

Management of adult cardiac arrest in the COVID-19 era. Interim guidelines from the

Australasian College for Emergency Medicine

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Abstract.

Introduction

The global pandemic of coronavirus disease 2019 (COVID-19) is creating significant and widespread disruptions in healthcare organisations and societies across the world. Resuscitation poses a risk to health care workers, and modifications to our traditional approach needs to change. These guidelines for adult cardiac arrest have been produced by the Australasian College for Emergency Medicine (ACEM), and align with national and international recommendations.

Main recommendations

- Important considerations include the need to balance the appropriateness of resuscitation against the risk of infection, use of personal protective equipment (PPE), recognition that in a setting of low community transmission most cardiac arrests are still not due to COVID-19, and that early defibrillation saves lives.
- Additionally, as COVID-19 increasingly affects hospital resource availability, the ethics of resource allocation must be considered.
- Early defibrillation saves lives, and is not considered an aerosol generating procedure.
- All other resuscitative procedures are considered aerosol generating, and require the use of airborne personal protective equipment (PPE).
- Methods to reduce nosocomial transmission of COVID-19 include a physical barrier such as a towel / mask over the patient's mouth and nose, appropriate use of PPE, minimising the staff involved in resuscitation, and use of mechanical chest compression devices when available.

Changes in management

The changes outlined in this document require a significant adaptation for many doctors, nurses and paramedics. It is critically important that all healthcare workers have regular PPE and advanced life support training, are able to access in-situ simulation sessions, and receive extensive debriefing after actual resuscitations. This will ensure safe, timely and effective management of the arrested patient in the COVID-19 era.

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“Protecting healthcare providers is the first priority, as you are the primary line of defence for this patient, and upcoming patients.”¹

- *World Federation of Societies of Anaesthesiologists, 2020*

The global pandemic of coronavirus disease 2019 (COVID-19) is creating significant and widespread disruptions in healthcare organisations and societies across the world. In addition to serious health outcomes, this has also led to social and economic upheaval in many countries, including mass job losses and nationwide shutdowns.

Experience from previous coronavirus outbreaks – notably Severe Acute Respiratory Syndrome (SARS) in 2003 – suggests that healthcare workers are at considerable risk of acquiring infection, particularly when involved in aerosol-generating critical care procedures.²⁻⁴ This risk is even more pronounced with COVID-19, with daily reports of personal protective equipment (PPE) shortages and fatalities of healthcare workers in other countries.⁵

In Emergency Departments (EDs), the traditional approach of rushing to a critically ill patient’s side to provide life-saving resuscitation must now be balanced with the risk of acquiring a potentially fatal illness.^{6,7} This highlights an ethical tension between the duty to treat and a healthcare worker’s right to protection.⁸

In this context, the Australasian College for Emergency Medicine (ACEM) has produced guidance for the management of adult cardiac arrest in the COVID-19 era. Clinical guidelines

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on many aspects of the response to COVID-19 have been produced by a team of emergency physicians and College staff working in collaboration with Safer Care Victoria.⁹

This paper describes the rationale for changing the approach to cardiac arrest. Our guidelines align with statements and guidance from national and international resuscitation bodies, including the Australian and New Zealand Committee on Resuscitation,¹⁰ the New Zealand Resuscitation Council,¹¹ the United Kingdom Resuscitation Council,^{12 13} the International Liaison Committee on Resuscitation,¹⁴ and the American Heart Association.¹⁵ We have also aligned with other local guidelines on critical care in the context of COVID-19, including the Safe Airway Society¹⁶ and the Australian and New Zealand Intensive Care Society.¹⁷

These latter guidelines provide specific advice on airway management and tracheal intubation, therefore ACEM's guidance does not provide detailed information on this aspect of cardiac arrest management.

Significant changes include an overarching and deliberate emphasis on staff safety, while still providing the best possible care for patients requiring resuscitation. Important considerations include the need to balance the appropriateness of resuscitation against the risk of infection, use of personal protective equipment (PPE), recognition that in a setting of low community transmission most cardiac arrests are still not due to COVID-19, and that early defibrillation saves lives. Additionally, as COVID-19 increasingly affects hospital resource availability, the ethics of resource allocation must be considered.

Most recommendations in this document are based on low certainty evidence. We have applied standard resuscitation principles, and substantially rely on expert opinion. Similar to

other COVID-19 guidelines, as knowledge develops during the pandemic, recommendations may change, and these guidelines will need to be updated. However, at the time of writing, it is believed that these recommendations are safe and appropriate for use in pre-hospital and emergency care systems in the current COVID-19 pandemic.

Is resuscitation appropriate?

Ethical consideration of the appropriateness of resuscitation should balance the:

1. Individuals' goals of care and requests for limitations on measures to prolong life.

These should be clarified early for all those admitted to hospital or at risk of requiring hospital admission. This is a shared responsibility of community- and hospital-based clinicians.

2. Likelihood that the patient will benefit from treatment/s
3. Potential for such treatment/s to limit capacity to offer treatment to others with an imperative for fair resource allocation
4. Potential of such treatments to cause harm, including harm to other patients (by diverting staff from attending to other patients who then deteriorate) and staff (through transmission of infection).

A variety of resources are available to assist patients and clinicians in discussions regarding treatment limitations and end of life decisions. ACEM's broader clinical guidelines include specific recommendations for establishing treatment goals in the context of COVID-19. A summary of this approach is included in Figure 1.⁹ For patients for whom resuscitation is deemed inappropriate, palliative care pathways should be utilised to ensure appropriate and evidence-based care for dying patients.

Systems to recognise clinical deterioration and *prevent* cardiorespiratory arrest due to progression of severe illness are also important, within the community, ED and in hospital.

In the event that resuscitation is required, a number of factors should be considered (Figure 2). These include:

- Are staff protected by appropriate personal protective equipment (PPE)?
- Are there any documented goals of care / advance care directives?
- Is there an appropriate resuscitation setting (single or negative pressure room) available that limits risk to others?
- What is the chance of successful resuscitation with good neurological outcome?
- What is the risk to other patients in offering resuscitation?

Infection control and aerosol-generating procedures (AGPs) in the context of resuscitation.

SARS-CoV-2 (the virus that causes COVID-19) is primarily transmitted through droplets.

Droplet transmission occurs when infectious droplets contact the conjunctiva or mucosal surfaces of the upper respiratory tract or the conjunctiva, either directly transmitted from a cough or sneeze, or by contact with a surface upon which droplets have deposited. The use of *droplet and contact PPE* (gown / apron, surgical mask, gloves and eye protection) reduces the risk of transmission, as it provides a physical barrier between the droplets and the portal of entry,¹⁸ and is recommended in most settings for prevention of transmission of SARS-CoV-2.¹⁹

SARS-CoV-2 may cause airborne transmission if there is generation of aerosols during specific procedures such as intubation and non-invasive ventilation. These aerosol generating

procedures (AGPs) are hypothesized to result in an infectious aerosol beyond that which would normally be released by coughing, sneezing, or breathing.²⁰ This aerosol may remain suspended in the air for a period of time, and can be inhaled, leading to healthcare worker infection. *Airborne and contact PPE* (gown, N95 mask, gloves and eye protection) is recommended for health care workers conducting AGPs in patients with confirmed or suspected COVID-19.

During periods where there is sustained community transmission of SARS-CoV-2 and no significant population immunity (either naturally or vaccine acquired) there will be times when it is reasonable to assume that in the first instance, all undifferentiated critically ill patients are infected with COVID-19.

Table 1 provides a summary of recommended PPE for various interventions and procedures associated with resuscitation. Some patients will have been assessed as low-risk for COVID-19 prior to deterioration, and not require droplet precautions for initial resuscitation steps. However, other patients will either be at high-risk for COVID-19, or their risk unable to be determined. In these cases, droplet precautions are recommended for healthcare workers providing the initial response.

Defibrillation is not considered an AGP, with a recent ILCOR systematic review finding no evidence that defibrillation generates aerosols.²¹ In general, all other resuscitative procedures are considered AGPs and therefore require airborne PPE. However, these recommendations are based on weak evidence, and further research may lead to changes in advice. We have taken a deliberately conservative approach, in line with various resuscitation organisations.¹

All staff attending a collapsed patient should be wearing appropriate PPE. The level of PPE dictates which interventions may be safely provided by healthcare workers. A staff member should be specifically assigned to ensure safe PPE use by all staff participating in resuscitation. Specific attention should be paid to mask fit for staff members wearing airborne PPE, and to supervise appropriate donning and doffing.

To further protect staff, it is recommended that senior oversight and expertise is used to minimise the number of people involved in a resuscitation. In-situ simulation may be helpful for ED staff to become familiar with the roles and practical challenges of a smaller resuscitation team.

Optimal setting for resuscitation.

It is recognised that cardiac arrests do not always occur in a convenient location. In hospital, a collapse may occur in a waiting room, bathroom, corridor, or a patient cubicle.

Traditionally, resuscitation occurs in a large, open ED resuscitation cubicle.

From an infection control perspective, a single negative pressure room is the safest location for aerosol-generating procedures (Figure 3), and the patient should be moved to one as soon as practicable. However, resuscitation should not be withheld if a single room is not immediately available.

Where there is no capacity to provide any type of single room (negative pressure room, single room with a door, or single room with a curtain) the most senior clinician should consider

whether it is appropriate to initiate or continue resuscitation. In particular, they should consider whether the potential risk of COVID-19 transmission to healthcare workers and other patients outweighs the possible benefit to the individual patient. In a setting where patients who are positive for COVID-19 are cohorted in an open ward, and all staff are wearing appropriate PPE, this consideration is less relevant.

How should the management of cardiac arrest change?

In view of the above considerations, a number of modifications to existing advanced life support protocols should be made. These will now be discussed, in the context of the “DRSABC” (Danger, Response, Send for help, Airway, Breathing, Circulation) approach. It should be emphasized that all standard resuscitation interventions are still appropriate, however, need to be performed by staff wearing adequate PPE.

Danger

Ideally, all resuscitation should be performed by healthcare workers in PPE suitable for AGPs. However, it is recognised that this may not be the case for first responders.

First responders should be wearing at least a surgical mask, eye protection and gloves. If the patient is high-risk for COVID-19 or unable to be assessed, first responders should be wearing droplet PPE. The patient’s mouth and nose should be covered by an oxygen mask (if available) with flow of up to 10 L/minute. Additional protection against droplet/spray contamination is recommended, and can be achieved by covering the mask with a towel, cloth, surgical mask or clear plastic sheet.¹¹

Defibrillation is not considered an AGP and can be performed by first responders, as long as the patient’s mouth and nose are covered.

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Ensure that any oxygen source is turned off (but oxygen mask and other covering left on patient) prior to defibrillation attempts.

Chest compressions, assisted ventilation, and advanced airway manoeuvres are all considered potentially AGPs, and should only be performed by responders in airborne PPE and in an appropriate space. It is reasonable for compression-only CPR to commence outside and en route to a single room (i.e. in a corridor, waiting room, etc), provided that responders are wearing airborne PPE, and the patient's mouth and nose are covered as outlined above.

Response and Send for help

If the patient is unresponsive and not breathing normally, then resuscitation may be necessary. Call for help. Ensure that all clinicians are wearing appropriate PPE.

Airway and Breathing

Listening or feeling for breathing should *not* occur. Instead, place a hand on patient's chest to feel for chest rise and fall while assessing for normal breathing.

Place a standard oxygen mask (e.g. Hudson mask) on the patient and open their airway with a head tilt / chin lift. Do *not* attempt to clear the airway using any other methods. Suctioning of the oropharynx should *not* occur through an open suction device (i.e. Yankauer sucker) until in an appropriate location with staff using airborne PPE.

Provide passive oxygen at a flow rate of 10 L/minute.

Do *not* provide positive pressure ventilation until in an appropriate physical location and wearing airborne PPE. An appropriate heat and moisture exchanging (HME) viral filter must be connected to any positive pressure oxygen delivery device, as close to the patient as possible. Consider adding a closed in-line suction system (Figure 3). Take care to ensure that all connections are secure and consider the use of reinforcing tape.

Bag-mask ventilation should be minimised. If required, use two hands to hold the mask.

Compressions should be paused, and the bag should be squeezed by a second rescuer at a compression:ventilation ratio of 30:2.²¹ A supraglottic airway device is preferred to a face mask, as it is thought to reduce the risk of aerosols.¹⁶

Pause compressions before inserting a supraglottic airway or attempting to intubate.

If additional oxygen delivery is required, a well-fitted supraglottic airway device (e.g. an i-gel) should be inserted and connected via an appropriate filter to a Mapleson circuit (“anaesthetic bag”) or a standard self-inflating bag.

A Mapleson circuit is preferred due to the ability to provide passive oxygen flow without the need to provide positive pressure ventilation. If using a Mapleson circuit, connect the circuit to oxygen, but do *not* squeeze the bag.

If using a standard self-inflating bag, monitor the movement of the reservoir bag. If oxygen is being delivered, then do *not* squeeze the bag. However, in the absence of respiratory effort, oxygen may not be delivered due to the valve mechanism of a standard self-inflating bag, and gentle squeezing of the bag may be required.

If possible, positive pressure ventilation should only be delivered once an endotracheal tube has been inserted in the trachea, the cuff has been inflated, a HME viral filter connected, and correct placement confirmed.

Suctioning through an endotracheal tube should occur through a closed inline system, in the highest level of isolation available, and by a healthcare worker in airborne PPE.

Circulation

Rapid rhythm assessment and defibrillation should be prioritised.

Until endotracheal intubation has occurred, compression-only CPR is recommended.

However, if positive pressure ventilation is required, then compressions should be paused to allow ventilation while using a mask or supraglottic airway.¹²

Mechanical CPR devices should be used when available and staff are adequately trained in their use. They may be useful to reduce the number of healthcare workers present during resuscitation.

Modified resuscitation algorithm

An algorithm for adult advanced life support is presented (Figure 4). This is an adaptation of the New Zealand Resuscitation Council algorithm, with modification of the terminology for PPE. An approach to the initial steps of resuscitation is presented in Figure 5.

Monitoring of Resuscitation

Apart from minimising the number of people in the room, resuscitation should occur according to established protocols. Waveform capnography should be used. Focused cardiac ultrasound may be useful to guide resuscitation efforts, and / or demonstrate absence of cardiac activity and early cessation of resuscitation.

Advanced Resuscitation Techniques

Advanced resuscitation techniques such as extracorporeal life support should be carefully considered and only used in exceptional circumstances for currently accepted indications (e.g. massive pulmonary embolism, or specific toxicologic emergencies). Provision of such

interventions should include assessment of the potential benefit to the patient, resources required, and the potential associated diversion of resources from others for delivery of such treatments.

In the setting of a cardiac arrest in the ED from presumed COVID-19, escalation to extracorporeal life support is not currently recommended, due to a high likelihood of futility.

Post-Resuscitation care

If return of spontaneous circulation is achieved prior to intubation, then time should be taken to assess need for and potential benefit of intubation in the context of the individual's goals of care.

If requiring mechanical ventilation, clamp the endotracheal tube before disconnecting from the patient. Ensure a closed inline suction system is connected.

At the end of resuscitation attempts, everyone should remove PPE carefully, and thoroughly wash their hands with soap and water (or use an alcohol-based hand sanitiser). It is recommended that staff observe each other while removing PPE to monitor for possible breaches in infection control procedures.

Equipment should be cleaned, disinfected or disposed of according to hospital protocols.

Following resuscitation, it is important to conduct a debrief with team members, to specifically address clinical care and decision-making, communication, PPE and prevention of COVID-19 transmission. Additional support may be required due to the risk to staff, altered decision-making framework, lack of physical proximity of the patient's family members and significant mortality rate of COVID-19. Any breaches of PPE policy should be documented and reported and followed up according to local protocols.

A log of all staff attending the resuscitation should be maintained to facilitate appropriate infection control follow-up if needed.

Termination of Resuscitation

Cardiac arrests will still occur due to all of the “usual” causes such as acute coronary syndromes, cardiomyopathy, pulmonary embolism, cardiac tamponade, anaphylaxis, drug toxicity, and neurological events. Decisions regarding resuscitation termination should be made according to currently accepted standards.

A cardiac arrest in a patient with COVID-19 infection and respiratory failure should prompt rapid assessment and treatment of potentially reversible causes. If no such cause is identified, clinicians should give early consideration to futility of ongoing resuscitation.²²

Care for family members

During the COVID-19 pandemic, family members are likely to be restricted from entering resuscitation rooms, apart from in exceptional circumstances (for example paediatric cardiac arrest). If resuscitation is unsuccessful, family members may – according to local hospital policies and infection control measures - be allowed to view the body. However, restrictions in place due to COVID-19 may significantly disrupt usual grieving processes – for example, not being allowed to touch or kiss the deceased.²³ If required, social work support should be provided to family members in a safe location or via telehealth where COVID-19 precludes visitation. Bereavement procedures can otherwise follow local hospital guidelines.

Appropriate PPE should be used by staff when preparing the body for the mortuary.

Training and simulation.

The changes outlined in this document require a significant adaptation for many doctors, nurses and paramedics. It is critically important that all healthcare workers have regular PPE and advanced life support training, are able to access in-situ simulation sessions, and receive extensive debriefing after actual resuscitations. This will ensure safe, timely and effective management of the arrested patient in the COVID-19 era.

Conclusion

Although infection risks posed by COVID-19 influence all aspects of adult cardiac arrest management, the basic principles of resuscitation remain the same. Modifications to traditional approaches include a much greater emphasis on safety of healthcare workers and use of adequate personal protective equipment. However, prioritisation of rapid defibrillation and attention to reversible causes of cardiac arrest remain critical interventions to improve patient outcomes. Future updates to this document will be available at www.acem.org.au/covid-19

Table 1. Summary of procedures able to be performed according to personal protective equipment (PPE) worn.

	Surgical mask, eye protection and gloves	<u>Droplet PPE</u> - Surgical mask - Eye protection - Gloves - Gown / apron	<u>Airborne PPE</u> - N95/P2 mask - Eye protection - Gloves - Gown / apron - Visor, hat and neck protection as per local guidelines
First responder – recognise cardiac arrest and send for help	✓	✓	✓
Oxygen mask (up to 10L/min) on patient	✓ Low-risk for COVID-19	✓ High-risk for COVID-19 OR Unknown / unable to assess risk	✓
Cover mask with towel / cloth or clear plastic sheet	✓ Low-risk for COVID-19	✓ High-risk for COVID-19 OR Unknown / unable to assess risk	✓
Defibrillation (with patient’s face covered)	✓ Low-risk for COVID-19	✓ High-risk for COVID-19 OR Unknown / unable to assess risk	✓
Chest compressions			✓
Airway manoeuvres			✓
Ventilation			✓
Intubation			✓

Supraglottic airway			✓
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Figure 1. An ethical framework for establishing treatment goals in the context of COVID-19 (Source: Australasian College for Emergency Medicine. Clinical guidelines for the management of COVID-19 in Australasian emergency departments. v2.2; used with permission)

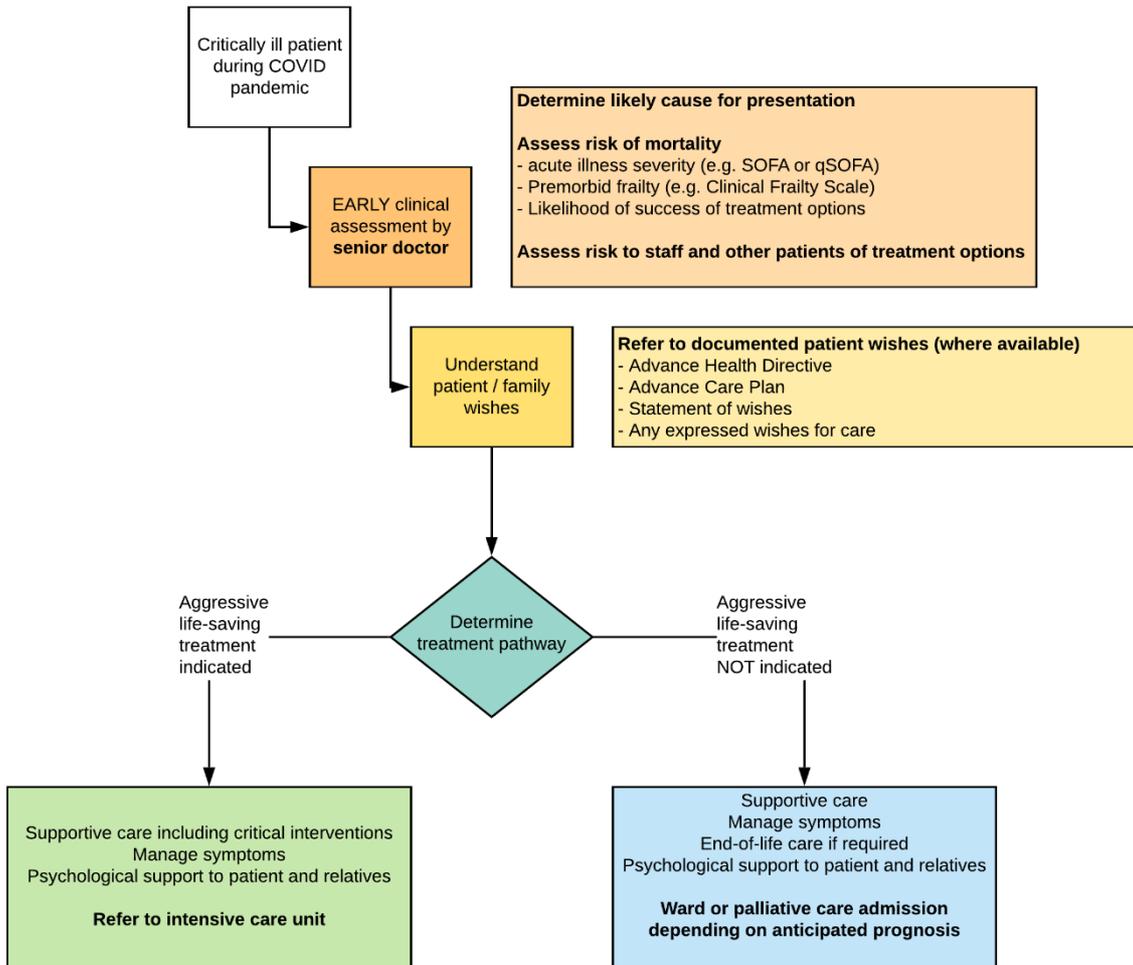


Figure 2. Factors to consider before resuscitation commences



Figure 3. Hierarchy of treatment spaces

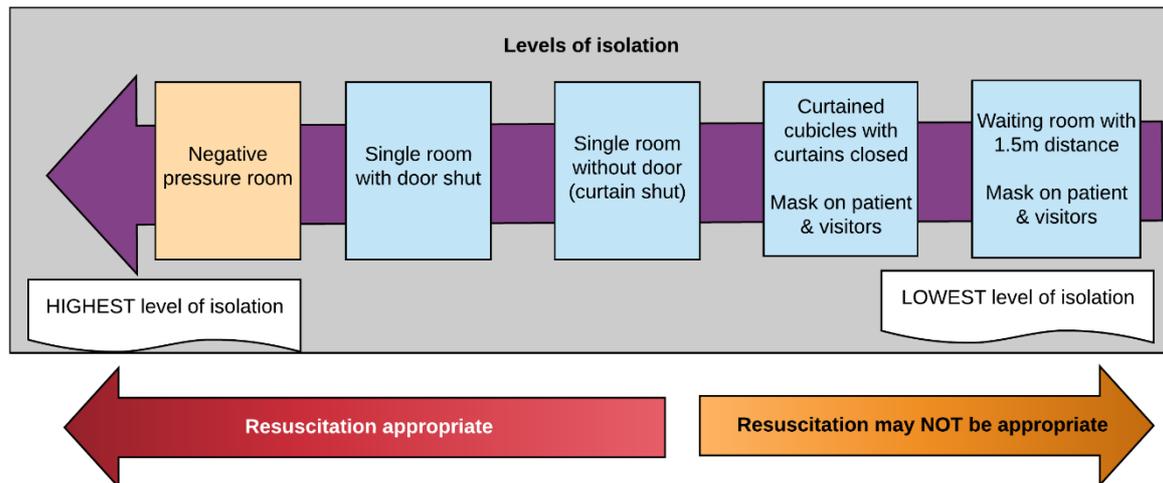


Figure 4. Set-up of bag-mask, in-line suction and filter.



Figure 5. Suggested algorithm for adult advanced life support in the COVID-19 era. (Adapted with permission from the New Zealand Resuscitation Council)

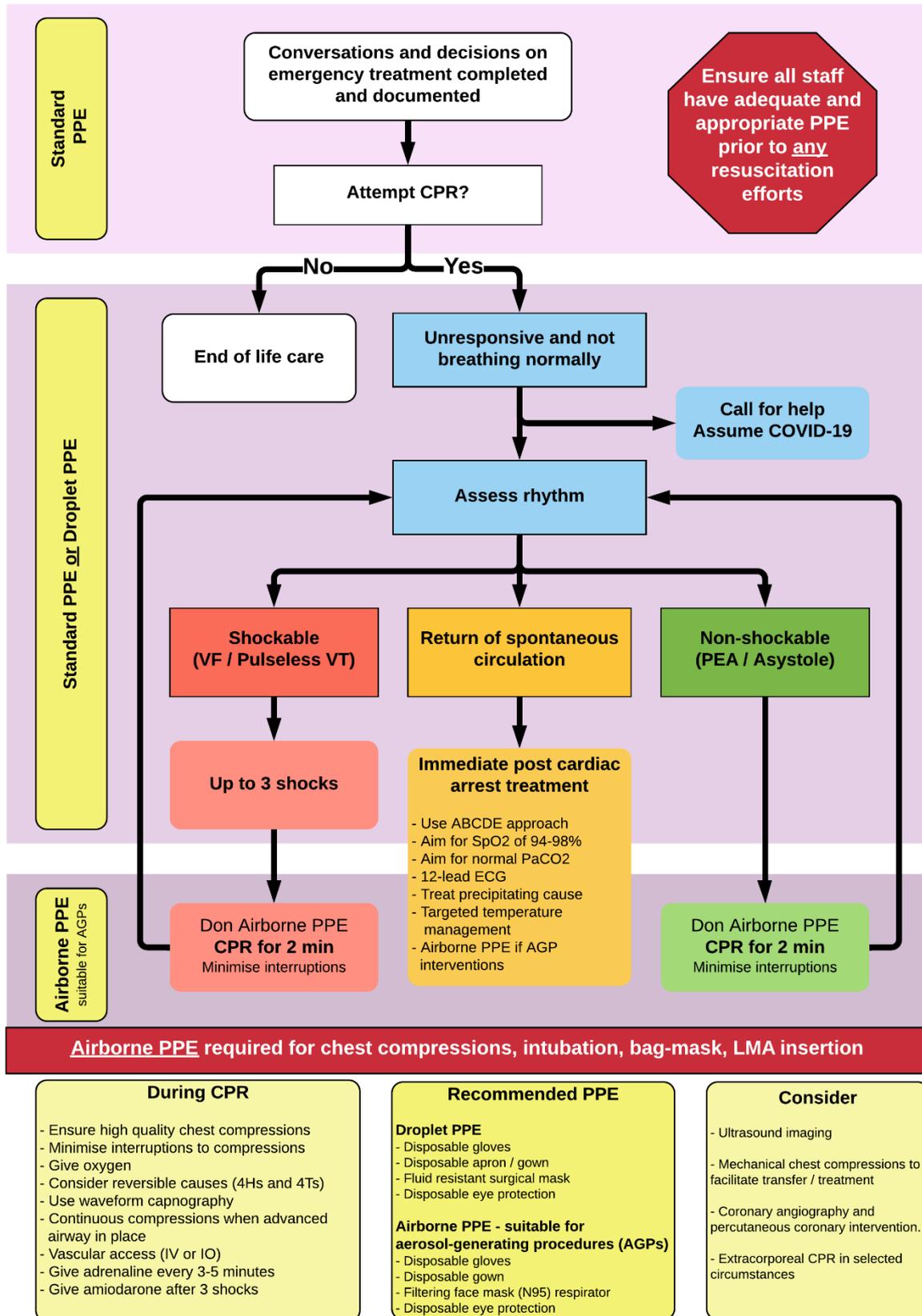
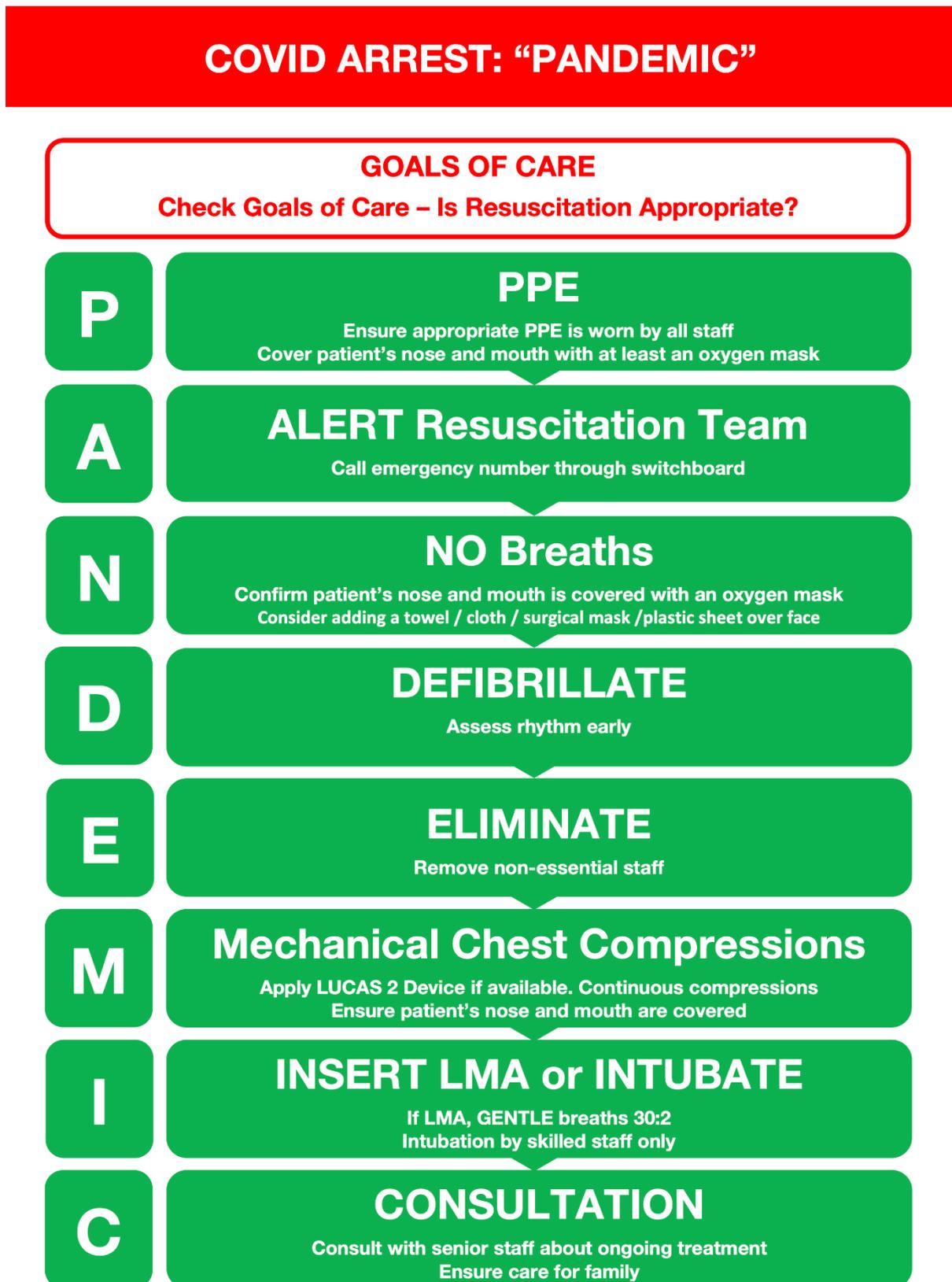


Figure 6. “PANDEMIC” approach to cardiac arrest (Adapted from Royal Hobart Hospital Emergency Department, used with permission).



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