside the ICU. Mechanical compression devices were rapidly introduced to further reduce the number of medical and nursing staff responding to an arrest. Medical ICU nurses, who respond to every cardiac arrest in our institution, carried a COVID-19 backpack to every cardiac arrest; these contain high-risk PPE [welders style face shields, N95 masks, impermeable gowns] due to the aerosolizing nature of CPR. Resuscitations in the ICU continue to be conducted in a standard fashion with attempts to minimize aerosolization by leaving the patient on the ventilator, or if absolutely necessary, using a bag valve mask with a high-efficiency particulate air (HEPA) filter attached to the expiratory port.

[Newly added] **Song et al (2020) Recommendations on cardiopulmonary resuscitation strategy and procedure for novel coronavirus pneumonia**[18]
This document features:

- Section 2: Prediction, prevention, and early warning of cardiac arresting patients with novel coronavirus pneumonia
- Section 3: Cardiopulmonary resuscitation strategy for cardiac arrest in novel coronavirus pneumonia
  - 3.1 Cardiopulmonary resuscitation strategy for out-of-hospital cardiac arrest [OHCA]
  - 3.2 Cardiopulmonary resuscitation strategy during vehicle transportation
  - 3.3 Cardiopulmonary resuscitation strategy for in-hospital cardiac arrest
- Algorithm for warning and cardiopulmonary resuscitation for cardiac arrest in patients with novel coronavirus pneumonia

[Newly added] **Li et al (2020) Anesthesia Management and Perioperative Infection Control in Patients With the Novel Coronavirus**[19]
This review emphasizes safety precautions that should be undertaken by anesthesia staff such as:

- Anesthesia staff should try to review the history, laboratory results and imaging before engaging in care, including intubation or resuscitation to determine the degree of protection needed.
- Anesthetic and resuscitation medicines, devices, and surgical instruments should be well prepared in advance to reduce the amount of traffic into and out of the operating room. Specific personnel assigned to the buffer area can be responsible for communication between areas and replenishing items.

[Newly added] **Chavez et al (2020) Coronavirus Disease (COVID-19): A primer for emergency physicians**[20]
This review suggests that over-resuscitation with intravenous fluids should be avoided, which can potentially worsen oxygenation. Even when COVID-19 is suspected as the cause of the patient's symptoms, the WHO recommends administering empiric antibiotics and a neuraminidase inhibitor within 1h of identifying sepsis. Early recognition of septic shock is critical, with

management of sepsis focusing on intravenous fluid resuscitation and antibiotics. A conservative resuscitation strategy with buffered/balanced crystalloids is recommended for those in shock, and hypotonic crystalloids should be avoided. Vasopressors, preferentially norepinephrine, are indicated for persistent shock with a goal MAP of 60–65 mmHg.

[Newly added] **Liew et al (2020) Preparing for COVID-19: early experience from an intensive care unit in Singapore**[21]
This letter outlines critical care issues and solutions for COVID-19, which includes their recommendations for resuscitation and code blue responses:

Principles

1. Provide clear guidelines on personal protective equipment and use of powered air-purifying respirators in ISO wards and normal wards during resuscitation
2. Provide inter-professional simulation of resuscitation scenarios for suspected or confirmed cases

Solutions

- Simulation practice with personal protective equipment and use of powered air-purifying respirators will help identify gaps in the wards and prepare ISO teams for such scenarios.
- Simulation with limited team members per scenario: eg 4 members per team to allow acclimatization of HCW to perform resuscitation in smaller teams.
- Checklists for preparation of drugs and pre-prepared trolleys for equipment, intubation, line setting and other procedures to minimize staff movement and enhance efficiency.
- Creative ways to improve communications during resuscitation, such as utilization of a printed 'CALL AIRWAY TEAM' card for difficult intubations, using a communication whiteboard in the patient room and using walkie-talkies to relay messages to staff outside the room for equipment and help.

[Newly added] **Kearsley (2020) Consensus guidelines for managing the airway in patients with COVID-19**[22]
This letter discusses the spread of online information about the use of 'aerosol box' for intubation and recommends caution when evaluating new airway management techniques.

Wax et al (2020) Practical recommendations for critical care and anesthesiology teams caring for novel coronavirus (2019-nCoV) patients[23]

Intubation of critically ill patients with SARS-CoV was associated with episodes of healthcare worker transmission. The reasons for this are likely multifactorial, including high-level viral shedding due to severity of patient illness, procedures associated with resuscitation or intubation that may generate aerosols, and healthcare worker use of PPE: high-risk patient + high-risk procedure = higher level of precautions.

Patients infected with 2019-nCoV should be monitored for early signs of respiratory deterioration and intubated electively rather than emergently. If possible, patients isolated with 2019-nCoV should be monitored in a critical care area with airborne isolation and continuous physiologic monitoring.

During the SARS outbreak, the concept of "Protected Code Blue" was created to distinguish usual resuscitation from those requiring special procedures and precautions. More information about PCB http://sars.medtau.org/simulatedprotectedcodeblue.pps and https://emergencymedicinecases.com/biohazard-preparedness-protected-code-blue/.

Once designated as requiring 2019-nCoV isolation:

- Resuscitation should take place in an airborne isolation room if possible, as it is an AGP.
- The resuscitation team must be wearing appropriate airborne/droplet/contact PPE.
- Given the greater risk of infection during a dynamic resuscitation use of powered air purifying respirators (PAPRs) by specially trained resuscitation teams should be strongly considered. Although PAPRs have a higher protective factor compared with N95 respirators, there is no definitive evidence that PAPRs reduce the likelihood of viral transmission in the setting of potential airborne spread. Nonetheless PAPRs may be more comfortable to wear for prolonged resuscitations, eliminate concerns of unexpected poor N95 respirator fit, and are less likely to be dislodged when managing an agitated patient. PAPRs with hoods covering the entire head and neck may provide additional protection against contamination.

- Initial resuscitation efforts by first responders wearing usual airborne/droplet/contact PPE to an acute crisis should focus on measures that are most likely to help the patient and have low risk for viral transmission.
- A list of specific low and high risk resuscitation interventions is provided in the full text of the article.
- Once the PCB team has donned PPE and been checked by an infection control coach, they can enter the room. Team size should be minimal to avoid unnecessary viral exposure—typically four people with designated roles.
- Consider use of a specialized cart containing modular packs of equipment, with PCB team members bringing in the necessary defibrillator and packs rather than an entire resuscitation cart.
- Following resuscitation, team members can exit when appropriate and should remove PPE under careful supervision of an infection control coach using a checklist to avoid self-contamination.

Ling et al (2020) COVID-19: A critical care perspective informed by lessons learnt from other viral epidemics[24]

Cardiopulmonary Resuscitation
The increased transmission of SARS-CoV to HCW previously reported during cardiopulmonary resuscitation (CPR) was likely due to virus aerosolisation during BVM ventilation. Preventive measures may include using apnoeic oxygenation during CPR, or careful two-person BVM ventilation to allow an effective face seal by two handed mask holding with inline bacterial/viral filter, and early intubation when indicated. The use of mechanical CPR devices to replace HCW CPR may reduce the risk of facemask leakage for the HCW and decreases their own minute ventilation, thus potentially reducing the risk of disease transmission. For patients already receiving mechanical ventilation in ICU, the ventilator may be set to volume control, with a large negative pressure trigger and high-pressure alarm setting to avoid a need for disconnection and change to manual BVM ventilation.

Szerlip et al (2020) Considerations for Cardiac Catheterization Laboratory Procedures During the COVID-19 Pandemic Perspectives from the Society for Cardiovascular Angiography and Interventions Emerging Leader Mentorship (SCAI ELM) Members and Graduates[25]

The authors recommend using appropriate PPE, disinfection and cleaning of all surfaces and if CPR is required in the cardiac catheterization lab consider using automated CPR devices for chest compression to minimize personnel exposure.

Driggin et al (2020) Cardiovascular Considerations for Patients, Health Care Workers, and Health Systems During the Coronavirus Disease 2019 (COVID-19) Pandemic[26]

In the event of a cardiac arrest, efforts at cardiopulmonary resuscitation causing aerosolized pathogens could result in the wide dissemination of virus particles to clinicians, health care workers, and other patients. One measure which may help protect health care workers in the setting of cardiac arrest and chest compressions is the use of external mechanical compression devices to minimize direct contact with infected patients. Another important consideration for the catheterization laboratory is appropriate post-intervention cleaning of all equipment potentially contaminated with SARS-CoV2. The necessary downtime required for cleaning may seriously impact the availability of catheterization laboratory-based treatments for other patients. As such, many hospitals are minimizing or cancelling elective procedures during the growth phase of the outbreak. Another consideration is the fact that catheterization laboratories and operating rooms are typically configured with positive pressure ventilation, and there have been reports of centers in China converting such facilities to negative pressure isolation in the setting of COVID-19. Guidance and recommendations in this space will be forthcoming from interventional communities, including the ACC and SCAI.

Christian et al (2004) Possible SARS coronavirus transmission during cardiopulmonary resuscitation[27]

Based on experience from the SARS coronavirus a continuous quality improvement framework was developed providing interventions for preventing future episodes of transmission:

Administrative Controls

Policies and protocols for emergency resuscitation should include:

- description of the roles and responsibilities of healthcare workers responding to the emergency
- mechanisms to alert responders that the emergency involves a potentially contagious patient: eg announcing the code as an "isolation code blue"
- steps to limit the number of healthcare workers involved to minimize potential exposures
- plans for having auxiliary staff staged in a safe area where they can be easily called on if needed but otherwise preventing unnecessary exposure
- plans for safe disposal and cleaning of equipment used during the emergency response
- procedures for disposition of the patient after the emergency, either to the ICU if resuscitation is successful or the morgue if unsuccessful.

Environmental Engineering Controls

- physical engineering elements such as negative pressure rooms, dilution ventilation, high-efficiency particulate air filtration, ultraviolet lights, and scavenging devices
- aims to contain the infectious agent in a limited area and to minimize or rapidly decrease the viral load in the environment

PPE

- discuss the use of 4 personal protective system versus PAPR
- regardless of what PPE is used for AGPs, it is essential that they are distributed throughout the hospital in areas where they are most likely to be required by primary responders in an emergency situation as opposed to a central area where teams must wait for them to be brought to the emergency
- extra protection equipment should be included as part of any crash cart used by the responding code team

Quality Control

- it is important not to forget the basics of infection control procedures such as glove changing and hand hygiene
- HCWs must remain vigilant about not only protecting themselves and protecting against patient-to-patient transmission
- after developing good policies and training staff who are rehearsed for emergencies and provided with appropriate protection equipment, the last step is to ensure ongoing adherence to the standards set. This adherence is achieved through quality control
- without an effective quality control program in place, lapses in infection control procedures will occur, particularly as healthcare workers become fatigued during a prolonged outbreak

ARTICLES RELATING TO ADVANCE CARE PLANNING, PALLIATIVE CARE AND DO NOT RESUSCITATE ORDERS TO REDUCE FUTILE LIFE SUSTAINING TREATMENTS SUCH AS CPR AND ENSURE RATIONAL USAGE OF PPE RESOURCES

[Newly added] Chan et al (2020) Code Blue During the COVID-19 Pandemic[28]

The authors suggest approaches to implement a more nuanced and contextualized approach to Code Blue responses for in hospital cardiac arrests in order to balance ethics, healthcare provider safety and scarce resources:

- we believe hospitals should implement policies to clarify patients' advanced directives and their COVID-19 status as soon as possible. All admitted patients regardless of COVID-19 status should have meaningful discussions about goals of care and DNAR/AND status on admission
- resource management during an IHCA will vary depending on whether one's hospital is confronted with imminent and extreme resource scarcity and they provide more detailed information for both scenarios

[Newly added] **Fritz et al (2020) Cardiopulmonary resuscitation after hospital admission with covid-19**[29]

This editorial suggests that the risk-benefit balance for CPR during the pandemic has changed from "there is no harm in trying" to "there is little benefit to the patient, and potentially significant harm to staff." They suggest that the argument for not attempting CPR on hospital patients with COVID-19 without enhanced personal protection is justifiable and that clinicians, patients, and those close to them need to have early discussions about CPR and the overall goals of care.

[Newly added] **Kramer et al (2020) Ethics in the Time of Coronavirus: Recommendations in the COVID-19 Pandemic**[30]

The sixth ethical issue this article deals with is: How should we address end of life issues, including do not resuscitate orders and goals of care discussions?

Their recommendation is: We recommend a stepwise approach to the question of end-of life issues in COVID-19 patients. First, in line with standard of care, one must address the likely medical benefit of resuscitation to the patient and only offer CPR if the particular clinical scenario suggests a medically defined benefit. Second, providers should only be required to perform CPR if adequate protective equipment is available to them; however, if protective gear is available, then the duty to perform CPR should strictly be dictated by its likely medical benefit. Finally, the question of allocation of resources should be considered separately from the CPR question and should follow the algorithms outlined above for allocation of scarce non-finite resources in general. When CPR is deemed to be medically non-beneficial, this decision must be promptly communicated with the patient and the patient's family. Palliative measures offered without delay.

[Newly added] **DeFilippis et al (2020) Cardiopulmonary Resuscitation During the COVID-19 Pandemic: A View from Trainees on the Frontline**[31]

This article provides US junior doctor perspectives on resuscitation and encourage broader discussion on the following points:

1. How can we better identify patients who would not want CPR?
2. Safety considerations when CPR is performed

3. More data are needed to clarify which COVID-19 patients are least likely to benefit from CPR
4. Guidance from professional societies and biomedical ethicists about how and when to perform CPR is needed

[Newly added] **Italian Society for Anesthesia, Analgesia, Resuscitation, and Intensive Care (2020) Clinical Ethics Recommendations for Admission to Intensive Care and for Withdrawing Treatment in Exceptional Conditions of Imbalance between Needs and Available Resources**[32]

15 recommendations are provided to:

- relieve clinicians from part of the responsibility for decisions, which can be emotionally burdensome in some cases
- render explicit the allocation criteria of healthcare resources in circumstances where they are extraordinarily scarce

Curtis et al (2020) The Importance of Addressing Advance Care Planning and Decisions About Do-Not-Resuscitate Orders During Novel Coronavirus 2019 (COVID-19)[33]

Curtis et al emphasise the importance of patients and clinicians working together on advance care planning, particularly regarding life-sustaining treatments such as cardiopulmonary resuscitation (CPR) or mechanical ventilation. The COVID-19 pandemic heightens the importance of implementing do-not-resuscitate (DNR) orders for appropriate hospitalized patients.

They suggest that the implementation of DNR orders can occur in 3 situations:

- Communicated by patients or surrogate decision makers.
- Patients or surrogate decision makers may follow the recommendation of a clinician to forgo CPR. This may occur through informed consent/informed assent.
- In extreme situations in which CPR cannot possibly be effective, clinicians in some health care settings may unilaterally decide to write a DNR order. This latter approach is not uniformly accepted and, prior to COVID-19, it rarely had a role. During this pandemic, however, in extreme situations such as a patient with severe underlying chronic

illness and acute cardiopulmonary failure who is getting worse despite maximal therapy, there may be a role for a unilateral DNR to reduce the risk of medically futile CPR to patients, families, and health care workers.

Fausto et al (2020) Creating a Palliative Care Inpatient Response Plan for COVID19 – The UW Medicine Experience[34]

UW Medicine developed a strategy to implement a palliative care response for a multi-hospital healthcare system that incorporates conventional capacity, contingency capacity, and crisis capacity. This strategy included among other measures:

- Palliative care specialists provided guidance and tools for primary teams conducting goals-of-care and code status discussions in order to preserve resources by avoiding unwanted or non-beneficial cardiopulmonary resuscitation and mechanical ventilation.
- Digital health/telehealth was used where possible for palliative care consultations, to reduce PPE usage.

Adams (2020) Goals of Care in a Pandemic: Our Experience and Recommendations[35]

Adams shares the experience of her institution in dealing with COVID-19 patients from a palliative care perspective. She recommends earlier goals of care conversations, multidisciplinary team work, and enhanced use of technology and telemedicine to address the care goals of patients, which reducing the need for rationing of resources.

[Newly added] Scottish Government (2020) Coronavirus (COVID-19): guidance on treating patients[36]

Specialty teams should discuss treatment escalation and limitation plans (TELPS) with patients and/or their families at the earliest opportunity in case of an unexpected deterioration. This should include treatment plans for patients who would not wish or benefit from critical care admission and, where this is appropriate, documenting DNACPR decisions.

Mahase et al (2020) [News Article] Covid-19: Doctors are told not to perform CPR on patients in cardiac arrest[37]

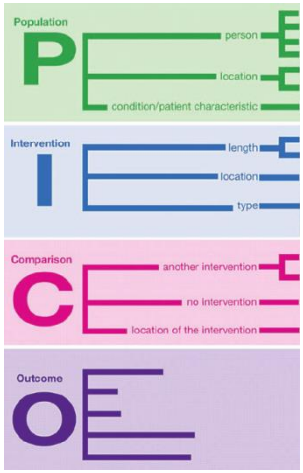
This article discusses the merits of CPR guidance given to staff in University Hospitals Birmingham NHS Foundation Trust.

OTHER

[Newly added] On-going systematic review:

Couper et al (2020) COVID-19 infection risk to rescuers treating cardiac arrest[38]

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.



Population	HEALTHCARE WORKERS IN THE HOSPITAL SETTING WORKING WITH PATIENTS WITH CONFIRMED OR SUSPECTED COVID-19
Intervention	PROVISION OF CPR TO PATIENTS
Comparison	NO CPR OR LIMITED CPR (E.G CHEST COMPRESSIONS AND AED USE ONLY)
Outcome	TRANSMISSION OF COVID-19 TO HCWS THROUGH THE PROVISION OF CPR

The following search strategy was used (in tandem with COVID-19 search strings):

EMTREE: RESUSCITATION/

MESH: CARDIOPULMONARY RESUSCITATION

KEYWORD: CPR OR RESUSCITATION OR RESUS OR CARDIO-PULMONARY RESUSCITATION OR CARDIOPULMONARY RESUSCITATION OR CHEST COMPRESSIONS OR AUTOMATED EXTERNAL DEFRIBRILLATOR OR CARDIAC ARREST OR ADVANCED CARDIAC LIFE SUPPORT OR CARDIO PULMONARY RESUSCITATION OR RESUSCITATE OR CARDIOVASCULAR

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SOURCES

[1] Edelson DP et al 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®-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 [published online ahead of print, 2020 Apr 9]. *Circulation*. 2020;10.1161/CIRCULATIONAHA.120.047463. doi:10.1161/CIRCULATIONAHA.120.047463 https://pubmed.ncbi.nlm.nih.gov/32270695 [Accessed 17/04/2020].
[2] *International Liaison Committee on Resuscitation*. COVID-19 infection risk to rescuers from patients in cardiac arrest. *Consensus on Science with Treatment Recommendations [Internet] Brussels, Belgium: International Liaison Committee on Resuscitation (ILCOR), 10 April 2020.* https://costr.ilcor.org/document/covid-19-infection-risk-to-rescuers-from-patients-in-cardiac-arrest [Accessed 17/04/2020].
[3] Resuscitation Council UK Statement on COVID-19 in relation to CPR and resuscitation in healthcare settings 6 April 2020. https://www.resus.org.uk/media/statements/resuscitation-council-uk-statements-on-covid-19-coronavirus-cpr-and-resuscitation/covid-healthcare/ [Accessed 17/04/2020].
[4] Alhazzani W, Møller MH, Arabi YM, et al Surviving Sepsis Campaign: guidelines on the management of critically ill adults with Coronavirus Disease 2019 (COVID-19) [published online ahead of print, 2020 Mar 28]. *Intensive Care Med*. 2020;1–34. doi:10.1007/s00134-020-06022-5 https://pubmed.ncbi.nlm.nih.gov/32222812/ [Accessed 17/04/2020].
[5] APA Rimawi, Ramzy H. MD Using the Surviving Sepsis Coronavirus Disease 2019 Guidelines—Anything New Yet?, Critical Care Explorations: April 2020 - Volume 2 - Issue 4 - p e0099 doi: 10.1097/CCE.0000000000000099 https://journals.lww.com/ccejournal/fulltext/2020/04000/using_the_surviving_sepsis_coronavirus_disease.13.aspx [Accessed 17/04/2020].
[6] Cook TM, El-Boghdadly K, McGuire B, McNarry AF, Patel A, Higgs A. Consensus guidelines for managing the airway in patients with COVID-19: Guidelines from the Difficult Airway Society, the Association of Anaesthetists the Intensive Care Society, the Faculty of Intensive Care Medicine and the Royal College of Anaesthetists [published online ahead of print, 2020 Mar 27]. *Anaesthesia*. 2020;10.1111/anae.15054. doi:10.1111/anae.15054 https://pubmed.ncbi.nlm.nih.gov/32221970
[7] Government of Canada (2020) Clinical management of patients with moderate to severe COVID-19 - Interim guidance. https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/clinical-management-covid-19.html#8 [Accessed 17/04/2020].
[8] Lakkireddy DR, Chung MK, Gopinathannair R, et al Guidance for Cardiac Electrophysiology During the Coronavirus (COVID-19) Pandemic from the Heart Rhythm Society COVID-19 Task Force; Electrophysiology Section of the American College of Cardiology; and the Electrocardiography and Arrhythmias Committee of the Council on Clinical Cardiology, American Heart Association [published online ahead of print, 2020 Mar 31]. *Circulation*. 2020;10.1161/CIRCULATIONAHA.120.047063. doi:10.1161/CIRCULATIONAHA.120.047063. https://pubmed.ncbi.nlm.nih.gov/32228309 [Accessed 17/04/2020].
[9] NICE. 20 March 2020. COVID-19 rapid guideline: critical care in adults https://www.nice.org.uk/guidance/ng159/resources/covid19-rapid-guideline-critical-care-pdf-661418486814l3 [Accessed 01/04/2020].
[10] The Faculty of Intensive Care Medicine, Intensive Care Society, Association of Anaesthetists and Royal College of Anaesthetists - Critical care preparation and management in the COVID-19 pandemic. (2020). https://icmanaesthesiacovid-19.org/critical-care-preparation-and-management-in-the-covid-19-pandemic [Accessed 01/04/2020].
[11] Health Protection Surveillance Centre Ireland. Use of PPE to support Infection Prevention and Control Practice when performing aerosol generating procedures on confirmed or clinically suspected Covid-19 cases in a pandemic situation. Guidance V 2, 23.3.2020. https://www.hpsc.ie/a-z/respiratory/coronavirus/novelcoronavirus/guidance/infectionpreventionandcontrolguidance/aerosolgeneratingprocedures/AGPs%20for%20confirmed%20or%20possible%20COVID19_v2.0_23032020.pdf [Accessed 01/04/2020].
[12] Health Service Executive Deteriorating Patient Improvement Programme (2020). CPR guidance for confirmed or suspected COVID-19 in community assessment hubs. https://www.hpsc.ie/a-z/respiratory/coronavirus/novelcoronavirus/guidance/primarycareguidance/communityassessmenthubs/. [Accessed 30/04/2020].
[13] WHO. 19 March 2020. Infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected. https://www.who.int/publications-detail/infection-prevention-and-control-during-health-care-when-novel-coronavirus-(ncov)-infection-is-suspected-20200125 [Accessed 01/04/2020].
[14] European Centre for Disease Prevention and Control. 31st March 2020. Infection prevention and control and preparedness for COVID-19 in healthcare settings Technical Report. https://www.ecdc.europa.eu/sites/default/files/documents/Infection-prevention-control-for-the-care-of-patients-with-2019-nCoV-healthcare-settings_update-31-March-2020.pdf [Accessed 01/04/2020].
[15] Centres for Disease Control and Prevention. Interim Infection Prevention and Control Recommendations for Patients with Suspected or Confirmed Coronavirus Disease 2019 (COVID-19) in Healthcare Settings. https://www.cdc.gov/coronavirus/2019-ncov/infection-control/control-recommendations.html [Accessed 01/04/2020].

[16] UpToDate. "Advanced cardiac life support (ACLS) in adults". https://www.uptodate.com/contents/coronavirus-disease-2019-covid-19-critical-care-issues [Accessed 31/03/2020].
[17] Griffin KM, Karas MG, Ivascu NS, Lief L. Hospital Preparedness for COVID-19: A Practical Guide from a Critical Care Perspective [published online ahead of print, 2020 Apr 16]. *Am J Respir Crit Care Med*. 2020;10.1164/rccm.202004-1037CP. doi:10.1164/rccm.202004-1037CP https://pubmed.ncbi.nlm.nih.gov/32298146 [Accessed 17/04/2020].
[18] Song W, Liu Y, Ouyang Y, et al Recommendations on cardiopulmonary resuscitation strategy and procedure for novel coronavirus pneumonia [published online ahead of print, 2020 Apr 7]. *Resuscitation*. 2020;S0300-9572(20)30137-4. doi:10.1016/j.resuscitation.2020.03.023. https://pubmed.ncbi.nlm.nih.gov/32276002/ [Accessed 17/04/2020].
[19] Li W, Huang J, Guo X, Zhao J, Mandell MS. Anesthesia Management and Perioperative Infection Control in Patients With the Novel Coronavirus [published online ahead of print, 2020 Mar 29]. *J Cardiothorac Vasc Anesth*. 2020;S1053-0770(20)30284-6. doi:10.1053/j.jvca.2020.03.035 https://pubmed.ncbi.nlm.nih.gov/32279934/ [Accessed 17/04/2020].
[20] Chavez S, Long B, Koyfman A, Liang SY. Coronavirus Disease (COVID-19): A primer for emergency physicians [published online ahead of print, 2020 Mar 24]. *Am J Emerg Med*. 2020;S0735-6757(20)30178-9. doi:10.1016/j.ajem.2020.03.036. https://pubmed.ncbi.nlm.nih.gov/32265065/ [Accessed 17/04/2020].
[21] Liew MF, Siow WT, MacLaren G, See KC. Preparing for COVID-19: early experience from an intensive care unit in Singapore. *Crit Care*. 2020;24(1):83. Published 2020 Mar 9. doi:10.1186/s13054-020-2814-x http://www.ncbi.nlm.nih.gov/pubmed/?term=32151274 [Accessed 17/04/2020].
[22] Kearsley R. Consensus guidelines for managing the airway in patients with COVID-19 [published online ahead of print, 2020 Apr 20]. *Anaesthesia*. 2020;10.1111/anae.15081. doi:10.1111/anae.15081 https://pubmed.ncbi.nlm.nih.gov/32311772/ [Accessed 17/04/2020].
[23] Wax and Christian (12 February 2020) Practical recommendations for critical care and anesthesiology teams caring for novel coronavirus (2019-nCoV) patients. Canadian Journal of Anaesthesia. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7091420/ [Accessed 01/04/2020].
[24] Ling et al COVID-19: A critical care perspective informed by lessons learnt from other viral epidemics. 20 February 2020. Anaesthesia, Critical Care & Pain Medicine. https://www.ncbi.nlm.nih.gov/pubmed/?term=32088344 [Accessed 01/04/2020].
[25] Szerlip et al (2020) Considerations for Cardiac Catheterization Laboratory Procedures During the COVID-19 Pandemic Perspectives from the Society for Cardiovascular Angiography and Interventions Emerging Leader Mentorship (SCAI ELM) Members and Graduates. Catheter & Cardiovascular Interventions. https://www.ncbi.nlm.nih.gov/pubmed/?term=32212409 [Accessed 01/04/2020].
[26] Driggin et al (2020) Cardiovascular Considerations for Patients, Health Care Workers, and Health Systems During the Coronavirus Disease 2019 (COVID-19) Pandemic. Journal of the American College of Cardiology. https://www.ncbi.nlm.nih.gov/pubmed/?term=32201335 [Accessed 01/04/2020].
[27] Christian et al (2004) Possible SARS coronavirus transmission during cardiopulmonary resuscitation. Emerging Infectious Diseases. 10(2):287-93. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3322904/ [Accessed 01/04/2020].
[28] Chan PS, Berg RA, Nadkarni VM. Code Blue During the COVID-19 Pandemic [published online ahead of print, 2020 Apr 7]. *Circ Cardiovasc Qual Outcomes*. 2020;10.1161/CIRCOUTCOMES.120.006779. doi:10.1161/CIRCOUTCOMES.120.006779. https://pubmed.ncbi.nlm.nih.gov/32255661 [Accessed 17/04/2020].
[29] Fritz Z, Perkins GD. Cardiopulmonary resuscitation after hospital admission with covid-19. *BMJ*. 2020;369:m1387. Published 2020 Apr 6. doi:10.1136/bmj.m1387 https://pubmed.ncbi.nlm.nih.gov/32253197 [Accessed 17/04/2020].
[30] Kramer JB, Brown DE, Kopar PK. Ethics in the Time of Coronavirus: Recommendations in the COVID-19 Pandemic [published online ahead of print, 2020 Apr 9]. *J Am Coll Surg*. 2020;S1072-7515(20)30309-4. doi:10.1016/j.jamcollsurg.2020.04.004. https://pubmed.ncbi.nlm.nih.gov/32278728 [Accessed 17/04/2020].
[31] DeFilippis EM, Ranard LS, Berg DD. Cardiopulmonary Resuscitation During the COVID-19 Pandemic: A View from Trainees on the Frontline [published online ahead of print, 2020 Apr 9]. *Circulation*. 2020;10.1161/CIRCULATIONAHA.120.047260. doi:10.1161/CIRCULATIONAHA.120.047260 https://pubmed.ncbi.nlm.nih.gov/32271616/ [Accessed 17/04/2020].
[32] Italian Society for Anesthesia, Analgesia, Resuscitation, and Intensive Care. "Clinical Ethics Recommendations for Admission to Intensive Care and for Withdrawing Treatment in Exceptional Conditions of Imbalance between Needs and Available Resources." English translation. March 13, 2020. https://www.academia.edu/42213831/English_translation_of_the_Italian_SIAARTI_COVID-19_Clinical_Ethics_Recommendations_for_Resource_Allocation_3_6_20. [Accessed 17/04/2020].
[33] Curtis et al (27 March 2020) The Importance of Addressing Advance Care Planning and Decisions About Do-Not-Resuscitate Orders During Novel Coronavirus 2019 (COVID-19). JAMA https://www.ncbi.nlm.nih.gov/pubmed/?term=32219360 [Accessed 01/04/2020].
[34] Fausto et al March 2020. Creating a Palliative Care Inpatient Response Plan for COVID19 – The UW Medicine Experience. Journal of Pain and Symptom Management. Article in Press: Accepted Manuscript https://doi.org/10.1016/j.jpainsymman.2020.03.025 [Accessed 01/04/2020].
[35] Adams, C. 31 March 2020. Goals of Care in a Pandemic: Our Experience and Recommendations. https://doi.org/10.1016/j.jpainsymman.2020.03.018 [Accessed 01/04/2020].
[36] Scottish Government (3 April 2020) Coronavirus (COVID-19): guidance on treating patients https://www.gov.scot/publications/coronavirus-covid-19-clinical-advice/ [Accessed 17/04/2020].

[37] Mahase, E. and Kmietowicz, Z. (2020) Covid-19: Doctors are told not to perform CPR on patients in cardiac arrest, *BMJ*, 368, m1282. https://www.ncbi.nlm.nih.gov/pubmed/?term=32224494 [Accessed 01/04/2020].
[38] Keith Couper, Amy Grove, Jerry Nolan, Sian Taylor-Phillips, Rachel Court, Peter Morley, Gavin Perkins, Jasmeet Soar. COVID-19 infection risk to rescuers treating cardiac arrest. PROSPERO 2020 CRD42020175594 Available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42020175594 [Accessed 17/04/2020].