Highlights of the 2025 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

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Introduction

These Highlights summarize the key issues and changes in the *2025 AHA Guidelines for Cardiopulmonary Resuscitation* (CPR) *and Emergency Cardiovascular Care* (ECC).[1] The 2025 Guidelines are a comprehensive revision of the AHA's guidelines for adult, pediatric, and neonatal life support; resuscitation education science; systems of care; and resuscitation ethics topics. They have been developed for resuscitation professionals and AHA instructors to focus on the resuscitation science and guidelines recommendations that are most significant or controversial or those that will result in changes in resuscitation training and practice. The rationale to support each of these recommendations is provided.

Because this publication is a summary, it does not reference the supporting published studies and does not list Classes of Recommendation or Levels of Evidence. For more detailed information and references, please read the 2025 Guidelines, including the Executive Summary, published in *Circulation* in October 2025, and the detailed summary of resuscitation science developed by the International Liaison Committee on Resuscitation (ILCOR) in the *2025 ILCOR Consensus on Science With Treatment Recommendations*,[2] published simultaneously in *Circulation* and *Resuscitation* in October 2025. The methods used by ILCOR to perform evidence evaluation and by the AHA to translate these evidence evaluations, as well as to evaluate topics not considered by ILCOR, into resuscitation guidelines have been published in detail.

The 2025 Guidelines use the most recent version of the AHA definitions for each Class of Recommendation and Level of Evidence (Figure 1). Overall, 760 specific recommendations are made for adult, pediatric, and neonatal life support; resuscitation education science; and systems of care. Of these recommendations, 233 are Class 1 recommendations and 451 are Class 2 recommendations (Figure 2). Additionally, 76 recommendations are Class 3, including 55 for evidence of no benefit and 21 for evidence of harm.

1. Del Rios M, Bartos JA, Panchal AR, et al. Part 1: executive summary: 2025 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation.* 2025;152(suppl 2):In press.
2. International Liaison Committee on Resuscitation. 2025 ILCOR Consensus on Science With Treatment Recommendations. *Circulation.* 2025;152(suppl 1):In press.

Figure 1. Applying the ACC/AHA Class of Recommendation and Level of Evidence to Clinical Strategies, Interventions, Treatments, or Diagnostic Testing in Patient Care* (Updated December 2024).

CLASS (STRENGTH) OF RECOMMENDATION

CLASS 1 (STRONG) — **Benefit >>> Risk**

Suggested phrases for writing recommendations:
- Is recommended
- Is indicated/useful/effective/beneficial
- Should be performed/administered/other
- Comparative-Effectiveness Phrases†:
  - Treatment/strategy A is recommended/indicated in preference to treatment B
  - Treatment A should be chosen over treatment B

CLASS 2a (MODERATE) — **Benefit >> Risk**

Suggested phrases for writing recommendations:
- Is reasonable
- Can be useful/effective/beneficial
- Comparative-Effectiveness Phrases†:
  - Treatment/strategy A is probably recommended/indicated in preference to treatment B
  - It is reasonable to choose treatment A over treatment B

CLASS 2b (WEAK) — **Benefit ≥ Risk**

Suggested phrases for writing recommendations:
- May/might be reasonable
- May/might be considered
- Usefulness/effectiveness is unknown/unclear/uncertain or not well-established

CLASS 3: No Benefit (MODERATE) — **Benefit = Risk**
(Generally, LOE A or B use only)

Suggested phrases for writing recommendations:
- Is not recommended
- Is not indicated/useful/effective/beneficial
- Should not be performed/administered/other

CLASS 3: Harm (STRONG) — **Risk > Benefit**

Suggested phrases for writing recommendations:
- Potentially harmful
- Causes harm
- Associated with excess morbidity/mortality
- Should not be performed/administered/other

LEVEL (QUALITY) OF EVIDENCE‡

LEVEL A
- High-quality evidence‡ from more than 1 RCT
- Meta-analyses of high-quality RCTs
- One or more RCTs corroborated by high-quality registry studies

LEVEL B-R (Randomized)
- Moderate-quality evidence‡ from 1 or more RCTs
- Meta-analyses of moderate-quality RCTs

LEVEL B-NR (Nonrandomized)
- Moderate-quality evidence‡ from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies
- Meta-analyses of such studies

LEVEL C-LD (Limited Data)
- Randomized or nonrandomized observational or registry studies with limitations of design or execution
- Meta-analyses of such studies
- Physiological or mechanistic studies in human subjects

LEVEL C-EO (Expert Opinion)
- Consensus of expert opinion based on clinical experience

COR and LOE are determined independently (any COR may be paired with any LOE).

A recommendation with LOE C does not imply that the recommendation is weak. Many important clinical questions addressed in guidelines do not lend themselves to clinical trials. Although RCTs are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

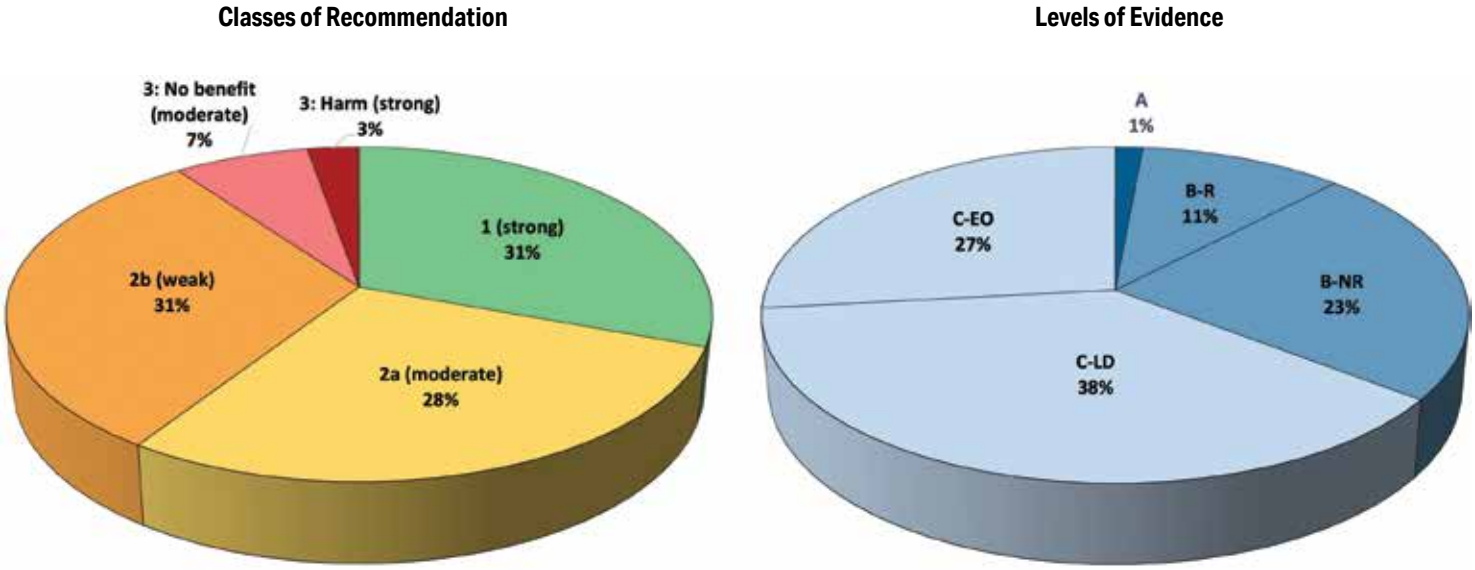
* The outcome or result of the intervention should be specified (an improved clinical outcome or increased diagnostic accuracy or incremental prognostic information).

† For comparative-effectiveness recommendations (COR 1 and 2a; LOE A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

‡ The method of assessing quality is evolving, including the application of standardized, widely used, and preferably validated evidence grading tools; and for systematic reviews, the incorporation of an Evidence Review Committee.

COR indicates Class of Recommendation; EO, expert opinion; LD, limited data; LOE, Level of Evidence; NR, nonrandomized; R, randomized; and RCT, randomized controlled trial.

Figure 2. Distribution of COR and LOE as percent of 760 total recommendations in the *2025 AHA Guidelines for CPR and ECC*.*



Abbreviations: EO, expert opinion; LD, limited data; NR, nonrandomized; R, randomized.

*Results are percent of 760 recommendations in the areas of adult basic and advanced life support (ALS), pediatric basic and advanced life support, neonatal life support, post–cardiac arrest care, resuscitation education science, special circumstances, and systems of care.

About the Recommendations

The fact that only 11 (1.4%) of these 760 recommendations are based on Level A evidence (at least 1 high-quality randomized clinical trial [RCT], corroborated by a second high-quality trial or registry study) testifies to the ongoing challenges in performing high-quality resuscitation research. A concerted national and international effort is needed to fund and otherwise support resuscitation research.

Both the ILCOR evidence-evaluation process and the AHA guidelines-development process are governed by strict disclosure policies designed to make relationships with industry and other conflicts of interest fully transparent and to protect these processes from undue influence. The AHA staff processed conflict-of-interest disclosures from all participants. All guidelines writing group chairs and at least 50% of guidelines writing group members were required to be free of all conflicts of interest, and all relevant relationships are disclosed in the respective guidelines publications.

Ethics

Summary of Key Issues and Major Changes

CPR and ECC are prevalent in high-stakes, unplanned situations. Health care professionals and organizations face challenging decisions at both individual and system levels. This chapter provides an overview of ethical frameworks that identify the obligations shared by health care professionals and organizations and offer frameworks through which difficult decisions can be analyzed. Previous Guidelines focused on ethical treatment recommendations (for example, recommending specific diagnostic tests to guide prognostication after cardiac arrest) but did not provide detailed discussion of the underlying ethical principles or considerations. The 2025 Guidelines chapter on ethics

- Provides narrative discussion focused specifically on ethics, with sufficient depth to allow readers to navigate the issues most encountered in this domain
- Multiple ethical frameworks, a preponderance of scholarship and expert consensus in this writing group support the imperative that HCPs and their organizations should actively address inequities in social determinants of health, thereby eliminating resulting disparities in cardiac arrest and emergency cardiovascular care.
- Reviews the many complexities in resuscitation, including the inability of the patient to participate in decisions and the challenges across the age continuum from newborns to geriatric patients, and considers the long-term effects of CPR on patients, families, and health care professionals alike

The writing group performed a comprehensive series of structured literature reviews. All content in this chapter is new compared with the content in previous Guidelines, although the underlying ethical considerations are largely consistent with those that informed previous Guidelines.

Foundational Ethical Principles

Principlism is the predominant medical ethical framework. It is a deliberative process centered on 4 coequal moral principles: beneficence, nonmaleficence, respect for autonomy, and justice. Ethical questions can be evaluated through the lens of each principle, offering perspectives that can be synthesized into a pluralistic approach. Beneficence guides decisions that benefit patients. Nonmaleficence is the ethical obligation to not harm patients. Respect for autonomy focuses on honoring individuals' rights to make informed decisions about their own care. Justice is fairness, specifically the fair, equitable, and appropriate treatment of people.

Other ethical principles and frameworks are also relevant, including narrative ethics, crisis standards of care, virtue ethics, and dignity. These offer complementary perspectives; often, a combination of frameworks and principles can best address an ethical conflict.

Striving for Equitable Health and Resuscitation

The AHA's goal of improving cardiovascular health for all cannot be fully realized until inequities that drive health care outcome disparities are eliminated. Health inequities arise from social determinants of health and are both entirely preventable and deeply rooted in societal structures. Failing to acknowledge and address these disparities allows systemic inequities to remain unchallenged and healthcare disparities to persist. For this reason, HCPs and their organizations should actively address structural inequities in social determinants of health, thereby eliminating resulting disparities in cardiac arrest and emergency cardiovascular care.

Ethical Decision-Making in Resuscitation

The need to make decisions to initiate or withhold resuscitative efforts, and whether to continue or terminate these therapies after initiation, is common. The default approach in many settings is to initiate treatment. It is critical to document an advanced care plan if a patient wishes to forgo these interventions in case of an emergency. Portable orders for life-sustaining treatment are the best manner in which to do this. When patients' wishes are not documented and they are unable to make independent decisions, surrogates do so on their behalf, using substituted judgement.

Shared decision-making is preferred when choosing from more than one medically reasonable option. This requires that (1) health care professionals ensure that a patient and/or surrogate understands the current medical condition of the patient; (2) health care professionals outline the available medical options; (3) health care professionals elicit the patient's goals, values, and preferences; (4) health care professionals make a recommendation aligned with the patient's goals and values; (5) health care professionals support the patient and/or surrogate in their choice.

For adults in cardiac arrest, the default approach is to initiate CPR, except when this would pose a serious risk of physical harm to the health care professional, there are objective signs of irreversible death, or there is an advanced directive declining treatment. Accepting verbal requests from family to withhold CPR or informed nondissent is ethical under some circumstances. After initiation, predefined termination of resuscitation rules can minimize medically ineffective treatment and promote distributive justice. Pediatric and neonatal patients present unique ethical challenges for health care professionals. Detailed consideration of pediatric and neonatal patients can

be found in the respective guidelines chapters.

In some circumstances, one or more treatments may be of no realistic benefit to a given patient. Health care professionals are not ethically obligated to provide these treatments even when requested by surrogates. This determination is challenging, can be subjective, and may result in conflict. To minimize the chance that an individual health care professional's perspectives and biases influence determinations of benefit and to protect health care professionals from moral distress, whenever possible these determinations should rely on an institutional committee or ethics consultant and be made in accordance with institutional policies.

Other Ethical Topics

Resuscitation research poses unique challenges. In resuscitation scenarios, patients with life-threatening emergencies often lack capacity, there are narrow therapeutic windows for intervention, and emotional reactions of surrogates preclude usual informed consent. Ethical pathways for research in these settings include exception from informed consent, waiver of informed consent, and prospective informed consent. Institutional review boards, not investigators, determine the appropriate regulatory pathways. It is unethical to bypass these requirements for activities meeting recognized definitions of clinical research.

ECC can have a lasting effect on health care professionals' physical and mental well-being. The AHA believes that health care professionals who perform resuscitation efforts must be protected from physical harm. Health care professionals also have duties in their professional capacities to provide treatment. Evidence-based recommendations cannot fully address every clinical scenario or circumstance. When interpreting guidance in context, health care professionals should be mindful of their potential biases, be deliberate in their approach to decision-making, and apply a systematic approach to weighing the available evidence. Moral distress can occur when someone is providing CPR, particularly when health care professionals perceive attempts at CPR to be inappropriate. Organizations should provide policies and guidance for resuscitation and help health care professionals resolve disputes and address moral distress. Managing these complex situations should not fall on the individual alone.

Patients who survive CPR often experience lasting symptoms. Health care organizations have a responsibility to develop systems of care to optimize these patients' long-term health and well-being. Cardiac arrest can also have lasting impacts on laypersons. Although the primary duty of health care professionals is to the patient, ethical obligations extend to supporting families, caregivers, and others who surround the patient. For families, presence during CPR can reduce complicated grief and improve psychological outcomes. Institutions should develop policies that define circumstances or considerations that could preclude family presence and should ensure adequate resources and training to support the practice.

Crisis standards of care amend the standard of medical care in response to a disaster event. Crisis standards do not change or diminish health care professionals' duty to patients, whose legal and ethical responsibilities are to take the same action that a reasonable health care professional would take under similar circumstances. Ethical norms of utilitarianism and fairness inform the design and implementation of crisis standards, which strive to provide a just distribution of resources and promote equitable health outcomes.

Extracorporeal CPR (ECPR) is a specific example of an advanced therapy that can be used to treat highly selected patients. Relevant ethical issues include limited data to guide patient selection, difficulty obtaining informed consent, high cost and resource utilization with associated questions of equitable distribution, and the role of these therapies in the possible transition from unsuccessful resuscitation to possible organ donation or withdrawal of life-sustaining therapies.

Organ and tissue donation should be considered in all postarrest patients who progress to death by neurological criteria or for whom withdrawal of life-sustaining therapies is planned. Decisions about end-of-life care should be made for the patient's benefit before, and independently of, offering the option of organ donation to the patient or surrogate. Institutions should develop processes to promote public trust and avoid conflicts of interest.

Systems of Care

Survival after cardiac arrest requires integrated systems of people, protocols, policies, and resources along with ongoing data acquisition and review. The systems of care guidelines follow the unified cardiac arrest Chain of Survival (Figure 3), beginning with prevention and preparedness to resuscitate, then proceeding with early identification of cardiac arrest, then effective resuscitation through to post–cardiac arrest care, survivorship, and recovery. Optimizing outcomes after cardiac arrest requires well-functioning systems of care both in- and out-of-hospital as well as a commitment to gather and analyze data aimed at quality improvement in every link of the Chain of Survival.

Summary of Key Issues and Major Changes

- A single Chain of Survival is intended to apply to adult and pediatric in-hospital cardiac arrest (IHCA) and out-of-hospital cardiac arrest (OHCA). In creating this singular chain, it is acknowledged that before cardiac arrest, prevention and preparedness can both avoid the need for and optimize resuscitation.
- Several recommendations have been consolidated into a knowledge chunk devoted to community initiatives to improve lay rescuer response to OHCA. Herein, the reader will find recommendations on system-based approaches intended to increase community awareness of cardiac arrest and the crucial role of lay rescuer CPR and automated external defibrillator use.
- Recommendations for pediatrics and adults on the use of early warning systems and rapid response or medical emergency teams to prevent IHCA have been combined, with an additional recommendation about the use of safety huddles to prevent IHCA.
- Policies to facilitate public access to naloxone are now recommended alongside public access to defibrillation because both have the potential to save lives.
- Telecommunicators are now provided with differing recommendations for adult and child CPR instructions; they are to guide lay rescuers to use Hands-Only CPR for adults and conventional CPR, including breaths, for children. The No-No-Go framework is reiterated as an effective method for recognizing OHCA.
- Clinical debriefing recommendations are reiterated, with a new recommendation on incorporation of immediate (hot) and delayed (cold) debriefing following CPR events.
- New recommendations are provided on in- and out-of-hospital resuscitation team composition.
- Uncertainty remains on the timing of transport of patients with ongoing resuscitation and following return of spontaneous circulation (ROSC). This is addressed in several knowledge chunks that cover on-scene resuscitation (versus transport with ongoing CPR), transport for ECPR, and interfacility transfer to cardiac arrest centers. The latter knowledge chunks attempt to address important system considerations within cardiac arrest centers and ECPR centers.
- New recommendations on creating a system of care to assure optimal postresuscitation recovery for cardiac arrest survivors are provided.

Major New and Updated Recommendations

Prevention of IHCA

2025 (New): Implementation of safety huddles to improve situational awareness in scenarios involving high-risk hospitalized patients and mitigate their deterioration can be effective in reducing cardiac arrest rates.

Why: Two multicenter, observational quality-improvement projects implementing a cardiac arrest bundle that includes safety huddles around high-risk patients reduced IHCA within the pediatric cardiac and general intensive care units.

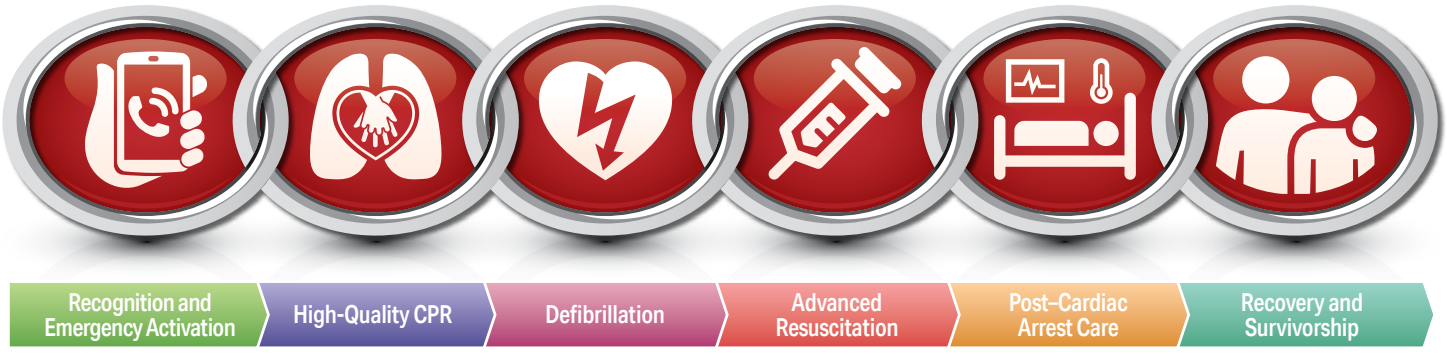
Public Access to Naloxone

2025 (New): Public policies should allow for possession, use, and immunity from civil and criminal liability for good-faith administration of naloxone by lay rescuers.

2025 (New): Naloxone distribution programs can be beneficial to increase naloxone availability among lay rescuers and decrease mortality from opioid-related overdose.

Why: Observational studies that examined the impact of legislation that makes naloxone more readily available and protects lay rescuers from prosecution for possession or good-faith use,

Figure 3. Cardiac arrest Chain of Survival.



as well as programs aimed at distributing naloxone within communities, are generally associated with reductions in mortality.

Community Initiatives to Improve Lay Rescuer Response to OHCA

2025 (Updated): Implementing a bundle of community initiatives is a reasonable strategy to improve lay rescuer response to OHCA.

2025 (New): Increasing the availability of instructor-led training in communities can be effective to improve lay rescuer response to OHCA.

2025 (New): Mass media campaigns may be considered to promote learning of CPR skills in all populations.

2025 (New): It may be reasonable for communities to implement policies that require CPR certification in the general public.

Why: Improving lay rescuer response requires a multifaceted approach, and existing evidence supports numerous interventions as being effective.

Clinical Debriefing

2025 (New): Incorporating immediate and delayed debriefing is reasonable and may identify different opportunities for system improvement.

Why: Studies examining debriefing use immediate and delayed methods, although neither has been proved to be superior and the use of both may offer advantages.

OHCA Team Composition

2025 (New): It can be beneficial to have an advanced life support (ALS)–level clinician present during the resuscitation of a person with suspected OHCA.

2025 (New): It is reasonable to ensure that emergency medical services (EMS) systems have a team size sufficient to achieve discretely assigned roles within the team.

Why: Studies demonstrate that optimizing OHCA resuscitation requires a sufficient team size to execute vital roles and sufficient training to provide advanced management.

In-Hospital Code Team Composition

2025 (New): In-hospital code teams should comprise members with ALS training.

2025 (New): Designated or dedicated code teams with clearly defined roles, diverse expertise, and adequate training that incorporates simulation can be beneficial in improving patient outcomes following IHCA.

Why: Akin to OHCA teams, IHCA code teams benefit from advanced training and defined roles with simulation-based training to support team members in those roles.

On-Scene OHCA Resuscitation

2025 (New): EMS systems should be prepared to perform termination of resuscitation on scene; this involves EMS professionals receiving training on death notification.

2025 (New): Prioritizing on-scene resuscitation focused on achieving sustained ROSC before initiation of transport for most adults and children experiencing OHCA can be beneficial in the absence of special circumstances.

Why: Remaining on-scene for the entire resuscitation will inevitably result in many deaths, so training on when to terminate efforts and how to provide notification to family is crucial to providing compassionate care and avoiding burnout. Attempting to transport patients to the hospital while CPR is ongoing compromises CPR quality and can risk the safety of rescuers and should be reserved for situations where it is believed to significantly improve the patient's odds of survival.

Extracorporeal Systems of Care

2025 (New): It is reasonable that centers with ECPR programs develop and frequently reassess patient selection criteria to maximize cardiac arrest survival, ensure equitable access, and limit futility.

2025 (New): It is reasonable that clinicians performing adult peripheral ECPR cannulation be experienced in percutaneous technique.

2025 (New): A regionalized approach to ECPR is reasonable to optimize outcomes and resource utilization.

2025 (New): Rapid intra-arrest transport for ECPR may be considered for limited, highly selected adult OHCA patients.

Why: ECPR is resource intensive and requires specialized, highly trained teams. These factors make regionalization attractive, but the requirement for intra-arrest transport in the setting of OHCA and the resource intensity require careful patient selection.

Organ Donation

2025 (New): Institutions should develop systems of care focused on facilitating and evaluating organ donation after cardiac arrest consistent with local legal and regulatory requirements.

Why: Policies aimed at increasing organ donation vary internationally and are closely linked to the values and culture of the nation where they are implemented.

Improving Cardiac Arrest Recovery

2025 (New): The recovery and long-term functional outcomes of cardiac arrest survivors are likely to benefit from the use of integrated systems that assess patients before discharge, reassess their needs after discharge, and address these needs on an ongoing basis during recovery.

Why: Rehabilitation of cardiac arrest survivors can improve long-term out-

comes, but implementation requires coordination of a multidisciplinary team that spans providers both in- and out-of-hospital.

Neonatal Life Support

There are about 4 million births in the United States and Canada each year. One of every 10 to 20 newborn infants will need help transitioning from the fluid-filled environment of the womb to the air-filled room. It is essential that every newborn infant requiring this care has a health care professional who is trained and equipped for the role dedicated to facilitating that transition.

Summary of Key Issues and Major Changes

- The newborn chain of care starts with prenatal care and extends to recovery and appropriate follow-up in the postnatal period.
- Newborn resuscitation requires anticipation and preparation by health care professionals who train individually and as teams.
- Most newborn infants can be evaluated and monitored during deferred cord clamping for 60 seconds or more and can maintain skin-to-skin contact with a parent after birth.
- Effective ventilation of the lungs is the priority in newborn infants who need resuscitation.
- Some new recommendations, such as positioning for chest compression, timing of pulse oximeter placement, and ventilation corrective steps, are practices that may already be commonly performed but have been added with review of the latest evidence.
- Ventilation corrective steps, which include use of an alternative airway like a laryngeal mask or endotracheal tube, may be required if the heart rate does not rise with face-mask ventilation.

Algorithms and Visual Aids

The Neonatal Resuscitation Algorithm (Figure 4) has been updated to emphasize the importance of umbilical cord management at birth. The target oxygen saturation table starts at 2 minutes because deferred cord clamping for 60 seconds or more means that oxygen saturation at 1 minute will not routinely be obtained. Electrocardiography is recommended before chest compressions.

Newborn outcomes are affected by the overall context in which neonatal resuscitation occurs, including the systems of care before, during, and after birth. The newborn chain of care (Figure 5) provides a framework for addressing essential elements of the health care system to enhance newborn health.

Major New and Updated Recommendations

Umbilical Cord Management

2025 (Updated): For term newborn infants who do not require immediate resuscitation, deferred cord clamping for at least 60 seconds can be beneficial when compared with immediate cord clamping.

Why: Meta-analyses have shown that hematologic indices and iron status in infancy are improved with deferred cord clamping. Recent studies that extend deferral to 60 seconds compared with early cord clamping have affirmed these findings.

2025 (New): For nonvigorous term newborn infants and late preterm infants 35 weeks or more gestational age, intact cord milking may be reasonable when compared with immediate cord clamping.

Why: A large RCT of nonvigorous infants 35 to 42 weeks gestation reported that intact umbilical cord milking compared with early cord clamping was associated with decreases in rates of cardiorespiratory support, moderate to severe hypoxic ischemic encephalopathy, and use of therapeutic hypothermia.

2025 (Updated): For newborn infants born at less than 37 weeks of gestation who do not require immediate resuscitation, deferred cord clamping for at least 60 seconds is recommended when compared with immediate cord clamping.

Why: Meta-analyses have shown that preterm newborn infants who received deferred cord clamping for 60 seconds or more compared with immediate cord clamping had reduction in mortality compared with those who had immediate cord clamping.

Ventilation and Continuous Positive Airway Pressure

2025 (Updated): For newborn infants, initial peak inflation pressures of 20 to 30 cm H_2O are reasonable, with adjustment of peak inflation pressures to provide effective ventilation.

Why: Observational studies in preterm and term newborn infants have reported peak inflation pressures up to 30 cm H_2O or more, corresponding to tidal volumes that are considered adequate for newborn ventilation. Pressures can be adjusted as effective ventilation is achieved.

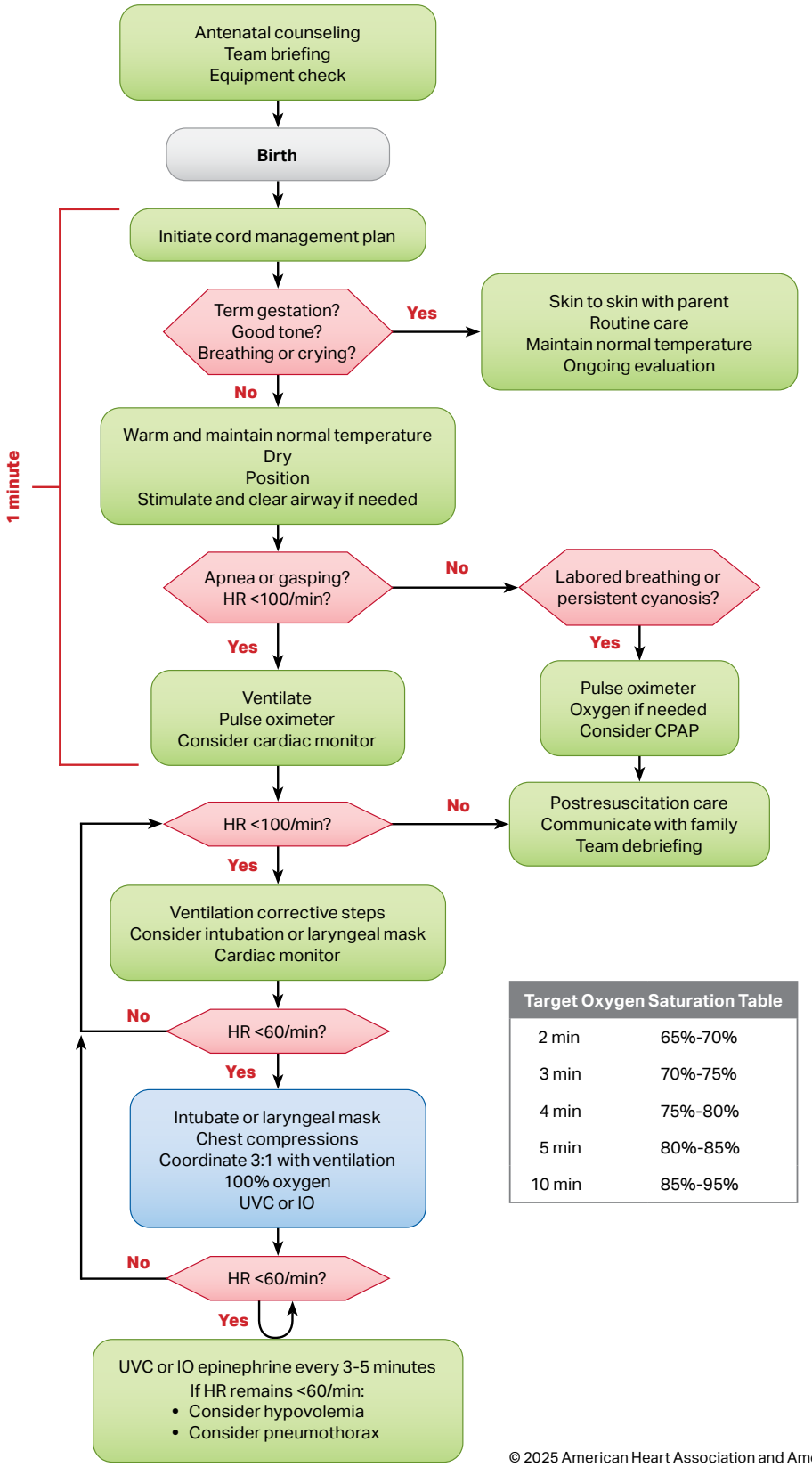
2025 (Updated): It is reasonable to provide ventilation at a rate of 30 to 60/min in newborn infants.

Why: An observational study reported that ventilation at a rate of 30 to 60/min resulted in delivered tidal volumes between 5 mL/kg and 10 mL/kg. An observational study of late preterm and term newborns reported that an inflation rate of 30/min was associated with the highest carbon dioxide clearance.

2025 (New): Video laryngoscopy can be useful for newborn infants who require endotracheal intubation.

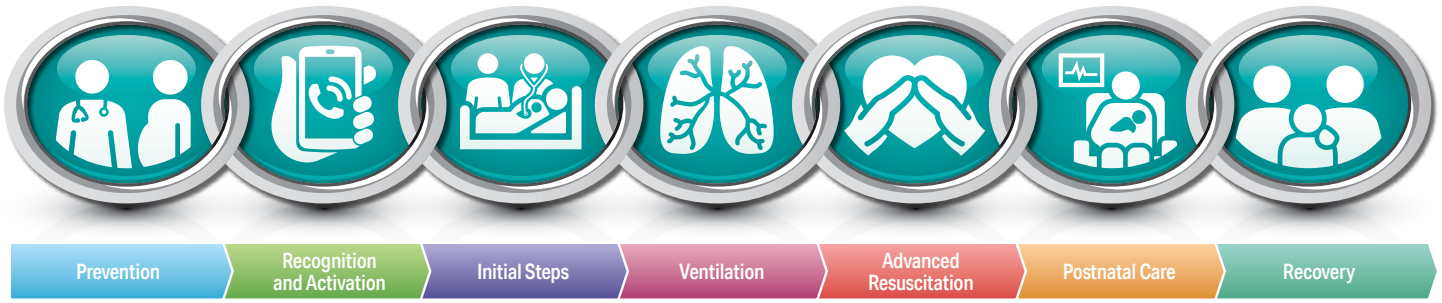
Why: In a meta-analysis of 6 RCTs

Figure 4. Neonatal Resuscitation Algorithm.



Target Oxygen Saturation Table	
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%

Figure 5. Newborn chain of care.



involving intubations, video laryngoscopy compared with traditional laryngoscopy led to increased intubation success. Traditional laryngoscopy remains a reasonable method to achieve endotracheal intubation.

2025 (New): It is reasonable to use a laryngeal mask as an alternative to endotracheal intubation for newborn infants at 34 0/7 weeks or more gestational age for whom ventilation via face mask is unsuccessful.

Why: In 4 RCTs, there was no significant difference in insertion time or first attempt success when a laryngeal mask (supraglottic airway) was used as a secondary device instead of endotracheal intubation after face-mask ventilation was unsuccessful. In 1 observational study, the use of a laryngeal mask instead of an endotracheal tube was associated with decreased admission to the neonatal intensive care unit.

2025 (New): It may be reasonable to use a laryngeal mask as the primary interface to administer ventilation instead of a face mask for newborn infants born at 34 0/7 weeks or more gestational age.

Why: A meta-analysis of 6 RCTs found that the use of a laryngeal mask, compared with the use of a face mask, decreased probability of failure to improve with the assigned device and the rate of endotracheal intubation. Duration of ventilation and time until heart rate reached greater than 100/min were shorter with the laryngeal mask.

Oxygen

2025 (New): A pulse oximeter should be placed as soon as possible for newborn infants receiving respiratory support or supplemental oxygen.

Why: Placement of a pulse oximeter early in resuscitation results in earlier reading of oxygen saturation for guidance of therapy. In observational studies, median time to obtain pulse oximetry reading ranged from 238 to 260 seconds and was longer in preterm infants compared with term infants.

2025 (Updated): In preterm newborn infants born at less than 32 weeks' gestational age receiving respiratory support at birth, it may be reasonable to begin with 30% to 100% oxygen.

Why: Analyses of available studies for this population have led to conclusions that conflict with those of a study-level meta-analysis of 10 RCTs showing no difference in short-term mortality when initial oxygen concentration was low compared with when it was high (with low oxygen generally being considered 21%-30% and high oxygen 60%-100% in these studies). A recent individual patient data meta-analysis found that high initial oxygen concentration of 90% to 100% was associated with lower mortality when compared with low initial oxygen concentration of 21% to 30%. Oxygen concentration can be titrated down as targets are achieved.

Chest Compressions

2025 (New): It may be reasonable to compress over the lower third of the sternum, taking care to be above the xiphoid process when providing chest compressions to newborn infants.

Why: An autopsy study of infants and young children found that providing midsternum compressions was not associated with liver rupture. Superficial tears of the liver capsule were produced when compressions were applied to the xiphoid process, and all patients with simultaneous chest and abdominal compressions or abdominal compressions alone had liver rupture. Chest radiograph studies identify that the heart lies under the lower third of the sternum in most infants.

2025 (New): It may be reasonable to change compressors every 2 to 5 minutes when providing chest compressions to newborn infants and to switch compressors while heart rate is being assessed.

Why: High-quality chest compressions encompass multiple factors, including optimal compression-to-ventilation ratio, adequate rate, adequate depth of compression, and full recoil between compressions. Neonatal manikin studies demonstrate that compression quality can diminish by 2 to 5 minutes when a single clinician performs compressions.

Pediatric Basic Life Support

Every year in the United States, more than 7000 OHCAs and approximately 20 000 IHCAs occur in infants and children. Despite increases in survival and comparatively good rates of favorable neurologic outcome after pediatric IHCA, survival rates from pediatric OHCA remain poor, particularly in infants. The Chain of Survival requires coordinated efforts from medical professionals in a variety of disciplines and, in the case of OHCA, from lay responders, telecommunicators, and emergency responders.

Summary of Key Issues and Major Changes

- Cardiac arrest in infants and children does not usually result from a primary cardiac cause; rather, it is typically the result of progressive respiratory failure or shock.
- Given the secondary nature of most pediatric cardiac arrest, early recognition of the critically ill infant or child by the caregiver, lay rescuer CPR training, and prompt access to emergency care are critical to improving outcomes.
- High-quality CPR and early defibrillation for shockable rhythms together are the cornerstone of treatment for pediatric cardiac arrest and must be provided to all patients for other therapies to be effective.

Major New and Updated Recommendations

Components of High-Quality CPR

2025 (New): For infants and children in cardiac arrest, interruptions in CPR should be minimized and pauses in chest compressions should be less than 10 seconds.

Why: Evidence from a multinational, multi-institutional observational cohort registry demonstrated that increased frequency and duration of pauses in CPR were significantly associated with a lower probability of achieving ROSC.

Sequence of Resuscitation

2025 (Updated): For infants, rescuers should compress the sternum with the heel of 1 hand or using the 2 thumb–encircling hands technique. If the rescuer cannot physically encircle the chest, it is recommended to compress the chest with the heel of 1 hand.

Why: Systematic reviews and meta-analyses from simulation studies suggest that the 2 thumb–encircling hands technique is the superior technique for giving compressions to infants when compared with the 2-finger technique, particularly for achieving adequate depth. In a multicenter prospective observational registry study, the single-hand technique resulted in greater compression depth than the 2-thumb technique in infants, with no difference in chest compression rate between hand positions. The 2-finger technique was utilized rarely in this study, but when used, no chest compression segments were compliant with AHA guidelines. Given this, the heel-of-1-hand or 2 thumb–encircling hands technique is recommended for infants. The long-used 2-finger technique for infant CPR is no longer recommended.

Foreign-Body Airway Obstruction

2025 (Updated): For children with severe foreign-body airway obstruction (FBAO), repeated cycles of 5 back blows alternated with 5 abdominal thrusts should be performed until the object is expelled or the child becomes unresponsive (see updated algorithm).

Why: Many FBAOs are relieved by allowing the patient to cough or, if severe, by lay rescuers using chest or abdominal thrusts. A recent observational study of adult and pediatric FBAOs suggests improved clearance of a foreign body with the use of back blows over abdominal thrusts. To create consistency for instructional purposes, and in the absence of inferiority from pediatric data, management of severe FBAO in children now starts with a series of back blows instead of abdominal thrusts. Repeated cycles of 5 back blows followed by 5 abdominal thrusts are performed until the obstruction is cleared or the child becomes unresponsive.

2025 (Updated): For infants with severe FBAO, repeated cycles of 5 back blows alternating with 5 chest thrusts should be performed until the object is expelled or the infant becomes unresponsive.

Why: Abdominal thrusts are not recommended for infants, given the potential to cause abdominal organ injury. The heel-of-1-hand technique for chest thrusts is now recommended for infants with severe FBAO. While the heel-of-1-hand technique for chest thrusts resembles chest compressions that are used as part of CPR, there is no focus on the other components of high-quality CPR chest compressions (eg, rate, recoil), so the term *chest compression* is not used.

Adult Basic Life Support

OHCA and IHCA impact hundreds of thousands of persons annually in the United States. There is significant variation in rates of lay rescuer CPR, public automated external defibrillator use, EMS response times, and survival to discharge among geographic regions. Survival for adults after OHCA and IHCA decreased during the COVID-19 pandemic.

Summary of Key Issues and Major Changes

- Early high-quality CPR and prompt defibrillation are the most important interventions associated with improved outcomes in adult cardiac arrest.
- For an adult with head and neck trauma, if the airway cannot be opened with a jaw thrust and airway adjunct insertion, rescuers should open the airway using a head tilt–chin lift.
- For adult cardiac arrest, rescuers should perform chest compressions with the patient on a firm surface and with the patient's torso at approximately the level of the rescuer's knees.
- When providing ventilation for an adult patient with respiratory arrest, it is reasonable for the health care professional to give 1 ventilation every 6 seconds, or 10 breaths/min, with each ventilation creating visible chest rise.
- CPR for adults with obesity who are in cardiac arrest should be provided in the same way as for patients without obesity.
- The routine use of mechanical CPR devices is not recommended for adult cardiac arrest.
- For adults with severe FBAO, repeated cycles of 5 back blows (slaps) followed by 5 abdominal thrusts should be performed until the object is expelled or the person becomes unresponsive.

Algorithms and Visual Aids

The Health Care Professional Basic Life Support (BLS) Algorithm was updated to illustrate the role of opioid antagonists (eg, naloxone) for suspected opioid overdose during respiratory and cardiac arrest. A simplified visual aid for lay rescuers emphasizes early activation of the EMS system and obtaining an automated external defibrillator in addition to initiation of chest compressions.

A new algorithm for the management of adult FBAO (Figure 6) was added to show the approach of using back blows as the initial maneuver, followed by abdominal thrusts. For patients with severe obstruction, the rescuer is directed to activate the emergency response system because once the person becomes unconscious, they can rapidly progress to cardiac arrest.

Major New and Updated Recommendations

Airway Management

2025 (Updated): For an adult with head and neck trauma, if the airway cannot be opened with a jaw thrust and airway adjunct insertion, trained rescuers should open the airway using a head tilt–chin lift.

Why: It is a priority to open a trauma patient's airway. While a jaw thrust is preferred in the setting of head and neck trauma, emphasis for trauma patients is placed on the importance of a patent airway for oxygenation and ventilation.

Ventilation

2025 (Updated): When ventilating an adult patient in cardiac arrest, it is reasonable to give enough tidal volume to produce visible chest rise.

2025 (Updated): When providing breaths to adult patients in cardiac arrest, rescuers should avoid hypoventilation (too few breaths or too little volume) or hyperventilation (too many breaths or too large a volume).

Why: Recent studies have shown that rescuers often fail to deliver ventilation in accordance with guidelines. In these studies, CPR with both effective ventilation and chest compressions was associated with improved outcomes.

Compression-to-Ventilation Ratio

2025 (Updated): It is reasonable for lay rescuers and health care professionals to perform CPR with cycles of 30 compressions followed by 2 breaths before placement of an advanced airway (eg, supraglottic airway or endotracheal tube).

Why: The majority of studies report no difference in patient outcomes between interrupted CPR with ventilation pauses and continuous chest compressions. However, recent evidence has shown that ventilation is often not adequate; the use of CPR with cycles of 30 compressions followed by 2 breaths—as opposed to continuous chest compressions—allows the rescuer to monitor for chest rise and, therefore, to check for adequate ventilation.

Defibrillation Pads

2025 (New): When placing pads for defibrillation for an adult in cardiac arrest, it might be reasonable to adjust the position of a bra instead of removing it.

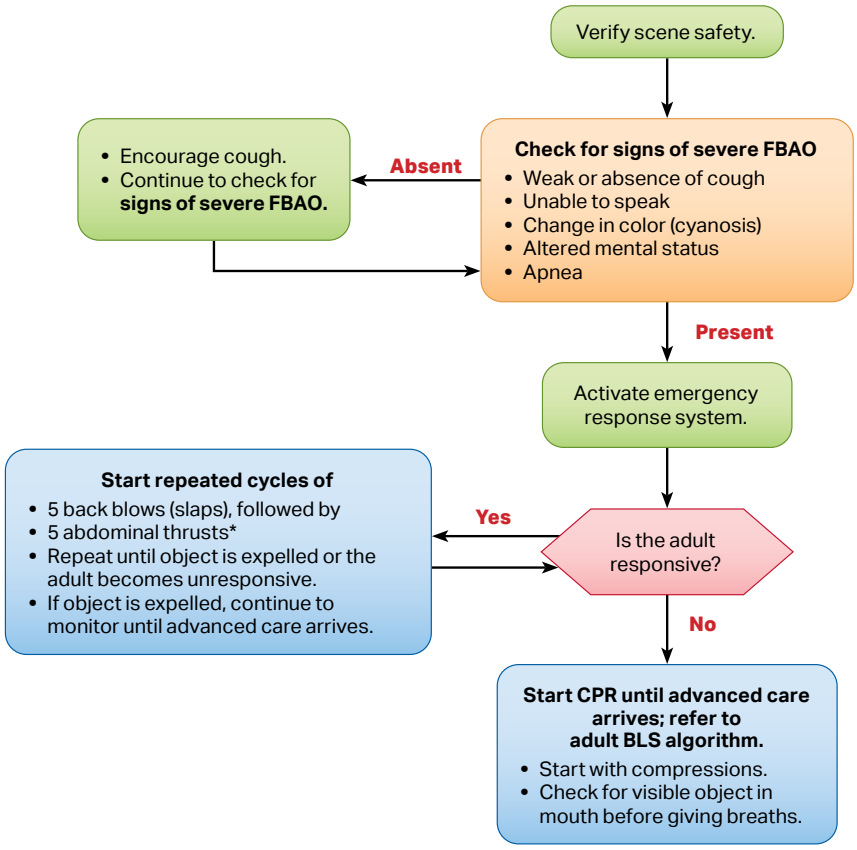
Why: Women experience significantly lower rates of public-access defibrillation compared with men. The need to apply pads or paddles directly to the bare chest may be a contributing factor. The option to adjust rather than remove a bra could mitigate factors like a rescuer's discomfort with exposing a woman's chest.

CPR for Adults With Obesity

2025 (New): CPR for adults with obesity who are in cardiac arrest should be provided using the same techniques as for patients without obesity.

Why: A 2024 ILCOR scoping review included 34 observational studies evaluating cardiac arrest in adult patients with obesity and found no evidence to support changes from standard CPR.

Figure 6. Adult FBAO Algorithm.



*For patients in the late stages of pregnancy, or when the rescuer is unable to encircle the patient's abdomen, 5 chest thrusts should be used instead.

Alternative Techniques for CPR

2025 (Updated): The routine use of mechanical CPR devices is not recommended for adult cardiac arrest.

2025 (New): In adult cardiac arrest, the use of mechanical CPR devices may be considered in specific settings where the delivery of high-quality manual compressions may be challenging or dangerous for the health care professionals as long as they strictly limit interruptions in CPR during deployment and removal of the device.

Why: Numerous RCTs have demonstrated no difference in patient survival between manual CPR and mechanical CPR. There may be specific circumstances, however, in which the use of mechanical CPR devices may provide logistical or safety advantages. These situations are not represented in current clinical trials.

Foreign-Body Airway Obstruction

2025 (Updated): For adults with severe FBAO, repeated cycles of 5 back blows (slaps) followed by 5 abdominal thrusts should be performed until the object is expelled or the person becomes unresponsive.

Why: Studies of adults with FBAO showed that back blows were associated with improved rates of FBAO relief and fewer injuries compared with abdominal thrusts. The recommendation for alternating sets of 5 back blows and 5 abdominal thrusts is based on the value of consistency with existing infant and pediatric guidelines that use this approach.

Pediatric Advanced Life Support

Given the poor outcomes previously noted for pediatric OHCA, significant opportunity to improve resuscitation remains in all phases of care. Growing research in pediatric resuscitation through both in- and out-of-hospital resuscitation networks is making major contributions toward advancing knowledge and has resulted in several changes in the 2025 Guidelines.

- This chapter includes updates about medications used during cardiac arrest, including changes in class of recommendation for several medications.
- New recommendations are provided as a result of the growing monitoring data available to drive best practice after cardiac arrest.
- For the first time, the guidelines include information on the complex task of predicting neurologic outcome after cardiac arrest (neuroprognostication), both for favorable and unfavorable outcomes.

Major New and Updated Recommendations

Drug Administration During Cardiac Arrest

2025 (Updated): For infants and children in cardiac arrest with initial non-shockable rhythm, it is reasonable to administer the initial dose of epinephrine as early as possible.

Why: A recent systematic review of 7 observational studies identified that shorter time to administration of epinephrine in OHCA and IHCA was associated with increased rates of favorable outcome. Time to first dose of epinephrine less than 3 minutes was associated with highest rates of favorable outcome, although there was no direct comparison across time to first epinephrine dose intervals (eg, <5 min, <10 min).

Measuring Physiology During CPR

2025 (Updated): For infants and children with invasive airways in place during CPR, end-tidal carbon dioxide ($ETCO_2$) monitoring may be considered to monitor CPR quality.

2025 (New): A specific $ETCO_2$ cutoff value alone should not be used as an indication to end resuscitative efforts in infants and children.

Why: Monitoring exhaled carbon dioxide levels among patients receiving CPR with an invasive airway is important because $ETCO_2$ reflects native cardiac output and ventilation efficacy as well as feedback on CPR quality. In a recent prospective multicenter study that evaluated average $ETCO_2$ during the first 10 minutes of in-hospital CPR in children, $ETCO_2$ values 20 mm Hg or greater during CPR were associated with increased odds of ROSC and survival to discharge as well as higher intra-arrest blood pressures. There was no association with CPR quality metrics, such as chest compression rate and depth. However, when rescuers are considering termination of resuscitative efforts, it is vital that they avoid using a specific $ETCO_2$ cutoff value alone because survival has been noted in patients with average $ETCO_2$ less than 20 mm Hg.

2025 (New): For infants and children with continuous invasive arterial blood pressure monitoring in place during CPR, it may be reasonable for health care professionals to target a diastolic blood pressure of 25 mm Hg or greater in infants and 30 mm Hg or greater in children 1 year of age or older.

Why: A new study shows that among pediatric patients receiving CPR with an invasive arterial line in place, rates of survival with favorable neurologic outcome were improved if the diastolic blood pressure was at least 25 mm Hg in infants and at least 30 mm Hg in children.

Treatment of Supraventricular Tachycardia With a Pulse

2025 (Updated): For infants and children with supraventricular tachycardia and cardiopulmonary compromise unresponsive to vagal maneuvers, adenosine, and electrical synchronized cardioversion and for whom expert consultation is not available, it may be reasonable to consider intravenous (IV) procainamide, amiodarone, or sotalol.

Why: Procainamide and amiodarone are moderately effective treatments for adenosine-resistant supraventricular tachycardia , although adverse effects may occur with both therapies. Sotalol was approved for the treatment of supraventricular tachycardia in 2009, with several studies demonstrating effectiveness in acute conversion of supraventricular tachycardia when it is administered under the guidance of pediatric electrophysiologists in acute care settings and reporting minimal adverse events.

Post–Cardiac Arrest Management

2025 (Updated): After cardiac arrest in infants and children, it is recommended to maintain systolic and mean arterial blood pressure greater than the 10th percentile for age.

Why: Because blood pressure is often labile in the post–cardiac arrest period, recognition of hypotension (less than fifth percentile for age and sex) is important. Hypotension is common following return of circulation from cardiac arrest, occurring in 25% to 50% of infants and children. Two observational studies associated systolic blood pressure below the fifth percentile for age in the first 12 hours following cardiac arrest with decreased rates of survival to discharge. In addition, a secondary analysis of the ICU-Resuscitation trial of pediatric IHCA found higher rates of survival to hospital discharge as well

as survival to hospital discharge with favorable neurologic outcome when blood pressure targets were above a threshold of systolic blood pressure greater than the 10th percentile for age and diastolic blood pressure greater than 50th percentile for age during the first 6 hours post–cardiac arrest.

Prognostication Following Cardiac Arrest

2025 (Updated): It is recommended that health care professionals consider multiple modalities when they are predicting neurological outcomes (favorable or unfavorable after resuscitation from cardiac arrest in infants and children).

2025 (New): The usefulness of cough or gag reflexes or response to pain to support a favorable or unfavorable neurological prognosis at any time point after cardiac arrest in infants and children is not well established.

2025 (New): When interpreted in the context of other prognostic criteria, it is reasonable to use electroencephalography (EEG) up to 72 hours after cardiac arrest in infants and children to support a favorable or unfavorable neurological prognosis.

Why: Two systematic reviews evaluated the association of neurological examination, biomarkers, EEG, and neurological imaging modalities with favorable and unfavorable outcomes after resuscitation from pediatric cardiac arrest. None of these modalities were assessed in isolation, and none met prespecified accuracy to be used as a lone prognostic criterion at any time point; thus, despite recommendations around individual tests, none should be used in isolation to predict outcome. Electroencephalography is a modality that may be used in conjunction with other tests based on numerous studies to prognosticate outcome. However, data are lacking to support the use of a cough or gag reflex to predict favorable or unfavorable outcome. Clinicians should consider multiple modalities when assessing the neurological prognosis of survivors after cardiac arrest.

Post–Cardiac Arrest Recovery and Survivorship

2025 (Updated): It is reasonable that infants and children who survive cardiac arrest be evaluated for physical, cognitive, and emotional needs to guide follow-up care within the first year following cardiac arrest.

Why: There is growing recognition that recovery from cardiac arrest continues long after initial hospitalization. Survivors may require ongoing integrated medical, rehabilitative, caregiver, and community support in the months to years after their cardiac arrest. A recent AHA scientific statement highlights the importance of supporting patients and families during this time to achieve the best possible long-term outcome.

Adult Advanced Life Support

Survival to hospital discharge after EMS-treated OHCA remains low, at approximately 10%, while survival to hospital discharge rates for IHCA are around 24%. Among those who survive to discharge, approximately 85% have favorable neurological outcome. Immediate high-quality CPR and timely defibrillation are the cornerstones of effective resuscitation. However, ALS interventions, including advanced airway management, pharmacologic therapies, and coordinated postresuscitation care in both prehospital and in-hospital settings remain essential for improving patient outcomes.

Summary of Key Issues and Major Changes

- Arrhythmias (such as tachycardias) can be both the cause of and a manifestation of clinical instability. Evaluating the proximal cause of that instability will direct professionals to the most judicious use of these guidelines.
- Higher first-shock energy settings (≥200 J) are preferable to lower settings for cardioversion of atrial fibrillation (AF) and atrial flutter.
- In addition to updates to double sequential defibrillation recommendations, recommendations for vector change defibrillation were added based on new literature.

Algorithms and Visual Aids

The Termination of Resuscitation Algorithm was updated to include BLS and universal termination of resuscitation rules. An updated algorithm for the management of bradycardia in adults with a pulse has been added.

Major New and Updated Recommendations

Vector Change and Double Sequential Defibrillation

2025 (New): The usefulness of vector change defibrillation for adults in cardiac arrest with persisting ventricular fibrillation/pulseless ventricular tachycardia after 3 or more consecutive shocks has not been established.

2025 (Updated): The usefulness of double sequential defibrillation for adults in cardiac arrest with persisting ventricular fibrillation/pulseless ventricular tachycardia after 3 or more consecutive shocks has not been established.

Why: A 2023 ILCOR International Consensus on CPR and ECC Science With Treatment Recommendations identified a single small RCT supporting the use of vector change defibrillation and double sequential defibrillation for refractory ventricular fibrillation. There are a number of outstanding questions about the impact of these interventions that require further investigation.

Initial Vascular Access

2025 (Updated): It is recommended that health care professionals first attempt establishing IV access for drug administration in adult patients in cardiac arrest.

2025 (Updated): Intraosseous (IO) access is reasonable if initial attempts at IV access are unsuccessful or not feasible for adult patients in cardiac arrest.

Why: A 2025 ILCOR systematic review and meta-analysis, including data from 3 recent large RCTs, found that the use of IO access compared with IV access did not result in a statistically significant improvement in outcomes. This systematic review noted lower odds of achieving sustained ROSC for the IO route compared with the IV route.

Vasopressor Medications

2025 (Updated): In consideration of timing, for adult patients in cardiac arrest with a shockable rhythm, it is reasonable to administer epinephrine after initial defibrillation attempts have failed.

Why: The literature supports prioritizing rapid defibrillation and administering epinephrine after initial attempts with CPR and defibrillation are not successful in patients with shockable rhythms.

2025 (Updated): Vasopressin alone or vasopressin in combination with epinephrine offers no advantage as a substitute for epinephrine for adult patients in cardiac arrest.

Why: Multiple systematic reviews and meta-analyses of RCTs and observational studies have found no difference in survival outcomes when comparing vasopressin alone or vasopressin combined with epinephrine versus epinephrine alone.

Nonvasopressor Medications

2025 (New): For adults in cardiac arrest, the use of β-blockers, bretylium, procainamide, or sotalol for ventricular fibrillation/pulseless ventricular tachycardia unresponsive to defibrillation is of uncertain benefit.

Why: No new evidence emerged from a 2025 ILCOR evidence update about the use of other parenteral antiarrhythmic agents in cardiac arrest. These include bretylium tosylate (which was recently reintroduced to the United States market with no new evidence on its effectiveness or safety).

Adjuncts to CPR

2025 (New): Head-up CPR in adults with cardiac arrest is not recommended except in the setting of clinical trials.

Why: A recent ILCOR systematic review identified no RCTs and only 3 observational studies, each with significant methodological limitations, identifying very low certainty of evidence downgraded for serious risk of bias for the outcome of survival to discharge and survival to discharge with favorable neurological outcome and noting that future work is needed to evaluate this adjunct.

Termination of Resuscitation Measures

2025 (Updated): In a tiered EMS system with both ALS and BLS professionals, it is reasonable to use the universal termination of resuscitation rule for adult patients with OHCA.

Why: The universal termination of resuscitation rule, which uses the same criteria as the BLS rule (ie, arrest not witnessed by EMS professionals; no shock delivered; no ROSC), has been prospectively validated specifically in combined BLS/ALS, or tiered response, EMS agencies.

Wide-Complex Tachycardia

2025 (Updated): Synchronized cardioversion is recommended for acute treatment of adult patients with hemodynamically unstable wide-complex tachycardia.

Why: In hemodynamically unstable patients with wide-complex tachycardia, it is critical to promptly restore sinus rhythm. Synchronized cardioversion has a high rate of termination of wide-complex tachycardia.

2025 (Updated): Synchronized cardioversion is recommended for acute treatment of adult patients with hemodynamically stable wide-complex tachycardia when vagal maneuvers and pharmacological therapy is ineffective or contraindicated.

Why: In stable patients with wide-complex tachycardia, vagal maneuvers or adenosine may be attempted; however, if the patient remains in wide-complex tachycardia following these therapies, synchronized cardioversion is recommended to restore sinus rhythm.

Atrial Fibrillation or Flutter With Rapid Ventricular Response

2025 (Updated): For synchronized cardioversion of AF in adults using any currently US-approved biphasic waveform defibrillator, an initial energy setting of at least 200 J is reasonable and incremented in the event of shock failure, depending on the biphasic defibrillator used.

Why: Recent randomized trials together with a network meta-analysis involving more than 3000 AF patients found that 200-J shocks achieved greater than 90% cumulative cardioversion success across all 3 biphasic platforms currently available in the United States. Low-energy monophasic shocks were significantly more likely to provoke ventricular fibrillation when cardioverting AF and AF when cardioverting atrial flutter than a 200-J or greater setting.

2025 (New): The usefulness of double synchronized cardioversion of AF in adults as an initial treatment strategy is uncertain.

Why: On the basis of currently available data and given the high success of optimal synchronized cardioversion using biphasic waveforms, the

incremental benefit from double synchronized cardioversion appears modest.

2025 (Updated): For synchronized cardioversion of atrial flutter in adults, an initial energy setting of 200 J may be reasonable and incremented in the event of shock failure, depending on the biphasic defibrillator used.

Why: Recent studies support the likelihood of greater efficacy, efficiency, and simplicity, without safety concerns, when a starting energy of 200 J with any currently US-marketed biphasic defibrillator is used for flutter cardioversion and incremented in the event of shock failure, depending on the defibrillator's features.

Initial Management of Bradycardia

2025 (New): In adult patients with persistent hemodynamically unstable bradycardia refractory to medical therapy, temporary transvenous pacing is reasonable to increase heart rate and improve symptoms.

Why: When the heart rate does not improve with medications and shock persists, transvenous pacing can improve the heart rate and symptoms until more definitive treatment (correction of underlying cause or permanent pacemaker placement) can be implemented.

Post–Cardiac Arrest Care

Post–cardiac arrest care focuses on reducing neurological sequelae and organ dysfunction while identifying and addressing any reversible cause of the cardiac arrest. Neuroprognostication is a key component of post–cardiac arrest care to ensure appropriate utilization of resources, withdrawal of life-sustaining therapy, and optimization of patient outcomes. The Adult Post–Cardiac Arrest Care Algorithm (Figure 7) has been updated to reflect new science in this area.

Summary of Key Issues and Major Changes

- The section on neuroprognostication was updated to include predictors of favorable outcome, and neurofilament light chain was added as a serum biomarker.
- It is reasonable that temperature control be maintained for at least 36 hours in adult patients who remain unresponsive to verbal commands after ROSC.
- Hypotension should be avoided in adults after ROSC by maintaining a minimum mean arterial pressure (MAP) of at least 65 mm Hg, though there is insufficient evidence to recommend a specific vasopressor to treat low blood pressure in adult patients after cardiac arrest.
- New recommendations for cardiac arrest survivors and their caregivers focus on structured assessment and treatment/referral for emotional distress after medical stabilization and before hospital discharge.

Major New and Updated Recommendations

Blood Pressure in Adults After Cardiac Arrest

2025 (Updated): Hypotension should be avoided in adults after ROSC by maintaining a minimum MAP of at least 65 mm Hg.

Why: Four randomized trials compared lower to higher MAP targets after OHCA. These studies did not demonstrate better overall survival or favorable neurologic outcome with higher MAP.

Diagnostic Studies for Adults After Cardiac Arrest

2025 (New): It may be reasonable to perform head-to-pelvis computed tomography (CT) for adult patients after ROSC to investigate the etiology of cardiac arrest and complications from resuscitation.

2025 (New): It may be reasonable to perform echocardiography or point-of-care cardiac ultrasound for adult patients after ROSC to identify clinically significant diagnoses requiring intervention.

Why: Echocardiography, point-of-care cardiac ultrasound, and CT imaging are used in postarrest patients to identify clinically significant diagnoses requiring intervention.

Temperature Control for Adults After Cardiac Arrest

2025 (Updated): It is reasonable that temperature control be maintained for at least 36 hours in adult patients who remain unresponsive to verbal commands after ROSC.

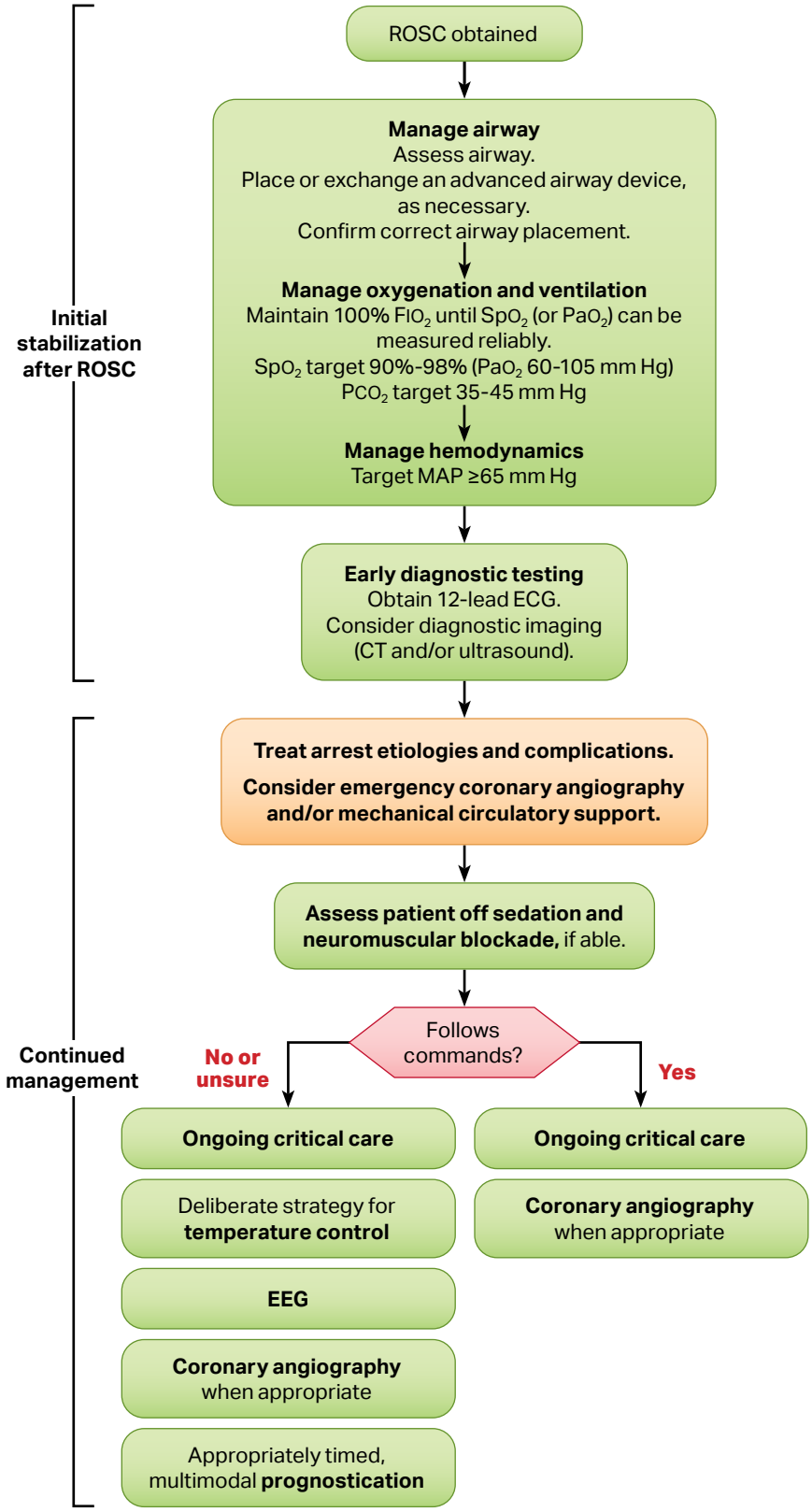
Why: Temperature control includes hypothermic temperature control (32-34 °C) and normothermic or fever-prevention temperature control (36-37.5 °C). Recognizing evolution of evidence and definitions with respect to temperature control, 36 hours of total temperature control is the shortest recommended duration.

Percutaneous Coronary Intervention for Adults After Cardiac Arrest

2025 (Updated): Coronary angiography is recommended before hospital discharge in adult cardiac arrest survivors with suspected cardiac etiology, particularly in the presence of an initial shockable rhythm, unexplained left ventricular systolic dysfunction, or evidence of severe myocardial ischemia.

Why: Coronary artery disease is commonly identified in patients after OHCA.

Figure 7. Adult Post–Cardiac Arrest Care Algorithm.



Initial Stabilization After ROSC

Resuscitation is ongoing during the post-ROSC phase, and many of these activities can occur concurrently.

Manage airway: Assess and consider placement or exchange of an advanced airway device (usually endotracheal tube or supraglottic device). Confirm correct placement of an advanced airway. This generally includes the use of waveform capnography or capnometry.

Manage oxygenation and ventilation: Titrate FIO_2 for SpO_2 90%-98% (or PaO_2 60-105 mm Hg). Adjust minute ventilation to target PCO_2 35-45 mm Hg in the absence of severe acidemia.

Manage hemodynamics: Initiate or adjust vasopressors and/or fluid resuscitation as necessary for goal MAP ≥65 mm Hg.

Early diagnostic testing: Obtain 12-lead ECG to assess for ischemia or arrhythmia. Consider CT head, chest, abdomen, and/or pelvis to determine cause of arrest or assess for injuries sustained during resuscitation. Point-of-care ultrasound or echocardiography may be reasonable to identify clinically significant diagnoses requiring intervention.

Continued Management

Treat arrest etiologies and complications.

Consider emergency cardiac intervention:

- Persistent ST-segment elevation present
- Cardiogenic shock
- Recurrent or refractory ventricular arrhythmias
- Severe myocardial ischemia

Temperature control: If patient is not following commands off sedation and neuromuscular blockade or is unable to assess, initiate a deliberate strategy of temperature control with goal 32 °C-37.5 °C as soon as possible.

Evaluate for seizure: Evaluate for clinical seizure and obtain EEG to evaluate for seizure in patients not following commands.

Prognostication: Multimodal approach with delayed impressions (≥72 hours from ROSC or achieving normothermia).

Ongoing critical care includes the following:

- Target PaO_2 60-105 mm Hg, PCO_2 35-45 mm Hg (unless severe acidemia); avoid hypoglycemia (glucose <70 mg/dL) and hyperglycemia (glucose >180 mg/dL); target MAP ≥65 mm Hg.
- Consider antibiotics.

Identifying and treating unstable coronary artery disease has been shown to improve outcomes.

Temporary Mechanical Circulatory Support for Adults After Cardiac Arrest

2025 (New): In highly selected adult patients with refractory cardiogenic shock after cardiac arrest and ROSC, temporary mechanical circulatory support may be considered.

Why: Cardiogenic shock commonly occurs as either a cause or consequence of cardiac arrest. Temporary mechanical circulatory devices can provide hemodynamic stabilization in refractory cardiogenic shock.

Diagnosis and Management of Myoclonus in Adults After Cardiac Arrest

2025 (New): Treatment to suppress myoclonus without an EEG correlate is not recommended in adult survivors of cardiac arrest.

Why: There is no evidence implicating myoclonus without an EEG correlate in the pathogenesis of secondary brain injury after cardiac arrest. Thus, the risk of side effects outweighs the unknown benefit of suppressing myoclonus without an EEG correlate on patient outcomes.

Neuroprognostication

2025 (New): When evaluated with other prognostic tests, it may be reasonable to consider a continuous EEG background without discharges within 72 hours after cardiac arrest to support the prognosis of favorable neurological outcome in adult patients who remain comatose after ROSC.

Why: The section on neuroprognostication was updated to include predictors of favorable outcome. A 2022 systematic review from ILCOR investigated prediction of favorable outcome.

Recovery and Survivorship After Cardiac Arrest

2025 (Updated): It is recommended that cardiac arrest survivors and their caregivers have structured assessment and treatment of or referral for emotional distress after medical stabilization and before hospital discharge.

Why: Approximately one fourth of cardiac arrest survivors and their caregivers experience emotional distress. Studies in survivor-caregiver pairs and in survivors showed improvements in emotional distress in those receiving a psychosocial intervention.

Cardiac Arrest Due to Special Circumstances

Several special circumstances may warrant additional treatment beyond standard BLS and ALS care. These recommendations are intended to cover the management of both pediatrics and adults in life-threatening conditions, including cardiac arrest.

Summary of Key Issues and Major Changes

- While extracorporeal life support (ECLS) is not available in every setting, adults and children in cardiac arrest or a periarrest state with a potentially reversible etiology are being supported with ECLS devices, such as venoarterial extracorporeal membrane oxygenation.
- Chest compressions, bag-mask ventilation, defibrillation, suctioning, and endotracheal intubation should be considered aerosol-generating procedures, which pose a risk of infection to resuscitation team members.
- Management of cardiac arrest during pregnancy is a complex clinical scenario that requires resuscitation strategies that accommodate for the physiological changes of pregnancy.
- An opioid antagonist (eg, naloxone) should be given to people with respiratory arrest from suspected opioid overdose. Trained rescuers, lay rescuers, and members of the general public can all administer naloxone.

Major New and Updated Recommendations

Life-Threatening Asthma Exacerbation

2025 (New): It may be reasonable to use ECLS for adults and children with life-threatening asthma refractory to standard therapies.

2025 (New): Treatment with volatile anesthetics for adults and children with life-threatening asthma refractory to standard therapies may be considered.

Why: Asthma can cause cardiac arrest from lower airway obstruction that leads to hypoxemia, hypercarbia, respiratory acidosis, and increased intrathoracic pressure, which leads to decreased cardiac output. Adult and pediatric observational studies of ECLS or volatile anesthetics demonstrate survival rates between 83.5% and 100%. Either venovenous or venoarterial extracorporeal membrane oxygenation can be considered depending on the needs of the particular patient.

Life-Threatening Hyperkalemia

2025 (Updated): The effectiveness of IV calcium administration for adults and children in cardiac arrest from suspected hyperkalemia is not well established.

Why: For adults and children in cardiac arrest from suspected hyperkalemia, human evidence of improved survival or favorable neurological status following IV calcium administration is

limited. Initiating IV calcium must be carefully weighed against the potential for detracting from time-sensitive, guideline-directed resuscitative interventions, including high-quality CPR, defibrillation of shockable rhythms, and administration of epinephrine.

Life-Threatening Hypothermia

2025 (New): It is reasonable to use prognostication scores to guide the decision for initiating ECLS rewarming for adults and children in hypothermic cardiac arrest.

2025 (New): It may be reasonable to rewarm adults and children with severe environmental hypothermia (core temperature, <28 °C [84 °F]) and not in cardiac arrest using ECLS.

Why: Severe environmental hypothermia (core temperature, <30 °C [86 °F]) can cause cardiac arrest as well as findings that mimic death. Reduced metabolic rate and oxygen consumption increase the likelihood of neurologically intact survival. Studies show improved survival in hypothermic cardiac arrest when ECLS is provided compared with when conventional CPR is provided. Rewarming adults and children not in cardiac arrest with ECLS can be faster but risks complications related to its use. The HOPE probability score and ICE survival score are better validated for predicting survival after hypothermic cardiac arrest compared with other prognostic factors in isolation.

Life-Threatening Hyperthermia

2025 (New): It is reasonable to choose immersion in ice water (1-5 °C [33.8-41 °F]) over other cooling methods in adults and children with life-threatening hyperthermia.

2025 (New): It is reasonable to cool adults and children with life-threatening hyperthermia as rapidly as possible with a decrease of at least 0.15 °C/min (0.27 °F/min).

Why: Cardiac arrest from life-threatening hyperthermia (>40 °C [104 °F]) may be preventable by rapid cooling. A systematic review of human clinical and observational studies found cooling by ice water immersion to be most efficient and most likely to achieve the optimal cooling rate of at least 0.15 °C/min (0.27 °F/min) compared with other strategies. These recommendations apply to environmental hyperthermia as well as hyperthermia associated with sympathomimetic and cocaine poisoning.

Left Ventricular Assist Devices

2025 (New): In unresponsive adults and children with durable left ventricular assist devices (LVADs) and impaired perfusion, chest compressions should be performed.

2025 (New): In unresponsive adults and children with durable LVADs and impaired perfusion, it may be reasonable to start chest compressions immediately while simultaneously assessing for device-related reversible causes.

Why: The absence of a palpable pulse can make confirming cardiac arrest in adults and children with an LVAD difficult. Perfusion is assessed using skin color, skin temperature, capillary refill, MAP, and partial pressure of end-tidal carbon dioxide, and if perfusion is impaired, cardiac arrest is likely. Outcomes of cardiac arrest with and without CPR in this population are difficult to assess due to bias in these studies, but the potential benefit of CPR outweighs the theoretical risk of device dislodgment. Treatment should prioritize CPR while simultaneously attempting to restore LVAD function if a second rescuer is available. The LVAD algorithm (Figure 8) details the treatment steps.

Cardiac Arrest During Pregnancy

2025 (Updated): Preparation for resuscitative delivery for a pregnant patient in cardiac arrest should begin at the recognition of cardiac arrest, with the goal to complete delivery by 5 minutes.

2025 (New): It is reasonable to use ECPR in pregnant or peripartum patients in cardiac arrest not responsive to standard resuscitation.

2025 (New): A massive transfusion protocol with a balanced transfusion strategy should be used for peripartum patients with suspected life-threatening amniotic fluid embolism.

Why: In addition to team planning, manual left lateral uterine displacement, and standard resuscitation, resuscitative delivery (replacing the term *perimortem cesarean delivery*) should be completed by 5 minutes to improve outcomes for the pregnant patient. Studies for ECPR reported survival rates between 55% and 75% for pregnant patients. Amniotic fluid embolism in peripartum patients can lead to cardiac arrest and is characterized by hemodynamic compromise, respiratory distress, and disseminated intravascular coagulation with resultant hemorrhage. A balanced massive transfusion strategy for red blood cells, plasma, and platelets equivalent reduces the risk of death. The Cardiac Arrest in Pregnancy Algorithm details the treatment steps.

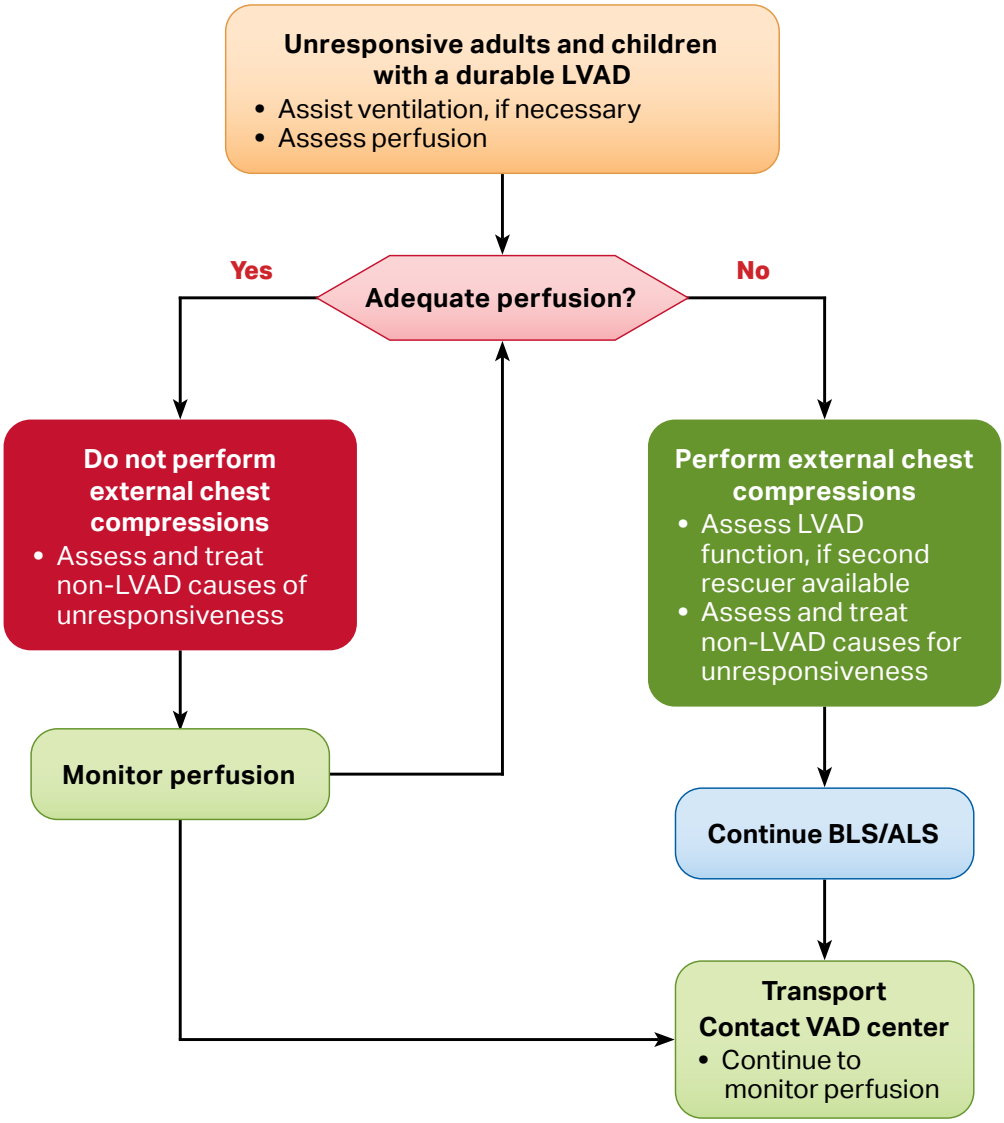
Toxicology: Opioid Overdose

2025 (New): For lay and trained rescuers, opioid antagonist administration may be reasonable for adults and children in cardiac arrest with suspected opioid overdose, provided that opioid antagonist (eg, naloxone) administration does not interfere with the delivery of standard resuscitation, including high-quality CPR with breaths.

2025 (New): Adults and children who are treated for opioid overdose should receive an opioid antagonist (eg, naloxone) and instruction on how to use it at the time of discharge from a health care setting.

Why: Opioid antagonists restore protective airway reflexes and reverse respiratory arrest from opioid overdose in adults and children and should be administered whenever opioid overdose is suspected. No clinical trials have evaluated the role of opioid antagonists in adults or children with cardiac arrest. The efficacy of naloxone administration

Figure 8. Adult and Pediatric Durable LVAD Algorithm.



Assessing Perfusion

Adequate perfusion* if any of the following present:
- Normal skin color and temperature
- Normal capillary refill
- MAP >50 mm Hg (if noninvasive BP cuff nonfunctional, use doppler or arterial line, if available)
- $PETCO_2$ >20 mm Hg

**Patients may not have palpable pulse*

Non-LVAD Causes of Unresponsiveness

- Dysrhythmia
- Hemorrhage/hypovolemia
- Hypoglycemia
- Hypoxia
- Overdose
- Right ventricular failure
- Sepsis
- Stroke

Assess and Attempt to Restart LVAD Function

- Look/listen for alarms
- Listen for LVAD hum
- Driveline connected?
- Power source connected?
- Need to replace system controller?

in animal studies and adult observational studies for undifferentiated cardiac arrest or cardiac arrest with suspected opioid overdose is conflicting. However, there is no known harm from administering naloxone to a person in cardiac arrest, provided that opioid antagonist administration does not interfere with standard resuscitation. People who survive an opioid overdose are at high risk of a subsequent overdose. In addition to brief psychosocial interventions and referral to evidence-based treatment programs, providing "take-home" or "leave-behind" doses of opioid antagonists with teaching may prevent future fatal overdoses.

Education Science

Education and training science and the technology to support training continues to evolve, and a comprehensive review of the literature resulted in several new and important updates that impact training both health care professionals and lay rescuers. Among the most significant updates are recommendations on feedback devices during training, disparities in CPR education, the use of virtual reality (VR), and lay rescuer training for opioid overdose.

- Technology continues to change the educational landscape, and health care market forces have driven implementation of new strategies to reduce costs.
- The growing body of education science has led to different recommendations in technology and techniques for teaching cognitive information and learning psychomotor skills as well as for different audiences (health care professionals and lay rescuers).
- Improved patient outcomes remain lacking for most life support training innovations, yet they remain the ultimate goal of training.

Use of Feedback Devices During CPR Training

2025 (Updated): Feedback devices are recommended for use during CPR training for health care professionals.

2025 (Updated): Feedback devices are recommended for use during CPR training for lay rescuers.

Why: A meta-analysis of several new RCTs conducted with health care professionals demonstrated that CPR feedback devices had a moderate to large effect on all CPR quality metrics. Three RCTs conducted with lay rescuers demonstrated that feedback devices were effective in increasing mean CPR quality metrics.

Rapid-Cycle Deliberate Practice

2025 (New): It may be reasonable to incorporate rapid-cycle deliberate practice as part of BLS or ALS training for health care professionals.

Why: Rapid-cycle deliberate practice is a simulation-based training method that incorporates within-event debriefing. Studies have found that rapid-cycle deliberate practice results in improved performance of multiple CPR skills and improved workload scores.

Teamwork and Leadership Training

2025 (Updated): It is recommended that life support training for health care professionals includes a specific emphasis on teamwork competencies.

Why: Twelve of 14 RCTs reviewed reported superior performance after specific teamwork training in outcomes related to communication, leadership behavior, nontechnical skills, workload management, and overall teamwork at course completion.

Gamified Learning

2025 (New): It may be reasonable to use gamified learning elements as a component of resuscitation training for health care professionals.

2025 (New): It may be reasonable to use gamified learning elements as a component of CPR instruction for lay rescuers.

Why: Because the evidence for gamified learning as well as virtual and augmented reality is growing, recommendations for these techniques were separated and a specific recommendation for augmented reality was added. Gamified learning is associated with improved CPR knowledge, skill performance, and self-confidence in lay rescuers and health care professionals; however, the current evidence to support gamified learning is weak.

Virtual Reality and Augmented Reality

2025 (New): It may be reasonable to use VR to support knowledge acquisition in BLS and ALS training for lay rescuers and health care professionals.

2025 (New): The use of augmented reality to provide real-time CPR feedback may be considered for BLS training of lay rescuers and health care professionals.

2025 (New): Virtual reality should not be used to teach CPR skills in lay rescuers and health care professionals.

Why: Thirteen studies explored the use of VR for life support knowledge training in health care professionals, with mixed results about knowledge acquisition compared with traditional training. Importantly, new data show a difference in the usefulness of VR to support knowledge acquisition versus skills training, leading to opposing recommendations for these 2 domains. Several studies looked at quantitatively measured CPR skill parameters (eg, depth, rate) and found that VR-based training was either inferior to or no different from other forms of CPR training for these outcomes.

2025 Highlights

Opioid Overdose Training for Lay Rescuers

2025 (Updated): It is recommended that lay rescuers receive education on recognition and initial treatment steps for people who have an opioid-associated OHCA.

2025 (Updated): The optimal training method for lay rescuers in recognizing and intervening in opioid overdose has not been established.

Why: Three recent systematic reviews of over 140 studies summarized the impact of lay rescuer training in opioid overdose recognition and treatment and found that this training increased knowledge, improved willingness to respond, and increased likelihood of naloxone use.

Disparities in Education

2025 (Updated): It is recommended to focus and tailor lay rescuer CPR training to specific racial and ethnic populations as well as neighborhoods with high densities of these populations and incorporate awareness efforts in these areas.

2025 (Updated): It is recommended to address barriers to performing lay rescuer CPR on women through educational training and public awareness efforts.

2025 (Updated): It is recommended to focus on low socioeconomic status populations and neighborhoods for lay rescuer CPR training and awareness efforts.

2025 (Updated): It is reasonable to address barriers to linguistically isolated communities by increasing availability and access to CPR training materials in diverse languages.

2025 (Updated): It is reasonable to consider cost-effective methods for CPR training and to promote safe access to CPR training for low socioeconomic status populations and settings.

Why: There are known disparities due to social factors in both patients who receive CPR outside the hospital and availability of CPR training. Focusing on specific populations for CPR education and modifying education to address differences could eliminate disparities in CPR training and lay rescuer CPR, potentially enhancing cardiac arrest outcomes in these populations. Specific recommendations have been made for training in low-income neighborhoods and linguistically isolated communities and for cost-effective CPR training methods in these populations.

CPR Training in School Children

2025 (New): It is recommended to start CPR training in children younger than 12 years of age to increase willingness and self-confidence in later years.

Why: Evidence shows that starting to introduce younger children to the concepts of emergency calls and the need for CPR and automated external defibrillators earlier improves socialization of timely lay rescuer response and its importance.

Alternative Objects for Chest Compression Training in Lay Rescuers

2025 (New): The usefulness of alternative objects to train lay rescuers in chest compressions, when compared with a manikin, is not well established.

Why: Preliminary data about the feasibility of the use of common household objects (eg, pillows, toilet paper rolls, foam blocks) to train and practice chest compressions have recently been described. Seven studies were identified in which learners used alternative objects to practice chest compressions, with mixed results. As such, the evidence is not yet strong enough to make a recommendation.

Scripted Debriefing

2025 (New): It may be reasonable for an instructor to use a debriefing script during resuscitation education.

Why: Scripted debriefing involves the creation of a written plan for debriefing learners during and/or following life support training. Standardized debriefing helps to maintain consistency in the delivery of debriefings across training centers and resuscitation programs. Six studies with varying outcomes were identified.

Use of Cognitive Aids

2025 (New): It may be reasonable for health care professionals to use cognitive aids during resuscitation.

2025 (New): It is not recommended for lay rescuers to use cognitive aids during resuscitation.

Why: Cognitive aids are resources that provide prompts aimed at encouraging recall of information and increasing the likelihood of correct performance and behaviors. Published simulation data suggest that cognitive aid use by health care professionals may improve resuscitation performance. In lay rescuers, cognitive aid use was associated with significant delays in starting CPR, leading to a recommendation against their use for lay rescuers.