Circulation: Cardiovascular Quality and Outcomes

SPECIAL REPORT

2022 Interim Guidance to Health Care Providers for Basic and Advanced Cardiac 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, the Society of Critical Care Anesthesiologists, and American Society of Anesthesiologists

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Key Words: adult ■ advanced cardiac life support ■ cardiopulmonary resuscitation ■ child ■ COVID-19 ■ infant ■ SARS-CoV-2

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Nonstandard Abbreviations and Acronyms

AGP	aerosol-generating procedure
AHA	American Heart Association
CDC	Center for Disease Control and Prevention
PPE	personal protective equipment

The American Heart Association, along with its collaborating organizations American Academy of Pediatrics, American Association for Respiratory Care, American Society of Anesthesiologists, and the Society of Critical Care Anesthesiologists, is committed to providing the most up-to-date evidence-based guidelines on resuscitation and supporting the health care providers that provide these interventions. At times, there is a need for an interim statement based on new data or, in the case of this pandemic, a rapidly changing environment. Interim guidance may arise from a scientific review of a single topic, or the need for a best-practice statement because of new or urgent public health initiatives. Based on evolving epidemiological reports, emergence of new and more transmissible strains of the coronavirus, declining vaccine effectiveness,[1] as well as recent feedback from the health care provider community, it became clear that the guidance developed in the spring of 2021 and published in October 2021[2] needed to be updated to emphasize fully protecting health care providers who perform resuscitation. Our overall guiding principles and goals in providing this interim guidance are to achieve the best possible resuscitation outcomes and simultaneously ensure optimal protection for health care providers. Language has been clarified in this updated interim guidance to adhere to this guiding principle. Interim guidance will continue to evolve as the pandemic continues to ensure our guidance reflects the best, most up-to-date science and available evidence to guide best practices.

This guidance is based on available scientific evidence at the time of its development, recommendations from public health organizations, and expert opinion; it should be adapted locally on the basis of current disease burden and resource availability. The interim guidance is not a guidelines statement which is based on a formal evidence review. Thus, the revisions have not undergone a systematic review process and cannot be assigned a Class of Recommendation or Level of Evidence.[3] This guidance can be considered similar to a best practice statement. These revisions should always be adapted to changing public health recommendations and local protocols and resources.

The writing group was comprised primarily of authors from the 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care,[3] the Emergency Cardiovascular Care Committee, and the Get With The Guidelines-Resuscitation Adult and Pediatric Task Forces. Additional writing group members were nominated by the collaborating organizations. Potential conflicts of interest are included in the Disclosures section of this article.

We developed this consensus guidance through conference call of the entire author group, one-to-one and small group conferences, and group/personal email exchanges. The final documents were reviewed by a smaller group of experienced authors who had previously been first authors on American Heart Association (AHA) statements or guidelines. All authors and organizational liaisons participated in each step of the submission, revision, and final review process. The discussions were centered on healthcare provider protection, reducing provider risk, and appropriate use of personal protective equipment (PPE). The remainder of the 2021 Interim Guidance is included in this document for the convenience of the reader, to have the most current guidance in one document.[2]

The changes in the interim guidance are focused on these 3 tenets:

1. Incorporating the most recent Center for Disease Control and Prevention (CDC) and World Health Organization guidance: All health care providers should wear a respirator (eg, N95) along with other PPE (gown, gloves, and eye protection) for patients with suspected or confirmed COVID-19 infection, when performing aerosol-generating procedures (AGPs) or in a setting where AGPs are regularly performed.[4,5] The definition of suspected cases should be consistent with the most current definitions from relevant public health officials as well as local standards and protocols. This includes donning appropriate PPE (including respirator) before performing the components of resuscitation that are aerosol generating, which include but are not limited to: chest compressions, defibrillation, bag-mask ventilation, intubation and positive-pressure ventilation. In the event, initial responders are not already wearing appropriate PPE, they should immediately don it and then begin CPR. As PPE recommendations change, health care providers should continue to follow the most-up-to-date recommendations from the World Health Organization, CDC, and regional health authorities and local institutions.
2. Reinforce resuscitation best practices: Cardiac arrest survival rates have decreased dramatically during the COVID-19 pandemic.[6] Out-of-hospital cardiac arrest survival in 2020 also declined in regions/time frames that did and did not have significant COVID infection rates. The reasons for this decline are both unclear and complex. Cardiac arrest survival is dependent on early initiation of CPR and we continue to recommend chest compressions as soon as is safely possible. We believe patients with confirmed or suspected

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COVID-19 should receive the best resuscitative efforts possible[7] and we are committed to both the training of health care providers, and rigorous evaluation of the evidence to ensure our CPR and First Aid guidelines support best practices.

3. Ensure adequate PPE supply: At this time, all health care providers should be following appropriate precautions and should have access to PPE in all clinical settings, regardless of the potential of encountering resuscitation events. Effective use of PPE is critical for the safety of health care providers performing resuscitations. Health care organizations should continue to secure appropriate PPE as available, ensure training regarding appropriate application and use of PPE, reinforce effective use of PPE, and create systems so that health care providers have immediate access to appropriate PPE when emergency care is required.

International data early during the COVID-19 pandemic described worse survival outcomes for both out-of-hospital and in-hospital cardiac arrests compared with prior years.[6–10] This worsening of outcomes may have been multifactorial; the severity of SARS-CoV-2 related cardiac arrest, the implementation of termination of resuscitation guidance, local crisis standards of care or patient hesitancy to seek medical care contributing to delays in care.[11] The provision of prompt chest compressions and defibrillation may also have been delayed due to the additional time required in donning PPE or securing the airway and the PPE may have accelerated rescuer fatigue resulting in decreased CPR quality.[12,13] Concerns that resuscitation from cardiac arrest due to COVID-19 may be futile may have led to earlier termination of resuscitative efforts and overwhelmed Emergency Medical Services systems may have had insufficient resources to respond to increased number of calls for arrests in regions with high rates of COVID-19.[6,14] Lastly, significant delays in presentation for medical care, such as a tripling of the time from onset of chest pain to presentation to emergency care, may have contributed to an increase in out-of-hospital cardiac arrests rates during the pandemic as compared with before the pandemic.[15]

With increased scientific knowledge, a more stable PPE supply chain and increasing availability of vaccines for healthcare providers and the general public, application of the best resuscitation science available must be once again assessed and prioritized. The following guidance should be applied to patients with suspected or confirmed COVID-19 infection (Figures 1 through 8).

REDUCE PROVIDER RISK

Rationale

Effective use of PPE is critical for the safety of health care providers performing resuscitations. Health care organizations should continue to secure appropriate PPE as available, ensure training regarding appropriate application and use of PPE, reinforce effective use of PPE, and create systems so that health care providers have immediate access to appropriate PPE when emergency care is required. Frontline health care providers are at significant risk for contracting respiratory illnesses due to frequent contact with symptomatic patients. Adequate PPE including N-95 masks or positive air pressure respirators, especially during AGPs, can reduce the risk of coronavirus transmission.[24] Provider risk may vary based on individual (age/ethnicity/comorbidities/vaccination status) and system factors. Health care providers can significantly reduce their risk of infection, especially severe illness or death, by receiving the vaccine and booster against the SARS-CoV-2 virus.[16–18] The American Heart Association strongly encourages all health care providers to receive the vaccines and comply with updated recommendations for boosters.

REDUCE PROVIDER EXPOSURE AND PROVIDE TIMELY CARE

Rationale

The data regarding which procedures are aerosol generating are conflicting and continue to develop. CPR is considered to be aerosol-generating.[25] SARS-CoV-2 is transmitted primarily by respiratory droplets and aerosols, with little transmission by fomites.[5,26,27] Rapid initiation of chest compressions is critical for successful resuscitation. Health care providers should wear a respirator (eg, N95) along with other PPE (gown, gloves, and eye protection) for patients with suspected or confirmed COVID-19 infection, when performing AGPs or in a setting where AGPs are regularly performed. This includes donning appropriate PPE (including respirator) before performing the components of resuscitation that are aerosol generating, which include but are not limited to: chest compressions, defibrillation, bag-mask ventilation, intubation, and positive-pressure ventilation. In the event initial responders are not already wearing appropriate PPE, they should immediately don it and then begin CPR. As PPE recommendations change, health care providers should continue to follow the most-up-to-date recommendations from the World Health Organization, CDC, and regional health authorities and local institutions.

The case definitions of suspected and confirmed COVID-19 have changed over time.[28] The incidence of COVID-19 disease has shifted rapidly over time with uneven geographic distribution.[29] The definition of suspected cases should be consistent with the most current definitions from relevant public health officials as well as local standards and protocols. Continuous use of an N-95 respirator and eye protection should be considered when the patient's COVID-19 status is unknown

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and resuscitation involves AGPs to which compressors and other personnel will be exposed.[4] This may apply to patients who initially tested negative for COVID-19 on admission to the hospital and suffer a cardiac arrest during the hospitalization. Initiate chest compressions without delay or interruption while wearing appropriate PPE. All persons not wearing appropriate PPE should be immediately excused from the room or area. Provided there is sufficient PPE, additional compressors may be required due to increased fatigue or potential for N-95 respirator slippage resulting from compressions.[30–32] The application of mechanical compression devices can reduce the number of health care providers required for compressions; however, these devices may not be appropriate or available for morbidly obese adults, infants, children, and small adolescents or for all clinical scenarios.[33] Training and regular practice in the use and rapid application of mechanical compressions devices is required to minimize the early no-flow time and to ensure proper application and utilization of the device.[23] Although the clinical use of

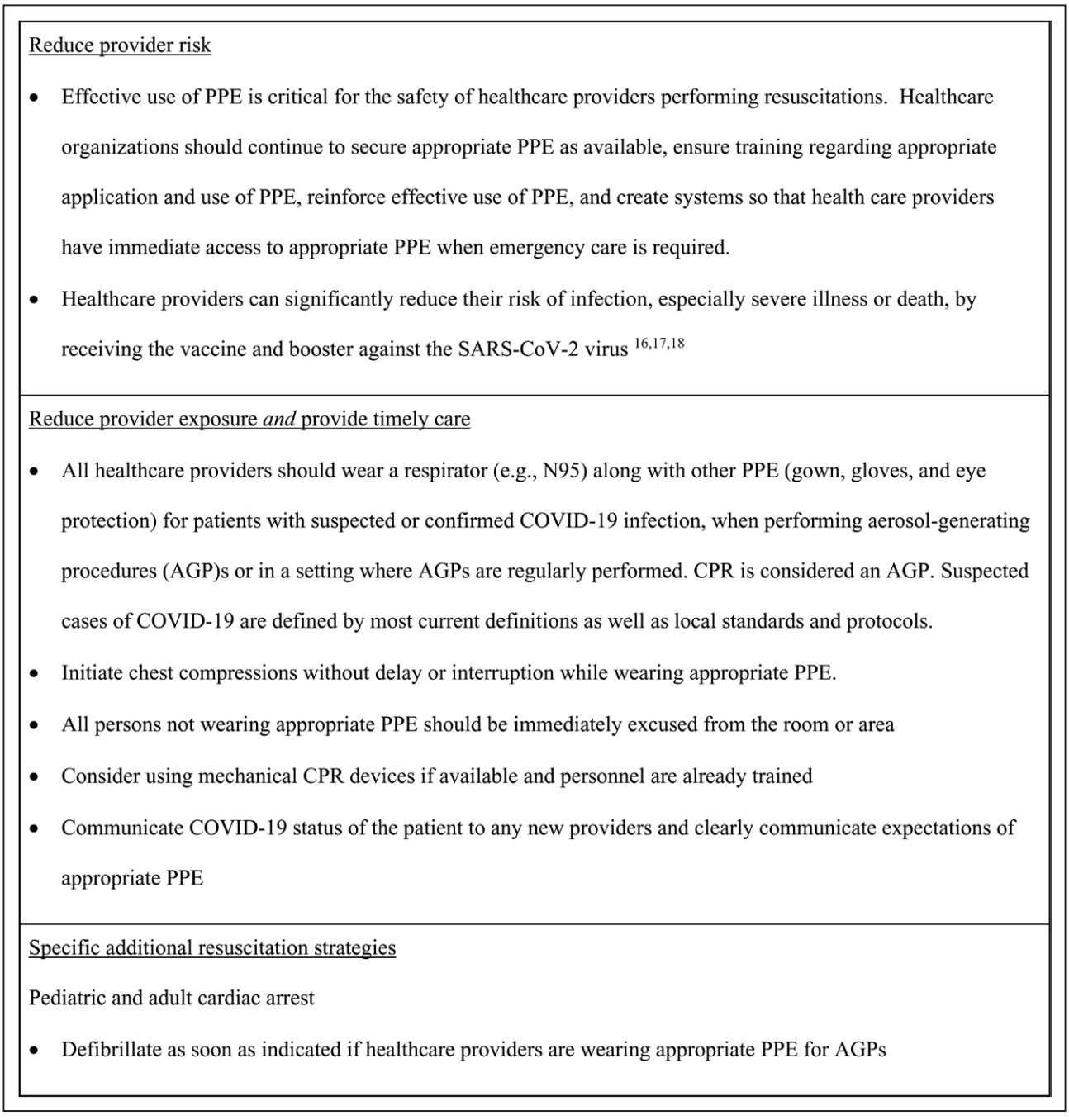

Figure 1. Summary of adjustments to cardiopulmonary resuscitation (CPR) algorithms in patients with suspected or confirmed COVID-19.
AED indicates automated external defibrillator; AGP, aerosol generating procedure; HEPA, high-efficiency particulate air; and PPE, personal protective equipment. (*Continued*)

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- For agonal breathing, consider passive oxygenation until HEPA filtered ventilation can be provided
- Securely attach a HEPA filter to any ventilation device
- Ventilate with a bag-mask-HEPA filter with tight seal until a supraglottic or endotracheal airway is placed
- Engage the intubator with the highest chance of first pass success
- Consider use of video laryngoscopy, if available and personnel are already trained
- Maximize chest compression fraction, pausing to intubate pausing only to facilitate intubation if needed.
- Minimize endotracheal administration of medication to avoid aerosol generation
- Minimize closed ventilation circuit disconnections
- Commit to ethical and evidence-based termination of resuscitation policies

Out-of-hospital cardiac arrest

- For adults, prioritize chest compressions and defibrillation when indicated
- For pediatrics, prioritize oxygenation and HEPA filtered ventilation with chest compressions

Maternal and neonatal cardiac arrest

- If return of spontaneous circulation is not achieved, complete perimortem cesarean delivery ideally within 5 minutes after time of arrest. We recommend calling multidisciplinary team members early in the resuscitation process for maternal cardiac arrest to allow time for PPE donning before they enter the resuscitation area
- Newborn babies are unlikely to be a source of SARS-CoV-2 transmission
- For newborns, bag-mask or T-piece / mask ventilation with appropriate PPE is safe
- Maternal respiratory secretions and fluids may be potential sources of SARS-CoV-2 transmission for the neonatal team and newborn

Figure 1 Continued.

mechanical devices has not demonstrated improvement in outcome compared to manual CPR, it may reduce the number of additional staff who are needed to participate in the resuscitation event.[21,22]

As not every resuscitation space has negative pressure ventilation, closing the door may help limit contamination of adjacent indoor spaces. In out-of-hospital cardiac arrest, taking measures to better ventilate a confined space such as opening windows or doors may reduce the local concentration of aerosols for health care providers if this does not risk contamination of other spaces in the adjacent vicinity. In addition, some health care organizations may have continued shortages in PPE supply, low vaccination rates among staff, and personnel limitations; this guidance needs to be adapted to local protocols with consideration of current COVID-19 disease burden and resource availability.

SPECIFIC ADDITIONAL RESUSCITATION STRATEGIES

Rationale

The experimental evidence evaluating the aerosol generating potential of chest compressions and

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Is CPR aerosol generating?	The CDC considers cardiopulmonary resuscitation and all of its components (e.g., chest compression, ventilation and defibrillation) aerosol generating. Therefore, all healthcare providers should wear appropriate PPE when performing CPR.
Do health care providers need to don PPE for their safety?	All healthcare providers should wear a respirator (e.g., N95) along with other PPE (gown, gloves, and eye protection) for patients with suspected or confirmed COVID-19 infection, when performing AGPs or in a setting where AGPs are regularly performed.
Are 'intubation boxes' useful in controlling aerosolization?	Evidence regarding using a protective barrier enclosure around the patient's head and neck for intubations is still developing. Their use may be considered in scenarios where there is appropriate negative pressure applied and when the intubator is familiar with the technique.[19] In cardiac arrest resuscitations, logistical considerations affecting chest compressions and other critical care may limit the use of an intubation box. Unless there is intubator and institutional experience with use of an intubation box during resuscitations, there is insufficient evidence to support their use at this time.[20]
Do mechanical compression devices help during resuscitations?	For institutions that have systems in place, timely implementation of mechanical compression devices can reduce the number of personnel required for chest compressions and maintain quality compressions but are not superior to manual compressions in survival to discharge with intact neurologic function.[21,22] Additional information is available in the AHA 2020 Guidelines.[23]

Figure 2. Frequently asked questions.
AGP indicates aerosol generating procedure; CPR, cardiopulmonary resuscitation; and PPE, personal protective equipment.

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defibrillation is extremely limited, conflicting, based on small human and animal studies.[34–37] The CDC considers cardiopulmonary resuscitation and all of its components (eg, chest compression, ventilation, and defibrillation) aerosol generating. Therefore, all health care providers should wear appropriate PPE when performing CPR. When actively ventilating using bag-mask ventilation, a supraglottic airway or an endotracheal tube, a HEPA filter on the ventilation exhaust port can capture aerosolized particles. Endotracheal intubation should be timed with having sufficient PPE-protected personnel to perform the procedure.

SITUATION- AND SETTING-SPECIFIC CONSIDERATIONS

Below we describe several specific scenarios related to resuscitation care and their application to the COVID-19 pandemic. We provide these comments covering topics such as prone position, starting/stopping CPR, pregnancy, compression devices, and postarrest care to give readers insight in to the complex discussion that occurred among committee members during each of the interim guidance documents of 2020 and 2021.[2,38] A comprehensive and evidenced-based review on each of these distinct scenarios is beyond

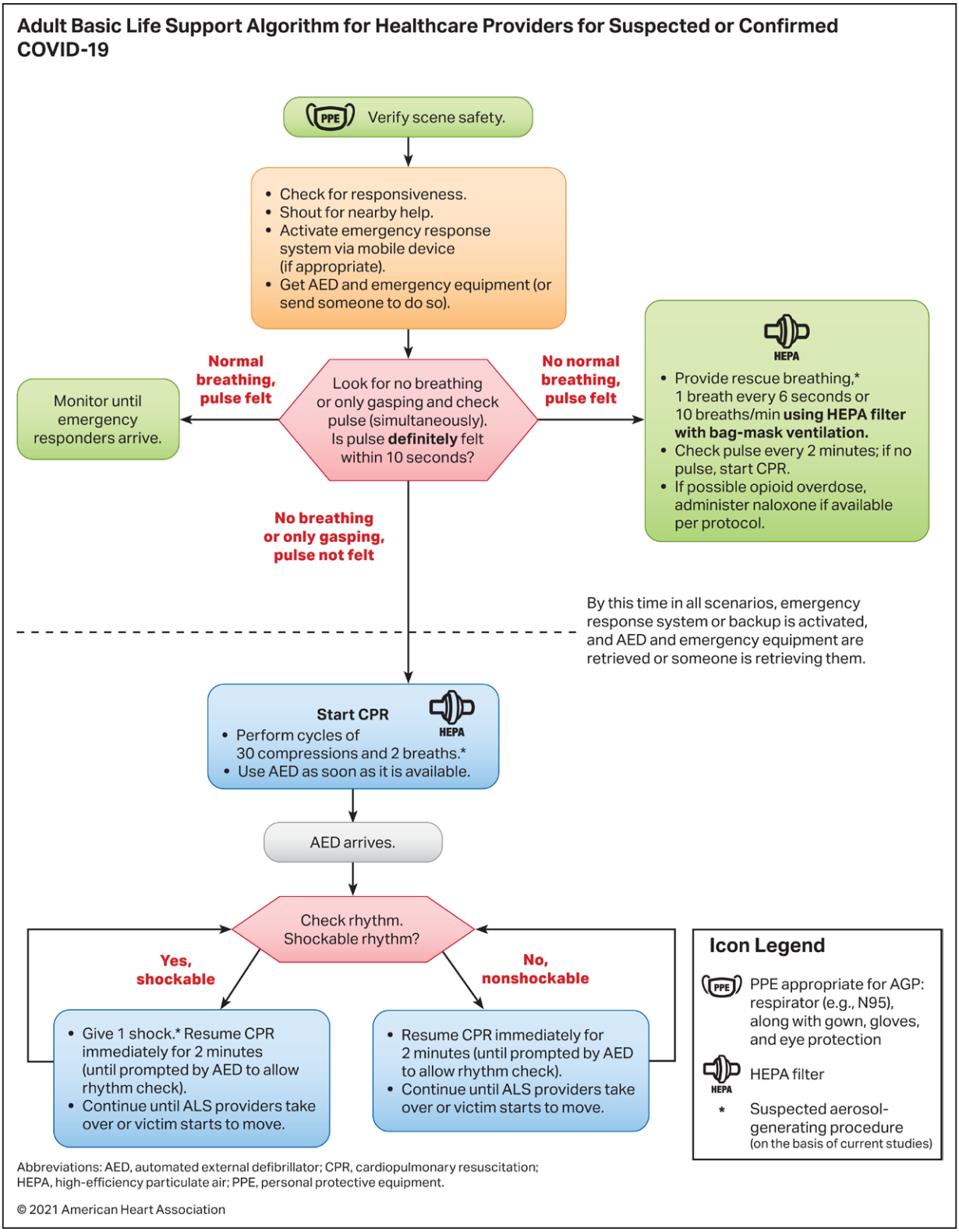

Figure 3. Adult basic life support algorithm for health care providers for suspected or confirmed COVID-19.
AED indicates automated external defibrillator; AGP, aerosol generating procedure; HEPA, high-efficiency particulate air; and PPE, personal protective equipment.

the scope of this interim guidance, but additional discussion on these topics can be found in the AHA 2020 Guidelines.[23]

Pediatric and Adult Cardiac Arrests

- In witnessed, sudden arrest, don appropriate PPE and initiate chest compressions immediately.

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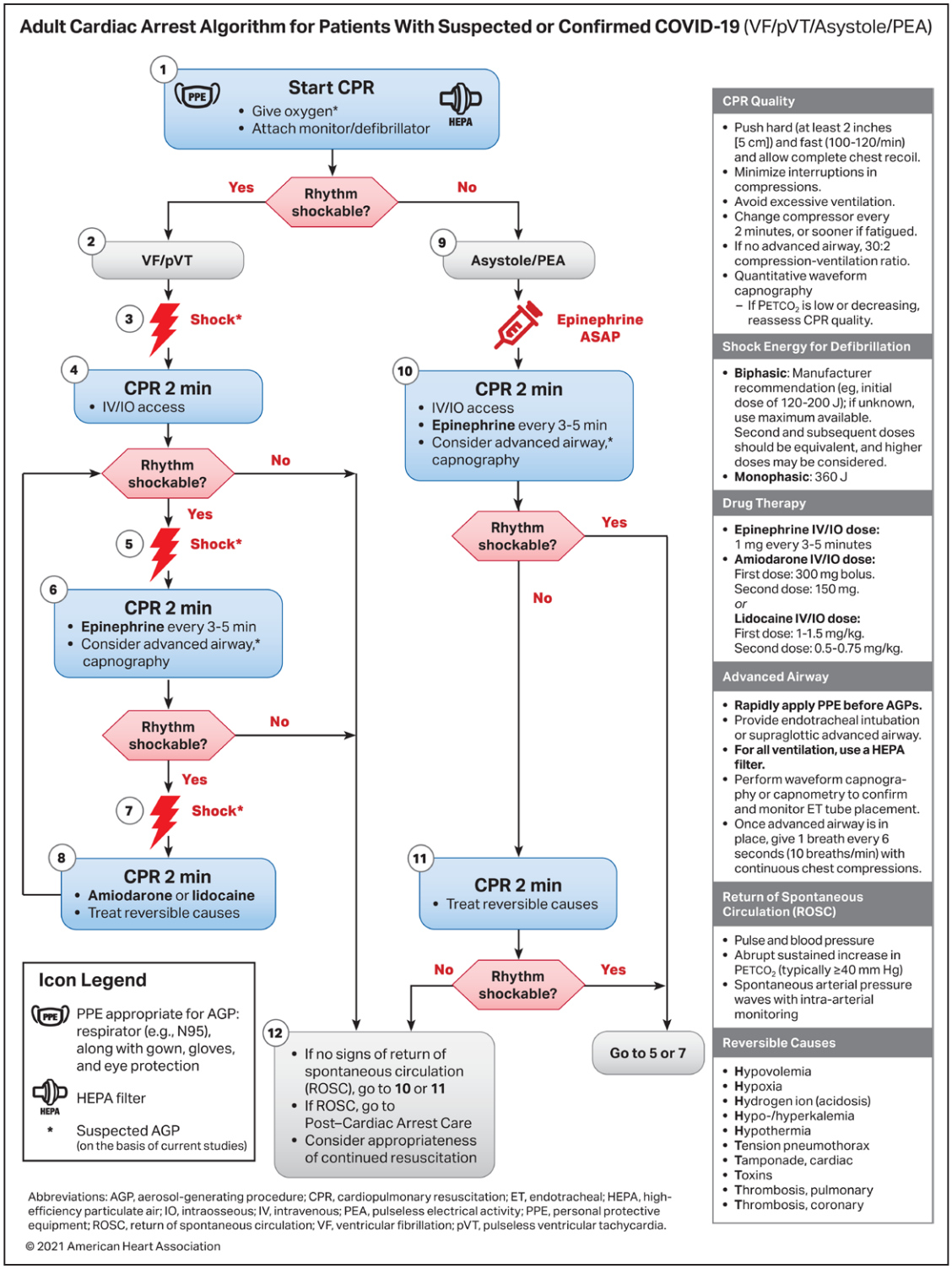

Figure 4. Adult cardiac arrest algorithm for patients with suspected or confirmed COVID-19 (ventricular fibrillation [VF]/pulseless ventricular tachycardia [pVT]/asystole/pulseless electrical activity [PEA]).
AGP, aerosol generating procedure; CPR, cardiopulmonary resuscitation; ET, endotracheal; HEPA, high-efficiency particulate air; IO, intraosseous; PPE, personal protective equipment; and ROSC, return of spontaneous circulation.

All persons not wearing appropriate PPE should be immediately excused from the room or area.

- Ventilations, which are prioritized in pediatric arrests, are considered aerosol generating. All rescuers should wear appropriate PPE for AGPs. All persons not wearing appropriate PPE should be immediately excused from the room or area.
- Defibrillate as soon as indicated when providers are wearing appropriate PPE for AGPs.

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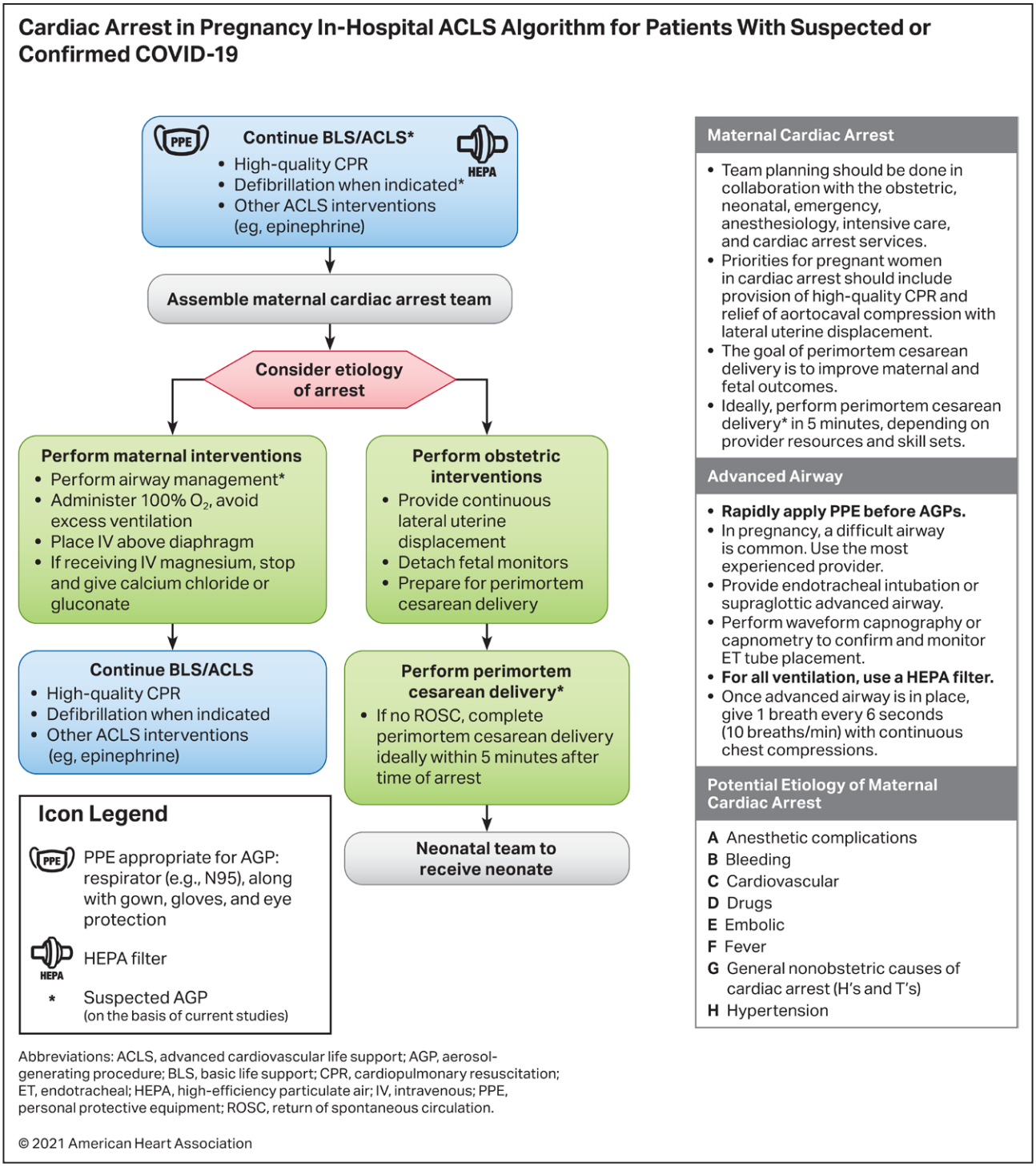

Figure 5. Cardiac arrest in pregnancy in-hospital acls algorithm for patients with suspected or confirmed COVID-19.
ACLS, advanced cardiovascular life support; AGP, aerosol-generating procedures; BLS, basic life support; CPR, cardiopulmonary resuscitation; ET, endotracheal; HEPA, high-efficiency particulate air; IV, intravenous; PPE, personal protective equipment; and ROSC, return of spontaneous circulation.

- A HEPA filter should be securely attached to any manual or mechanical ventilation device along the exhalation port before all ventilation devices such as, but not limited to: bag-mask-valve, supraglottic airway devices, endotracheal tubes, and ventilator mechanical circuits. Alternatively, a low-dead space viral filter or a heat and moisture exchanging filter with >99.99% viral filtration efficiency may be placed between the ventilation device and the airway. The viral filter or the heat and moisture exchanging filter should remain attached to the airway when changing ventilation devices.

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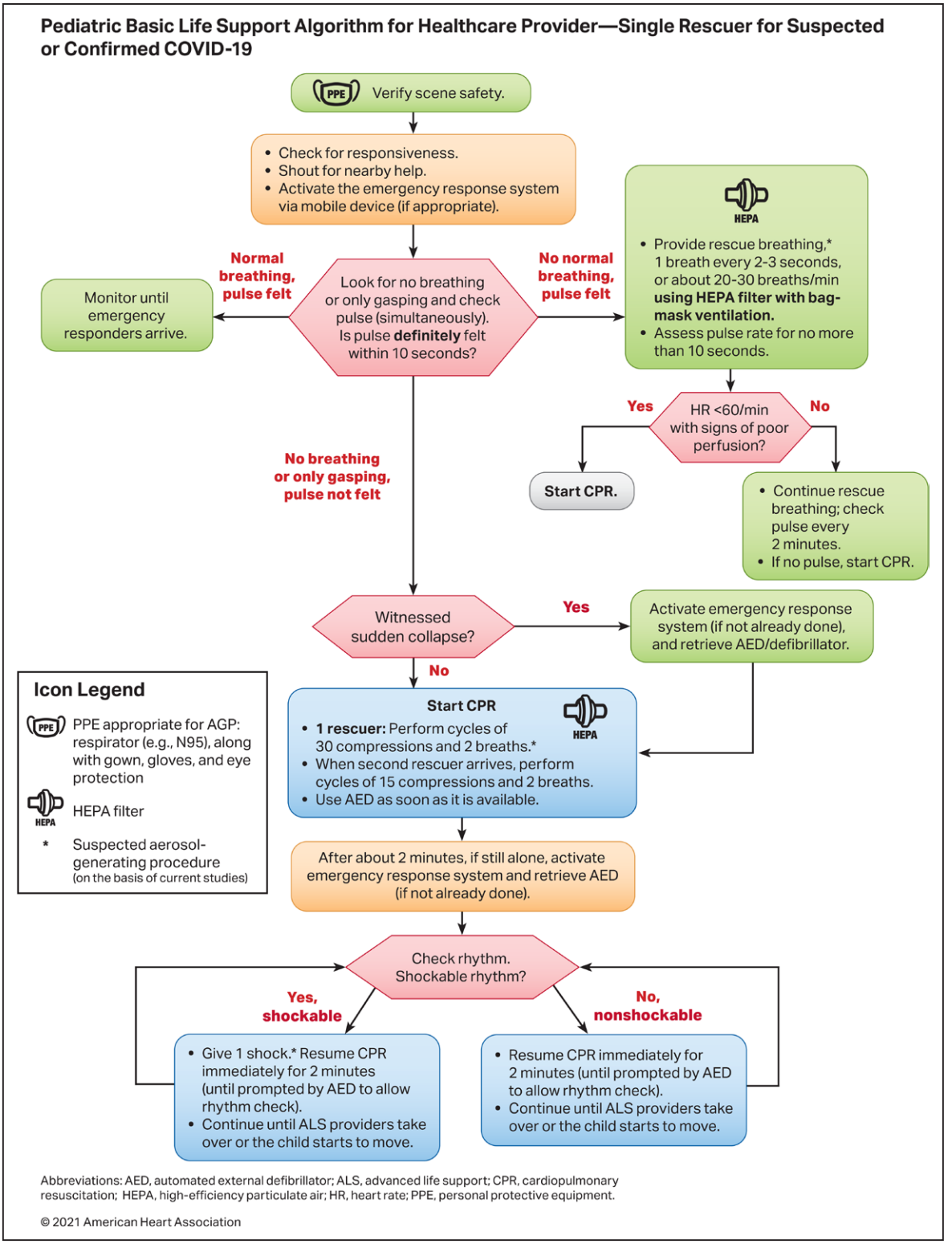

Figure 6. Pediatric basic life support algorithm for health care provider–single rescuer for suspected or confirmed COVID-19. AED indicates automated external defibrillator; ALS, advanced life support; CPR, cardiopulmonary resuscitation; HEPA, high-efficiency particulate air; HR, heart rate; and PPE, personal protective equipment.

- Secure placement of a supraglottic airway with HEPA filters can help maximize chest compression fraction and control aerosol generation before endotracheal intubation.
- Before intubation, ventilate with a bag-mask-HEPA filter and a tight seal using practiced 2-person technique, ideally. The second team member can help provide extra support for additional

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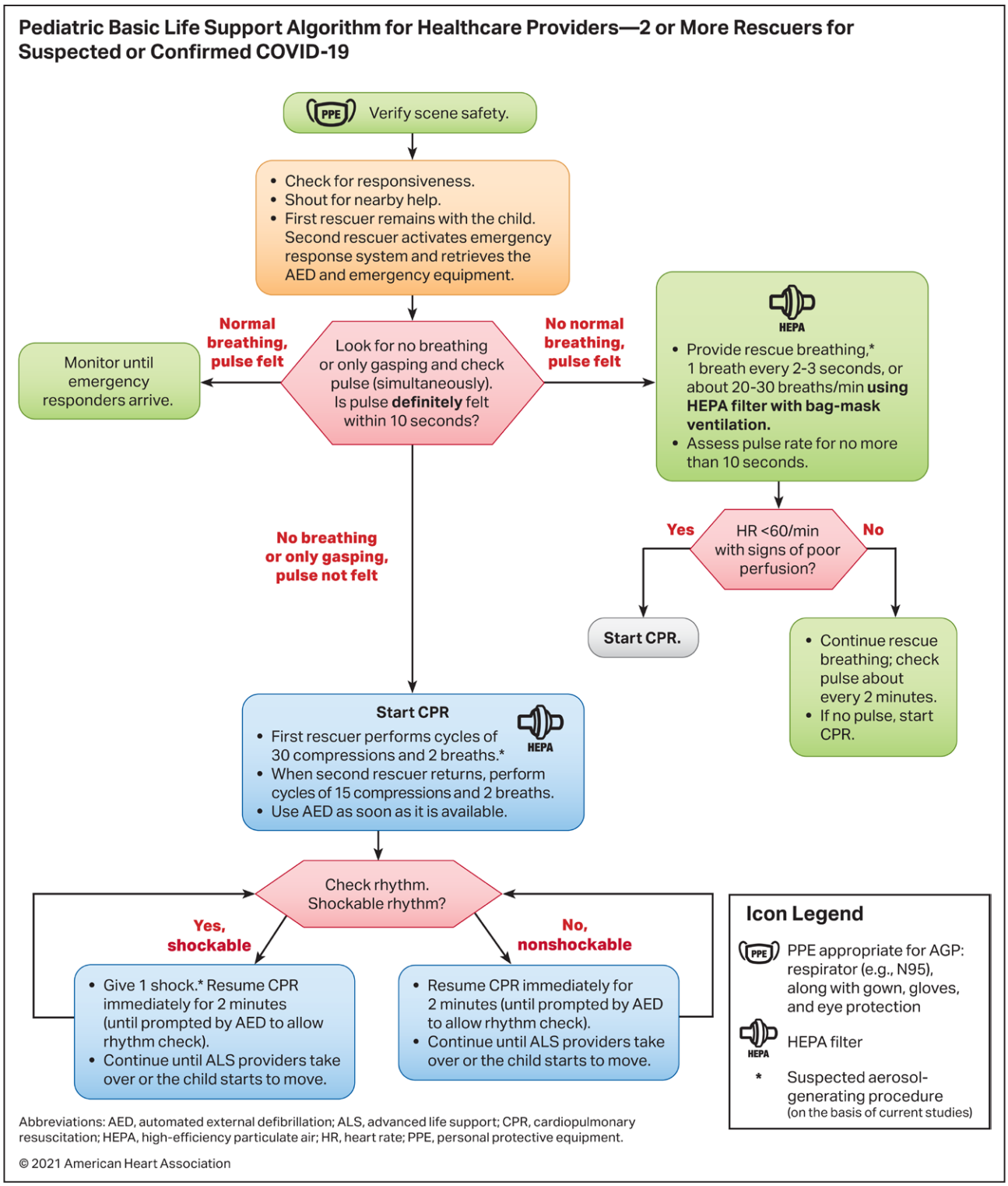

Figure 7. Pediatric basic life support algorithm for health care providers–2 or more rescuers for suspected or confirmed COVID-19. AED indicates automated external defibrillator; ALS, advanced life support; CPR, cardiopulmonary resuscitation; HEPA, high-efficiency particulate air; HR, heart rate; and PPE, personal protective equipment.

procedures such as compressions once the airway is established.

- Assign the intubator with the highest chance of first pass success using the method the intubator is most comfortable with while protected with appropriate PPE for AGPs. Intubate with a cuffed endotracheal tube to minimize aerosolization of respiratory particles.
- Consider use of video laryngoscopy if available and if the operator is experienced with this

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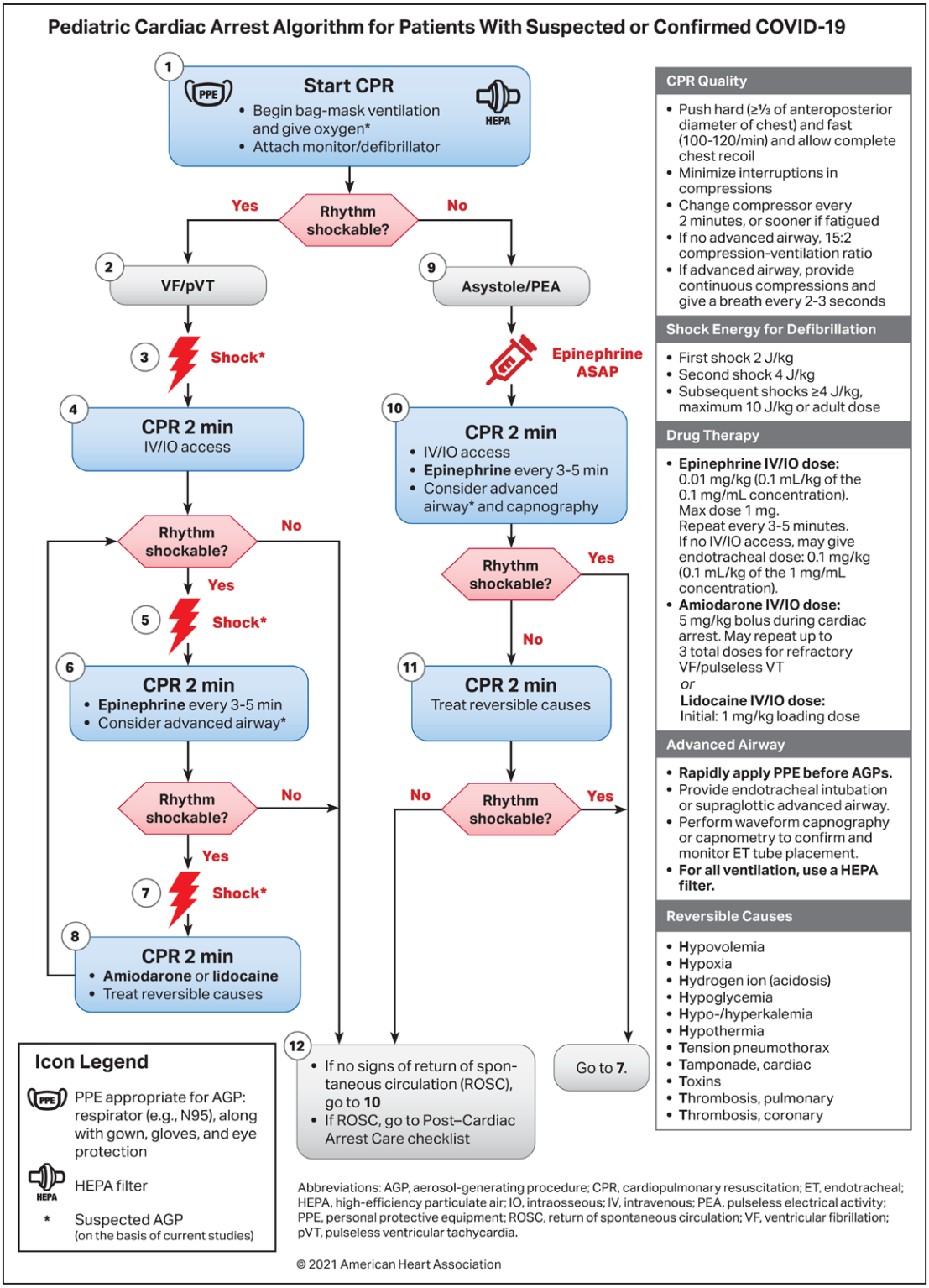

Figure 8. Pediatric cardiac arrest algorithm for patients with suspected or confirmed COVID-19.
AGP, aerosol-generating procedures; CPR, cardiopulmonary resuscitation; ET, endotracheal; HEPA, high-efficiency particulate air; IO, intraosseous; IV, intravenous; PEA, pulseless electrical activity; PPE, personal protective equipment; ROSC, return of spontaneous circulation; VF, ventricular fibrillation; and pVT, pulseless ventricular tachycardia.

technique as this may reduce direct exposure of the intubator to respiratory aerosols. Currently, there is no evidence of a difference in transmission risk using video versus direct laryngoscopy in the setting of providers wearing appropriate PPE for AGPs.

- As in any resuscitation, maximize the chest compression fraction, pausing only to facilitate

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intubation if needed. Minimizing noncompression time can require team-based instruction including pulse checks, advanced airway placement, and focused ultrasound evaluation coordinated with pulse checks and other necessary interruptions.
- Avoid endotracheal administration of medications; disconnections may be a source of aerosolization due to unfiltered exhalation.

Prearrest

Closely monitor for signs and symptoms of clinical deterioration to minimize the need for emergency intubations which put patients and providers at higher risk.
- Address advanced care directives and goals of care with all patients with suspected or confirmed COVID-19 (or proxy) on hospital arrival and with any subsequent significant change in clinical status.
- If the patient is at risk for cardiac arrest, consider proactively moving the patient to a negative-pressure room/unit, if available, to minimize risk of exposure to rescuers during a resuscitation.
- Close the door, when possible, to prevent airborne contamination of adjacent indoor space. Conversely, for out-of-hospital cardiac arrests, ventilating confined spaces by opening windows or doors may help disperse aerosolized particles if this does not risk exposure of others in the vicinity and not already in an outdoor setting.

Out-of-Hospital Cardiac Arrest

Guidance regarding Emergency Medical Services and lay rescuer is described in detail in other literature.[39,40]

In-Hospital Cardiac Arrest

Crowd control for effective direction of resuscitation by the minimum number of persons required is advised. Closing the door to the resuscitation area, when possible, may minimize airborne contamination of adjacent indoor space. Health care personnel should continue to wear appropriate PPE for clinical care including masks, eye protection, and gloves as recommended by the CDC and World Health Organization.[4,41] All persons not wearing appropriate PPE should be immediately excused from the room or area.

Patients Who Are Intubated Before Arrest

Consider leaving the patient on a mechanical ventilator with a HEPA filter to maintain a closed circuit and to reduce aerosolization and adjust the ventilator settings to allow asynchronous ventilation with the following suggestions:
- Increase the FiO2 to 1.0.
- Use either pressure or volume control ventilation and limit pressure or tidal volume to generate adequate chest rise (4–6 mL/kg ideal body weight is often targeted for adults and neonates, 5–8 mL/kg for children).
- Adjust the trigger settings to prevent the ventilator from auto triggering with chest compressions and possibly prevent hyperventilation and air trapping.
- Adjust respiratory rate to 10 breaths/min for adults, 20 to 30 breaths/min for infants and children, and 30 breaths/min for neonates.
- Assess the need to adjust the positive end-expiratory pressure level to balance lung volumes and venous return.
- Adjust ventilator settings to deliver full breaths with asynchronous chest compressions.
- Ensure endotracheal tube/tracheostomy and ventilator circuit continuity to prevent unplanned airway dislodgement or tubing disconnections.

If return of spontaneous circulation is achieved, set ventilator settings as appropriate to the patients' clinical condition and treat the underlying cause of cardiac arrest.

Patients Who Are in Prone Position at the Time of Arrest

Anticipation and preparation are important in rotating patients to a supine position. The very limited evidence for providing CPR in the prone position suggests it may be better than not providing CPR.[23,42] For patients in the prone position with an advanced airway, it may be reasonable to provide manual compressions in the prone position until a patient can be safely transitioned to a supine position with a trained team. If deemed necessary for optimal clinical care, such as assessing endotracheal tube patency and positioning, the following steps for transitioning a patient to a supine position are suggested:
- Provide compressions with hands centered over the T7-T10 vertebral bodies.
- Arrange for sufficient, trained, PPE-protected personnel to achieve safe supination on the first attempt.
- If already intubated, ensure ventilation and vascular tubing continuity and apply the posterior defibrillator pad to the patient's back before rotating.
- Immediately resume CPR supine once the patient has been rotated. Confirm tubing and access lines have not been dislodged and are in working order.

Additional discussion of CPR in the prone position is available in the AHA 2020 Guidelines.[23]

Postarrest Patients

Health care providers wearing appropriate PPE should continue to provide post cardiac arrest care per the 2020 AHA guidelines for CPR and ECC.[23,43]

Appropriateness of Starting and Continuing Resuscitation

Address and follow the patient's goals of care and commit to ethical and evidence-based organizational policies to guide the determination of initiation and continuing resuscitative efforts. Follow the 2020 AHA guidelines

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for cardiopulmonary resuscitation and emergency cardiovascular care for termination of resuscitation.[23]

Unsuccessful Resuscitations With Suspected and Confirmed COVID-19

Inquire with the infection control officer or medical examiner if further postmortem testing is required for epidemiological or contact tracing purposes.[44]

MATERNAL AND NEONATAL CONSIDERATIONS

Neonatal Resuscitation

Every newborn baby should have a skilled attendant prepared to resuscitate regardless of COVID-19 status. The newborn baby is unlikely to be a source of COVID-19 transmission even when mothers have confirmed COVID-19, but maternal respiratory secretions and fluids may be a potential source of SARS-COV-2 transmission for the neonatal team and newborn.[45] When appropriate, mothers can be encouraged to wear a surgical mask during the delivery. For suspected or confirmed COVID-19 infected mothers, health care providers should don appropriate PPE for AGPs to decrease the risk of transmission to themselves and the baby.

- Initial steps: Routine neonatal care and the initial steps of neonatal resuscitation are unlikely to be aerosol generating; they include drying, tactile stimulation, placement into a plastic bag or wrap, assessment of heart rate, and placement of pulse oximetry and electrocardiographic leads.
- Suction: Suction of the airway after delivery should not be performed routinely for clear or meconium-stained amniotic fluid. Suctioning is an AGP and is not indicated for uncomplicated deliveries, regardless of COVID-19 status.
- Endotracheal medications: Endotracheal instillation of medications such as surfactant or epinephrine is an AGP, especially via an uncuffed tube. Intravenous delivery of epinephrine via a low-lying umbilical venous catheter is the preferred route of administration during neonatal resuscitation, regardless of COVID-19 status.
- Positive pressure ventilation remains the main resuscitation strategy for newborns for apnea, ineffective breathing (gasping), and bradycardia. Chest compressions occur later in the resuscitation algorithm.
- Delayed cord clamping and skin-to-skin contact may be practiced in the setting of a suspected or confirmed COVID-19 positive mother in stable neonates provided the mother is appropriately masked.
- Until confirmed to be COVID-19 negative, suspected or confirmed COVID-19 positive mothers should practice hand and breast hygiene and wear a mask during care and feeding.
- Closed incubators: Closed incubator transfer and care (with appropriate distancing) should be used for neonatal intensive care patients when possible but incubators do not protect against aerosolized particles.

Maternal Cardiac Arrest

Symptomatic pregnant patients with COVID-19 are at increased risk of more severe illness compared with nonpregnant peers. Although the absolute risk for severe COVID-19 is low, data indicate an increased risk of ICU admission, need for mechanical ventilation and ventilatory support, and death in pregnant women with symptomatic COVID-19 infection.[46]

- If return of spontaneous circulation is not achieved, complete perimortem cesarean delivery ideally within 5 minutes after time of arrest. We recommend calling multidisciplinary team members early in the resuscitation process for maternal cardiac arrest to allow time for PPE donning before they enter the resuscitation area.
- Oxygenation with intubation should be prioritized earlier in pregnant women with symptomatic COVID-19 who suffer cardiac arrest. Provide chest compressions with concurrent left lateral uterine displacement when the uterine fundus is at the level of the umbilicus or greater.

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