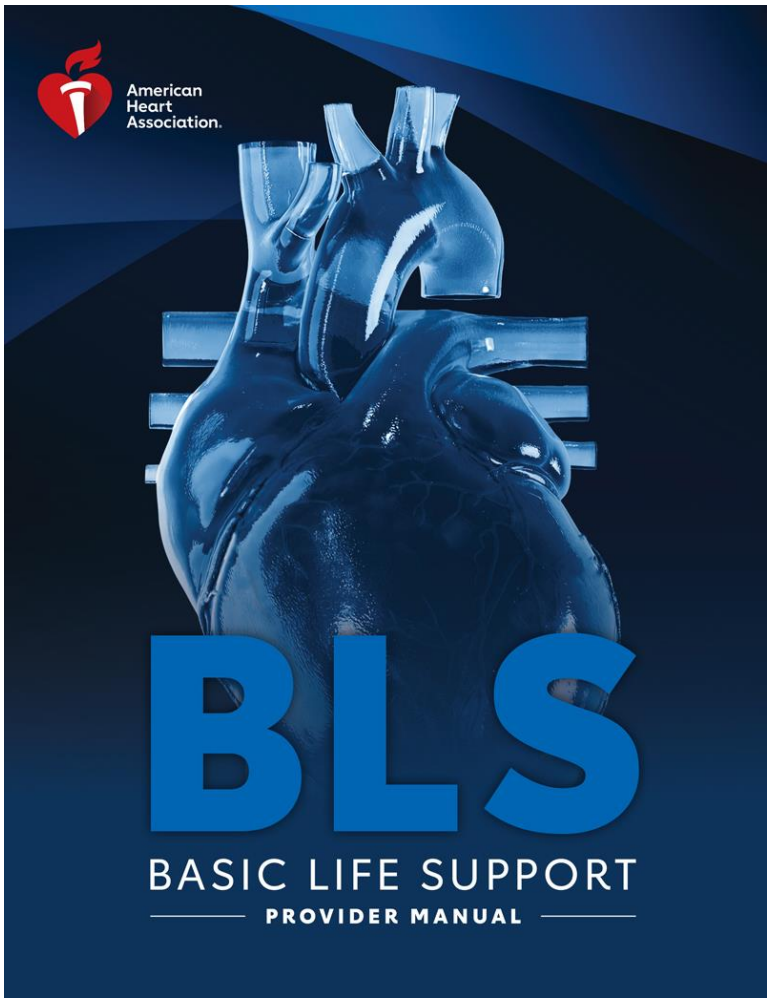
American
Heart
Association.
BLS
BASIC LIFE SUPPORT
PROVIDER MANUAL

Basic Life Support

PROVIDER MANUAL

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To find out about any updates or corrections to this text, visit **heart.org/courseupdates**.

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Appendix

Abbreviations

Abbreviation	Definition
AED	automated external defibrillator
AHA	American Heart Association
ALS	advanced life support
AP	anteroposterior
BLS	basic life support
CCF	chest compression fraction
CPR	cardiopulmonary resuscitation
ECG	electrocardiogram
ED	emergency department
EMS	emergency medical services
FBAO	foreign-body airway obstruction
LUD	lateral uterine displacement
PAD	public access defibrillation
PALS	pediatric advanced life support
PPE	personal protective equipment
pVT	pulseless ventricular tachycardia
ROSC	return of spontaneous circulation
T-CPR	telecommunicator-assisted cardiopulmonary resuscitation
TIA	transient ischemic attack

Part 1
General Course Concepts

Welcome to the American Heart Association Basic Life Support (BLS) Provider Course. BLS is the foundation for saving lives after cardiac arrest. In this course, you will learn the skills of high-quality cardiopulmonary resuscitation (CPR) for people of all ages. You will practice delivering these skills both as a single rescuer and as a member of a multirescuer team. The skills you learn in this course will enable you to

- Recognize cardiac arrest
- Activate the emergency response system early
- Respond quickly and confidently

Despite important advances in prevention, sudden cardiac arrest remains a leading cause of death in many countries. About half of cardiac arrests are unwitnessed. Outcome from out-of-hospital cardiac arrest remains poor. Only about 10% of adult patients with nontraumatic cardiac arrest who are treated by emergency medical services (EMS) survive to hospital discharge.

This course will help you give people in cardiac arrest the best chance of survival.

BLS Course Objectives

The BLS Course focuses on what you need to know to perform high-quality CPR in a wide variety of settings. You will also learn how to respond to choking and other types of life-threatening emergencies.

After successfully completing the BLS Course, you should be able to

- Describe the importance of high-quality CPR and its impact on survival
- Apply the BLS concepts of the Chain of Survival
- Recognize the signs of someone needing CPR
- Perform high-quality CPR for an adult, a child, and an infant
- Perform chest compressions using correct hand placement at the correct rate and depth with chest recoil
- Demonstrate effective breaths or ventilation
- Describe the importance of early use of an automated external defibrillator (AED)
- Demonstrate how to use an AED
- Perform as an effective team member during multirescuer CPR

- Describe how to relieve a foreign-body airway obstruction (FBAO) for an adult, a child, and an infant
- Describe how to help someone in an opioid-associated emergency
- Describe how to perform high-quality CPR on a pregnant person, including manual lateral uterine displacement (LUD), during maternal cardiac arrest
- Describe the Drowning Chain of Survival
- Recognize signs of a heart attack
- Describe actions to help someone having a heart attack

Course Description

This course prepares you to perform high-quality CPR skills. CPR is a lifesaving procedure for a person who has signs of cardiac arrest (ie, unresponsive, no normal breathing, no pulse). The 2 key components of CPR are **chest compressions** and **breaths**.

High-quality CPR improves a person's chances of survival. Study and practice the characteristics of high-quality CPR so that you can perform each skill effectively.

Critical Concepts

High-Quality CPR

- Start compressions within 10 seconds after recognizing cardiac arrest.
- Push hard, push fast: Compress at a rate of 100 to 120/min with a depth of
    - –At least 2 inches (5 cm) but no more than 2.4 inches (6 cm), for adults
    - –At least one third the AP diameter of the chest, or approximately 2 inches (5 cm), for children
    - –At least one third the AP diameter of the chest, or approximately 1½ inches (4 cm), for infants
- Allow complete chest recoil after each compression. Avoid leaning on the chest between compressions.
- Minimize interruptions in compressions (limit interruptions to less than 10 seconds).
- Give effective breaths. Deliver each breath over 1 second, using only enough volume to make the person's chest rise. Avoid excessive ventilation.

Completion Requirements

To successfully complete this course and receive your BLS course completion card, you must do the following:

- Participate in hands-on interactive demonstrations of high-quality CPR skills

- Pass the Adult CPR and AED Skills Test
- Pass the Infant CPR Skills Test
- Achieve a minimum passing score of 84% on the written exam of the instructor-led course, or successfully complete the online portion of the Heartcode BLS Course.

Skills Tests

You must pass 2 skills tests to receive your BLS course completion card. During the course, you will have an opportunity to learn and practice chest compressions, bag-mask ventilation, and using an AED. After practice, your instructor will test your skills by reading a brief scenario. You will be asked to respond as you would in a real-life situation. The instructor will not coach or help you during the skills tests.

Exam

The exam is open resource. This means that you may refer to print or digital resources while you are taking the exam. You may not, however, discuss the exam questions with other students or your instructor. Examples of resources that you may use include notes you take in class, this provider manual, and the American Heart Association's *2025 Handbook of Emergency Cardiovascular Care for Health Care Professionals*.

Your Approach to a Resuscitation Attempt

The BLS techniques and sequences you will learn offer 1 approach to a resuscitation attempt. But every situation is unique. Your response will be determined by

- Available emergency equipment
- Availability of trained rescuers
- Level of training expertise
- Local protocols

Personal Protective Equipment

Personal protective equipment (PPE) helps protect rescuers from health or safety risks. PPE varies based on situations and protocols. It can include a combination of items, such as medical gloves, eye protection, gowns or full-body suits, high-visibility clothing, safety footwear, and safety helmets.

Ask your employer, local health authority, or regulatory body about the PPE protocols for your role. For specific infectious diseases, you should consult the Centers for Disease Control and Prevention or the Association for Professionals in Infection Control and Epidemiology for additional information.

The *BLS Provider Manual*

Read your *BLS Provider Manual* carefully. Study the skills and lifesaving sequences. During the course, you'll apply this knowledge as a rescuer in simulated emergency scenarios. Your *BLS Provider Manual* can serve as a resource long after you complete your course.

Age Definitions

In this course, age definitions are as follows:

- Infants: younger than 1 year (excluding newly born infants in the delivery room)
- Children: 1 year of age to puberty (signs of puberty are chest or underarm hair in male individuals; any breast development in female individuals)
- Adults: adolescents (ie, after the onset of puberty) and older

Callout Boxes

This manual includes Critical Concepts boxes that call attention to specific content.

Critical Concepts

These boxes contain important information you must know, including background on key topics and specific risks associated with certain interventions.

Part 2
The Chain of Survival

For many years, the American Heart Association has adopted, supported, and helped develop the concept of emergency cardiovascular care. The term *Chain of Survival* provides a useful metaphor for the elements of the emergency cardiovascular care systems-of-care concept. The Chain of Survival shows the actions that must take place to give the person in cardiac arrest the best chance of survival. Each link is independent, yet connected, to the links before and after. If any link is broken, the chance for a good outcome decreases.

Learning Objectives

At the end of this Part, you will be able to

- Describe the importance of high-quality CPR and its impact on survival
- Apply the BLS concepts of the Chain of Survival

Overview

Cardiac arrest can happen anywhere—on the street, at home, or in a hospital emergency department (ED), inpatient bed, or intensive care unit. Elements in the system of care and order of actions in the Chain of Survival differ based on the situation. Care will depend on whether the person has the arrest outside the hospital or inside the hospital. Care also depends on whether the person is an adult, a child, or an infant.

Prevention of cardiac arrest is the foundation of the Chain of Survival (Figure 1). *Prevention* includes measures to improve the health of individuals and communities. It includes public awareness programs and training to help people recognize the signs of a heart attack and cardiac arrest and to take effective action. Community CPR training and emergency response system development are important.

Figure 1. The American Heart Association 2025 Cardiac Arrest Chain of Survival.

Emergency telecommunicators (ie, call takers, dispatchers) who give CPR instructions help increase rates of lay rescuer CPR and improve outcomes. This telecommunicator-assisted CPR (T-CPR) enables the general public to perform high-quality CPR and early defibrillation.

Mobile phone apps or text messages can be used to summon members of the public who are trained in CPR. Mobile phone apps and mapping can help rescuers locate the nearest AED.

Widespread AED availability supports early defibrillation and saves lives. Public access defibrillation (PAD) programs are designed to reduce the time to defibrillation by placing AEDs in public places and training laypeople to use them.

For adult patients in the hospital, cardiac arrest usually happens because of serious respiratory or circulatory conditions that get worse. Health care professionals can predict and prevent many of these arrests by careful observation, preventive care, and early treatment of prearrest conditions.

Once a health care professional recognizes cardiac arrest, immediate activation of the emergency response system, early high-quality CPR, and rapid defibrillation are essential. Many institutions conduct ongoing training in resuscitation response. Some maintain rapid response teams or medical emergency teams.

Chain of Survival Links

Each link in the Chain of Survival represents the important interventions applicable to adults, children, and infants, both in and out of the hospital. The links in the Chain of Survival include the following:

- Recognition and Emergency Activation
- High-Quality CPR
- Defibrillation
- Advanced Resuscitation
- Post–Cardiac Arrest Care

- Recovery and Survivorship

In the in-hospital setting, the Chain of Survival interventions focus on prevention and early recognition of cardiac arrest with patient monitoring and assessment and, if necessary, rapid response by the medical emergency team when a patient's condition starts to deteriorate.

There is a separate newborn chain of care that provides a framework for considering essential elements of the health care system related to neonatal health. A strong newborn chain of care has the potential to improve health in the neonatal period and long-term outcomes. The links include prevention, recognition and activation, initial steps, ventilation, advanced resuscitation, postnatal care, and recovery. Although the newborn population is not a main focus for BLS, many BLS professionals may encounter situations where they would need to know the initial steps and immediate response before the arrival of the advanced neonatal resuscitation team.

Recognition and Emergency Activation

As a rescuer, the first step to take is to assess the surroundings for safety. After ensuring the scene is safe, check for responsiveness in an adult and child by tapping the person's shoulders and shouting, "Hey! Are you OK? Are you OK?" When assessing an infant's responsiveness, you will tap the infant's heel. Someone who is responsive moves, speaks, blinks, or otherwise reacts when you do this. If the person is not responsive, activate the emergency response system.

Activating the emergency response system usually means shouting for nearby help and calling 911 or the local emergency response number. In the workplace, every employee should know how to activate the emergency response system in their setting. The sooner a rescuer activates the emergency response system, the sooner the next level of care will arrive.

Activation of the emergency response system may include summoning the rapid response team by using a mobile device (Figure 2A) or by using an emergency response button (Figure 2B). If another rescuer is present, you may ask them to help activate the emergency response system and get help. Ensure that you follow your institution's protocols to activate the emergency response system.

Figure 2A. **Activate the emergency response system in your setting. A, Using a mobile device.**

Figure 2B. **Using an emergency response button.**

To minimize delay in starting CPR, you should assess breathing at the same time as you check for a pulse. Check for breathing by scanning the person's chest. Watch their chest for at least 5 but no more than 10 seconds to see if it rises. If the person is not responding, not breathing normally, and does not have a pulse, start CPR.

High-Quality CPR

High-quality CPR with minimal interruptions and early defibrillation are the actions most closely associated with good resuscitation outcomes. High-quality CPR started immediately after cardiac arrest combined with early defibrillation can double or triple the chances of survival. These time-sensitive interventions can be provided both by members of the public and by health care professionals. Lay rescuers who are not trained in CPR should at least provide chest compressions (also called *Hands-Only CPR*) for teens or adults. Even without training, lay rescuers can perform chest compressions with guidance over the phone from emergency telecommunicators (ie, T-CPR).

Defibrillation

Defibrillation should be provided promptly, with either a monitor/defibrillator or an AED. Health care professionals and members of the public should provide early defibrillation as soon as a device is available. Early defibrillation by lay rescuers is associated with improved survival to hospital discharge and 30-day and 1-year survival rates in adults and children.

PAD programs are recommended in communities at high risk for out-of-hospital cardiac arrest. These programs are designed to reduce time to defibrillation by placing AEDs in public places and training community members in how to use them.

Advanced Resuscitation

For both in-hospital and out-of-hospital settings, high-quality CPR and defibrillation are not only key interventions, they are also the foundation of a successful outcome.

Lay rescuers provide high-quality CPR and defibrillation with an AED until a multirescuer team takes over the resuscitation attempt. This high-performance team will continue high-quality CPR and defibrillation and may perform advanced interventions.

Advanced interventions may be performed by medically trained professionals during a resuscitation attempt. Examples include obtaining vascular access, giving medications, placing an advanced airway, and obtaining a 12-lead electrocardiogram (ECG) or starting advanced cardiac monitoring.

The high-performance team in a hospital may include physicians, nurses, respiratory therapists, pharmacists, and others.

Post–Cardiac Arrest Care

After return of spontaneous circulation (ROSC), all patients with cardiac arrest should receive post–cardiac arrest care. Post–cardiac arrest care includes routine critical care support, such as artificial ventilation and blood pressure management. This care begins in the field and continues during transport to a medical facility, with a focus on systems of care.

In the hospital, a multidisciplinary team provides this advanced level of care. Health care professionals focus on preventing the return of cardiac arrest, and they tailor specific therapies to improve long-term survival. Post–cardiac arrest care and neuroprognostication may occur in the ED, cardiac catheterization lab (or cath lab), intensive care unit, or coronary care unit.

The patient may undergo a cardiac catheterization procedure. During this procedure, a catheter is inserted in an artery (most frequently the groin or wrist) and threaded through the blood vessels to the patient's heart to evaluate heart function and blood flow. Some cardiac problems, such as a blocked artery, may be fixed or other problems diagnosed.

Recovery and Survivorship

Recovery from cardiac arrest continues long after hospital discharge. Depending on the outcome, survivors of cardiac arrest may need specific interventions to address the underlying cause of cardiac arrest or to provide cardiac rehabilitation. Some patients need rehabilitation focused on neurological recovery. Survivors and their caregivers will need support that includes a multimodal approach for recovery.

Psychological support for patients and families is important during the recovery period. Rescuers also may benefit from psychological support. Rescuers and caregivers may benefit from additional support for resiliency, burnout prevention, and effective debriefing after the event.

Comparison of the In-Hospital and Out-of-Hospital Settings

Table 1 shows key differences in initial support, resuscitation teams, and available resources between the in-hospital and out-of-hospital settings. Resuscitation constraints and level of complexity are the same in both settings.

Table 1. Comparison of In-Hospital and Out-of-Hospital Settings

Comparator	In-hospital cardiac arrest	Out-of-hospital cardiac arrest
Initial support	Depends on an in-hospital system of appropriate monitoring, prevention, and intervention with responsive primary health care teams	Depends on community and EMS professionals for support
Resuscitation teams	Resuscitation efforts depend on • The smooth interaction of an institution's various departments and services (such as the patient ward, ED, cardiac cath lab, and intensive care unit) • A multidisciplinary team of health care professionals that includes physicians, nurses, respiratory therapists, pharmacists, counselors, and others	Resuscitation efforts depend on • Lay rescuers who recognize an unresponsive person and quickly activate the emergency response system • Lay rescuers who perform CPR and use an AED (if available) until a high-performance team takes over resuscitation efforts • EMS that responds with a high-performance team providing resuscitation and transport as needed for continued care
Available resources	Depending on the facility, in-hospital multidisciplinary teams may have immediate access to additional personnel as well as the resources of the ED, cardiac cath lab, and intensive care unit.	Available resources may be limited in the out-of-hospital settings: • AED access: AEDs may be available through a local PAD program or included in emergency or first aid equipment. • Untrained rescuers: T-CPR helps untrained rescuers perform high-quality CPR. • EMS high-performance teams: The only resources may be those they bring with them. Additional backup resources and equipment may take some time to arrive.
Resuscitation constraints	Factors that may affect both the in-hospital and out-of-hospital settings include crowd control, family presence, space constraints, resources, patient transport, and device failures.	
Level of complexity	Resuscitation attempts, both in and out of the hospital, are typically complex. They require teamwork and coordination between rescuers and health care professionals.	

Part 3
BLS for Adults

This section describes BLS for adults. You will learn to perform high-quality CPR skills, both as a single rescuer and as a member of a multirescuer team.

Use adult BLS skills for adolescents (ie, after the onset of puberty) and older.

Learning Objectives

At the end of this Part, you will be able to

- Recognize the signs of someone needing CPR
- Perform high-quality CPR for an adult
- Perform chest compressions using correct hand placement at the correct rate and depth with chest recoil
- Demonstrate effective breaths or ventilation
- Describe the importance of early use of an AED
- Demonstrate how to use an AED
- Perform as an effective team member during multirescuer CPR
- Describe how to perform high-quality CPR on a pregnant person, including manual LUD, during maternal cardiac arrest

Basic Framework for CPR

Anyone can be a lifesaving rescuer for a person in cardiac arrest (Figure 3). The particular CPR skills a rescuer uses depend on several variables, such as level of training, experience, and confidence (ie, rescuer proficiency). Other variables are the type of person in cardiac arrest (eg, child vs adult), available equipment, and the availability of other rescuers. A single rescuer with limited training or who has training but limited equipment can do Hands-Only CPR. A rescuer with more training can do cycles of CPR with 30 compressions and 2 breaths. When several rescuers are present, they can perform multirescuer-coordinated CPR.

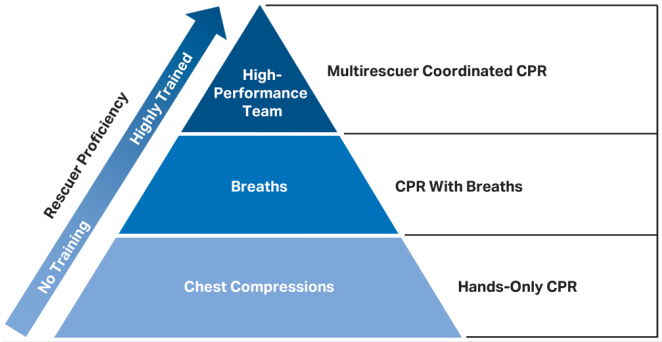

Figure 3. **Building blocks of CPR.**

Here are some examples:

- **Hands-Only CPR:** A single rescuer with little training and no equipment who witnesses a teen or an adult in cardiac arrest might provide only chest compressions until help arrives.
- **30:2 CPR:** A police officer trained in BLS who finds an adolescent in cardiac arrest will provide both chest compressions and breaths by using a ratio of 30 compressions to 2 breaths.
- **High-performance team:** Three emergency responders who are called to assist a woman in cardiac arrest will perform multirescuer coordinated CPR. Rescuer 1 performs chest compressions, rescuer 2 gives breaths with a bag-mask device, and rescuer 3 uses the AED. Rescuer 3 also assumes the role of CPR Coach. A CPR Coach helps team members perform high-quality CPR and minimize pauses in chest compressions.

High-Performance Teams

Coordinated efforts by several rescuers during CPR may increase the chances for a successful resuscitation. High-performance teams divide tasks among team members during a resuscitation attempt.

As a team member, you will want to perform high-quality CPR skills to make your maximum contribution to each resuscitation team effort.

Refer to Part 5: Team Dynamics for more information on team dynamics.

Main Components of CPR

The main components of CPR are

- Chest compressions
- Airway
- Breathing

You will learn about each of these throughout this course.

Adult BLS Algorithm

The Adult BLS Algorithm for Health Care Professionals outlines steps for single rescuers and multiple rescuers of an unresponsive adult (Figure 4). Use this algorithm as a quick reference for providing high-quality CPR to an adult who is in cardiac arrest.

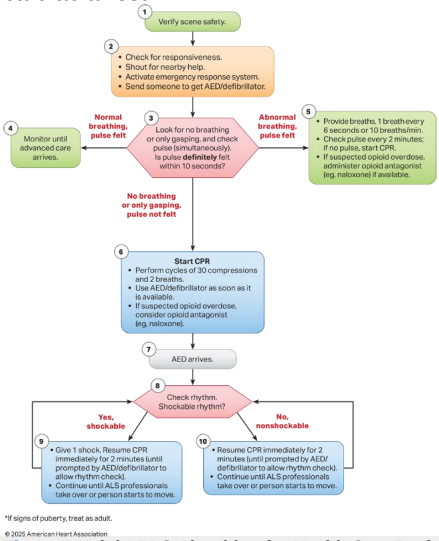

Figure 4. Adult* BLS Algorithm for Health Care Professionals.

Adult 1-Rescuer BLS Sequence

This is your step-by-step guide to providing high-quality CPR when you encounter an unresponsive adult. The numbered steps correspond to the steps on the Adult BLS Algorithm for Health Care Professionals (Figure 4).

A rescuer who arrives at the side of a person with potential cardiac arrest should quickly perform the following steps:

Step 1: Verify scene safety.

- Make sure that the scene is safe for you and the person.

Step 2: Check for responsiveness, shout for nearby help, activate the emergency response system, and send someone to get an AED/defibrillator.

- Tap the person's shoulders and shout, "Hey! Are you OK? Are you OK?"
- If the person is not responsive, activate the emergency response system. Get the AED/defibrillator or send someone to do so.

Step 3: Look for no breathing or only gasping, and check pulse (simultaneously).

- Next, assess the person for normal breathing and a pulse (Figure 5) to determine next actions.
- *To minimize delay in starting CPR, you should assess breathing and pulse at the same time. This should take at least 5 but no more than 10 seconds*.
- For detailed instructions on checking for breathing and a pulse in an adult, refer to the Breathing and Checking for the Carotid Pulse on an Adult sections in this Part.

Step 4: If the person is breathing normally and a pulse is felt:

- Monitor until advanced care arrives.

Step 5: If the person has abnormal breathing and a pulse is felt:

- Provide breaths, with 1 breath every 6 seconds or 10 breaths per minute.
- Check pulse every 2 minutes; if there's no pulse, start CPR.
- If an opioid overdose is suspected, administer an opioid antagonist (eg, naloxone), if available.

Step 6: If the person is not breathing or is only gasping and a pulse is not felt:

- Start CPR.
    - –Perform cycles of 30 compressions and 2 breaths.
    - –Use AED/defibrillator as soon as it is available.

- –If an opioid overdose is suspected, administer an opioid antagonist (eg, naloxone), if available.

Step 7: The AED arrives.

- Turn on the AED and follow the prompts.

Step 8: Check rhythm. Is it shockable?

- Follow the AED prompts.

Step 9: Yes, the AED identifies a shockable rhythm.

- Give one shock. Immediately resume CPR for 2 minutes (until prompted by the AED/defibrillator to allow for a rhythm check).
- Continue until ALS professionals take over or the person starts to move.

Step 10: No, the AED identifies a nonshockable rhythm.

- Immediately resume CPR for 2 minutes (until prompted by the AED/defibrillator to allow for a rhythm check).
- Continue until ALS professionals take over or the person starts to move.

High-Quality CPR Skills: Adults

Learning the skills in this section will prepare you to provide high-quality CPR to adults.

Assess for Breathing and a Pulse

Assess the person for normal breathing and a pulse (Figure 5). This will help you determine the next appropriate actions.

To minimize delay in starting CPR, you should assess breathing at the same time as you check the pulse. This should take at least 5 seconds but no more than 10 seconds.

Breathing

To check for breathing, scan the person's chest for rise and fall for at least 5 but no more than 10 seconds.

- **If the person is breathing:** Monitor the person until additional help arrives.
- **If the person is not breathing or is only gasping:** Be prepared to begin high-quality CPR. Gasping is not normal breathing and is a sign of cardiac arrest. Seizure-like activity may occur immediately after cardiac arrest.

Critical Concepts
Agonal Gasps

Agonal gasps may be present in the first minutes after sudden cardiac arrest. Agonal gasps are not normal breathing and may sound like a gasp, snort, snore, or groan.

A person who gasps usually appears to be drawing air in very quickly. The mouth may be open, and the jaw, head, or neck may move with gasps. Gasps may appear forceful or weak. Some time may pass between gasps because they usually happen at a slow, irregular rate. Gasping is not normal breathing. It is a sign of cardiac arrest.

Critical Concepts
Seizure-Like Activity

During cardiac arrest, a person will become unresponsive and collapse. They can look like they are having a seizure for the first few minutes. They might stop breathing or may only gasp, which can sound like a snort, snore, or groan.

Checking for the Carotid Pulse on an Adult

To perform a pulse check on an adult, feel for a carotid pulse (Figure 5).

If you do not definitely feel a pulse within 10 seconds, begin high-quality CPR, starting with chest compressions.

Figure 5. Check for breathing and a pulse at the same time.

Follow these steps to feel for and find the carotid pulse:

- Locate the trachea (on the side closest to you) using 2 or 3 fingers (Figure 6A).
- Slide those fingers into the groove between the trachea and the muscles at the side of the neck, where you can feel the carotid pulse (Figure 6B).
- Feel for a pulse *for at least 5 but no more than 10 seconds*. If you do not definitely feel a pulse, begin CPR, starting with chest compressions.

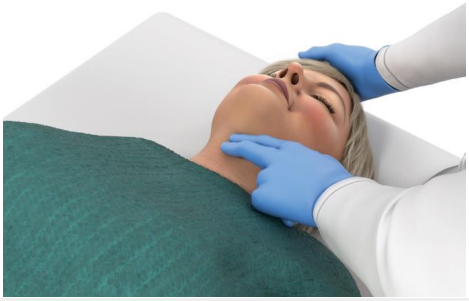

Figure 6A. Finding the carotid pulse. A, Locate the trachea.

Figure 6B. Gently feel for the carotid pulse.

In all scenarios, by the time a breathing-and-pulse check indicates cardiac arrest, the following should already be happening:

- Someone has activated the emergency response system.
- Someone has gone to get the AED.

Perform High-Quality Chest Compressions

The foundation of CPR is high-quality chest compressions. Compressing the chest during CPR pumps blood from the heart to the brain and then to the rest of the body. Each time you stop chest compressions, the blood flow from the heart to the brain and other organs decreases significantly. Once you resume compressions, it takes several compressions to bring the blood flow back up to the levels present before the interruption. Thus, the more often you interrupt chest compressions and the longer the interruptions are, the lower the blood supply to the brain and critical organs.

When a person is not breathing normally or is only gasping and has no pulse, begin CPR, starting with chest compressions. There is no difference in how you perform CPR related to a person's sex or gender.

Position the Person

Position the person faceup on a firm, flat surface, such as the floor or a backboard. This will help ensure that the chest compressions are as effective as possible. If the person is on a soft surface, such as a mattress, the force from the chest compressions will simply push the person's body into the soft surface. A firm surface allows compression of the chest and the heart to create adequate blood flow. Quickly move bulky clothing out of the way. If a person's clothes are difficult to remove, you can still provide compressions over the clothing. However, if they are wearing sports equipment or safety gear, you may need to remove it.

Compression-to-Ventilation Ratio

Single rescuers should use the compression-to-ventilation ratio of 30 compressions to 2 breaths when giving CPR to people of any age.

Compression Rate

Compress at a rate of 100 to 120/min. This compression rate is the same for all cardiac arrests.

Compression Depth

Compress the chest at least 2 inches (5 cm). As you practice this skill, remember that chest compressions are more often too shallow than too deep. However, it is possible to compress too deeply. Compressing the chest more than 2.4 inches (6 cm) in adults may decrease effectiveness of the compression and cause injuries. Using a CPR-quality feedback device can help you reach the optimal compression depth of 2 to 2.4 inches (5-6 cm).

Chest Recoil

Allow the chest to recoil (re-expand) completely after each compression. Chest recoil (re-expansion of the chest) allows blood to flow into the heart. Incomplete chest recoil reduces the filling of the heart between compressions and reduces the blood flow created by chest compressions. To help ensure complete recoil, avoid leaning on the chest between compressions. Chest compression and chest recoil times should be about equal.

Interruptions in Chest Compressions

Minimize interruptions in chest compressions. Shorter duration of interruptions in chest compressions is associated with better outcomes. The proportion of time that rescuers perform chest compressions during CPR is called *chest compression fraction* (CCF). A CCF of at least 60% increases the likelihood of ROSC, shock success, and survival to hospital discharge. With good teamwork and training, rescuers often can achieve 80% or greater. This should be the goal in all team resuscitation events.

Do not move the person while CPR is in progress unless the person is in a dangerous environment (such as a burning building) or you believe you cannot perform CPR effectively under the current circumstances.

When help arrives, the resuscitation team may choose to continue CPR at the scene or transport the person to an appropriate facility while continuing rescue efforts, depending on local protocol. High-quality BLS is key at all times during the resuscitation event.

Chest Compression Technique

Follow these steps to perform chest compressions on an adult:

1. Position yourself at the person’s side.

    a. Make sure the person is lying faceup on a firm, flat surface. If the person is facedown, carefully roll them over. If you suspect a head or neck injury, try to keep the head, neck, and torso in a line when rolling the person to a faceup position. It is best if someone can help you roll the person.
2. Position your hands and body to perform chest compressions:
    a. Place the heel of one hand in the center of the person's chest, on the lower half of the sternum (Figure 7A).
    b. Put the heel of your other hand on top of the first hand.
    c. Straighten your arms and position your shoulders directly over your hands.
3. Give chest compressions at a rate of 100 to 120/min.
4. Press down at least 2 inches (5 cm) with each compression; this requires hard work. For each chest compression, make sure you push straight down on the person's sternum (Figure 7B).
5. At the end of each compression, always allow the chest to recoil completely. Avoid leaning on the chest between compressions.
6. Minimize interruptions of chest compressions. (You will learn to combine compressions with ventilation next.)

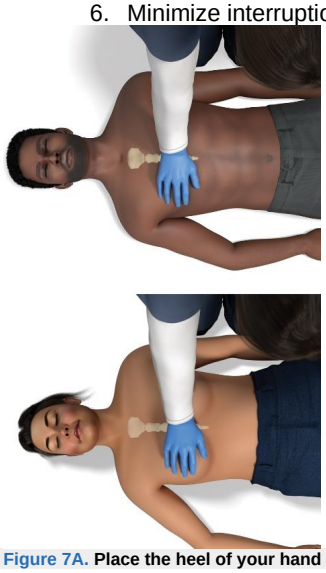

Figure 7A. Place the heel of your hand on the sternum, in the center of the chest.

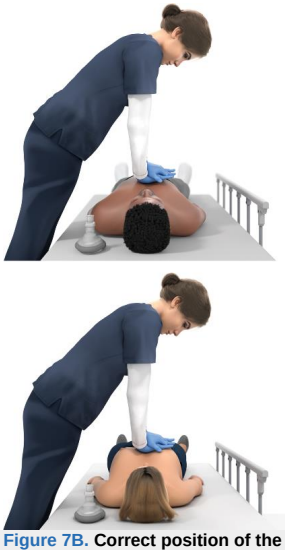

Figure 7B. Correct position of the rescuer during chest compressions.

Alternate Technique for Chest Compressions

If you have difficulty pushing deeply during compressions, do the following:

- Put one hand on the sternum to push on the chest.
- Grasp the wrist of that hand with your other hand to support the first hand as you push down on the chest.

This technique may be helpful for rescuers with joint conditions, such as arthritis.

Compressions for a Pregnant Person

Do not delay providing chest compressions for a pregnant person in cardiac arrest. High-quality CPR, including respiratory support and early medical intervention, increases the chance of survival for both the pregnant person and the infant. If you do not perform CPR on a pregnant person when needed, the lives of both are at risk. Perform high-quality chest compressions and ventilation for a pregnant person just as you would for anyone in cardiac arrest. For more information, refer to Figure 9 and Cardiac Arrest in Pregnancy: BLS Considerations later in this Part.

Be aware that when a visibly pregnant person (approximately 20 weeks) is lying flat and faceup (or supine), the uterus compresses the large blood vessels in the abdomen. This pressure can interfere with blood flow to the heart generated by the chest compressions. If additional help is available, rescuers should perform manual LUD (ie, manually moving the uterus to the person's left to relieve the pressure on the large blood vessels), which can help relieve this pressure. To do this, use 1 or 2 hands to manually shift the abdomen to the left.

If additional rescuers are present and rescuers are trained, perform continuous LUD in addition to high-quality BLS (Figure 8). Remember, if you are a single rescuer, perform high-quality chest compressions and ventilations for a pregnant person just as you would for anyone in cardiac arrest. If the person is revived, place them on their left side. This may help improve blood flow to the heart and, therefore, to the fetus.

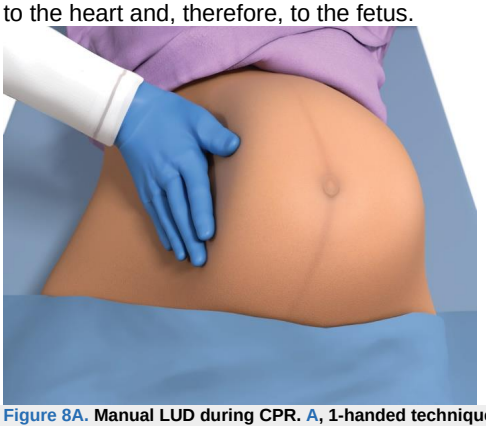

Figure 8A. Manual LUD during CPR. A, 1-handed technique.

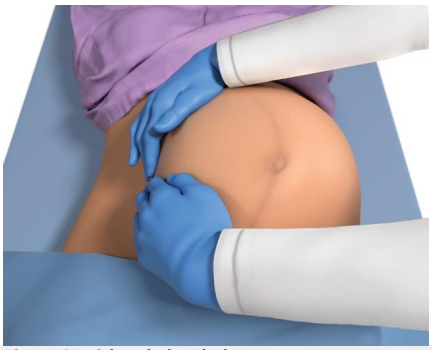

Figure 8B. 2-handed technique.

Critical Concepts

Perform High-Quality Chest Compressions

- Use a ratio of 30 compressions to 2 breaths.
- Compress at a rate of 100 to 120/min, with a depth of at least 2 inches (5 cm) for adults.
- Allow complete chest recoil after each compression. Do not lean on the chest between compressions.
- Minimize interruptions in chest compressions. Try to limit pauses in compressions to less than 10 seconds. The goal is a CCF of at least 60%; with good teamwork, rescuers often can achieve 80% or higher.

Cardiac Arrest in Pregnancy Algorithm

This is your step-by-step guide to providing high-quality CPR when you encounter an unresponsive pregnant adult (Figure 9).

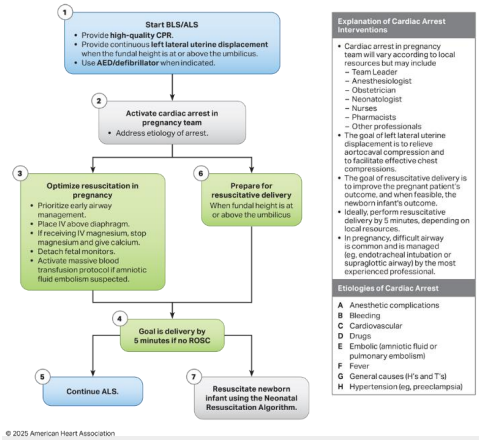

Figure 9. Cardiac Arrest in Pregnancy Algorithm.

Cardiac Arrest in Pregnancy Sequence

Step 1: Start BLS.

- **Provide high-quality CPR.**
  - –Start cycles of CPR with 30 chest compressions followed by 2 breaths (refer to Critical Concepts: High-Quality CPR in Part 1 and Critical Concepts: Perform High-Quality Chest Compressions in this Part).
  - –Remove bulky clothing and undergarments from the person's chest so that you can locate appropriate hand placement for compressions and pad placement when the AED arrives.
- **Provide continuous left LUD when the fundal height is at or above the umbilicus.**
  - –If additional rescuers are present and rescuers are trained, perform continuous LUD to relieve pressure on major vessels in the abdomen to help with blood flow (Figure 8) during high-quality BLS. If the person is revived, place them on their left side. This may help improve blood flow to the heart and, therefore, to the fetus.
- **Use the AED/defibrillator when indicated.**
  - –Turn on the AED as soon as it becomes available and follow the AED prompts.

- If the AED detects a shockable rhythm, follow the AED prompts to deliver a shock. After the shock, immediately resume CPR and use the AED until ALS professionals take over or the person begins to breathe, move, or otherwise react.
- If the AED detects a nonshockable rhythm, resume high-quality CPR and follow the AED prompts. Continue CPR and using the AED until ALS professionals take over or the person begins to breathe, move, or otherwise react.

Step 2: Activate the cardiac arrest in pregnancy team.

- Address the etiology of arrest.

Open the Airway

For breaths to be effective, the person's airway must be open. When a person is unresponsive, the tongue can block the upper airway (Figure 10).

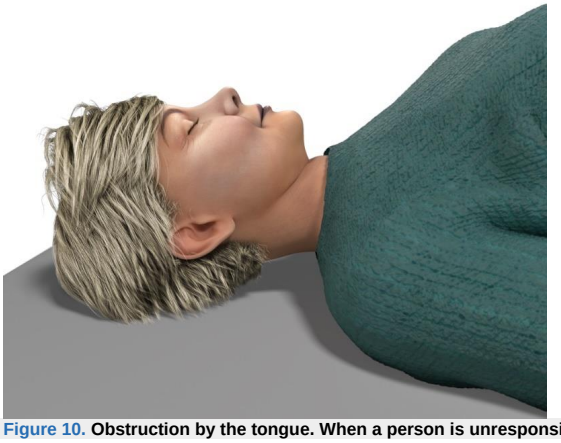

Figure 10. Obstruction by the tongue. When a person is unresponsive, the tongue can block the upper airway.

Two methods for opening the airway are

- Head tilt–chin lift
- Jaw thrust

Important: If you suspect a head or neck injury, use the jaw-thrust maneuver to reduce neck and spine movement. If the jaw thrust does not open the airway, use the head tilt–chin lift maneuver.

When multiple rescuers are available, one rescuer can perform a jaw thrust while another rescuer provides breaths with a bag-mask device. The third rescuer will give chest compressions.

Head Tilt–Chin Lift

Follow these steps to perform the head tilt–chin lift maneuver (Figure 11):

1. Place one hand on the person's forehead and push with your palm to tilt the head back.
2. Place the fingers of the other hand under the bony part of the lower jaw, near the chin.
3. Lift the jaw to bring the chin forward.

Figure 11. The head tilt–chin lift maneuver lifts the tongue, relieving the airway obstruction.

When performing a head tilt–chin lift, make certain that you

- Avoid pressing deeply into the soft tissue under the chin because this might block the airway
- Do not close the person's mouth completely

Jaw Thrust

When the head tilt–chin lift doesn't work or when you suspect a spinal injury, use the jaw-thrust maneuver (Figure 12).

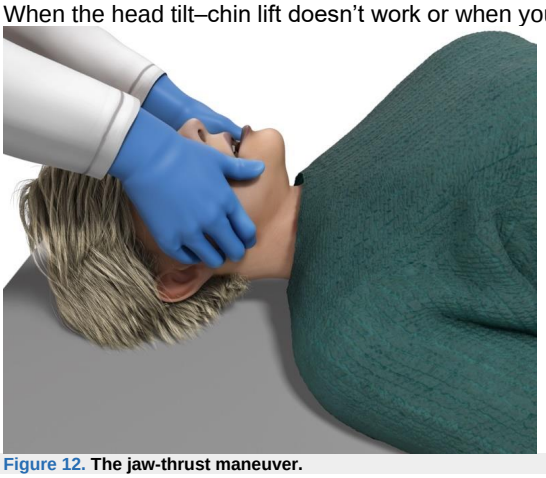

Figure 12. The jaw-thrust maneuver.

Follow these steps to perform a jaw thrust:

1. Position yourself at the person's head.
2. Place one hand on each side of the person's head. You may rest your elbows on the surface where the person is lying.
3. Place your fingers under the angle of the person's lower jaw and lift with both hands, displacing the jaw forward (Figure 12).
4. If the person's lips close, push the lower lip with your thumbs to open the lips.
    a. If the jaw thrust does not open the airway, use the head tilt–chin lift.

Barrier Devices for Giving Breaths

When giving breaths during CPR, it is standard precaution to use a barrier device, such as a pocket mask (preferred) or face shield. Rescuers should replace a face shield with a pocket mask at the first opportunity.

CPR is an aerosol-generating procedure; however, infection from CPR is extremely unlikely. Follow the Centers for Disease Control and Prevention and your local guidelines on how to keep yourself safe when performing CPR.

Pocket Masks

For mouth-to-mask breaths, use a pocket mask (Figure 13). Pocket masks usually have a 1-way valve that diverts exhaled air, blood, and bodily fluids away from the rescuer but allows the rescuer's breath to enter the person's mouth and nose.

Pocket masks are available in different sizes for adults, children, and infants (Figure 13). Ensure that you select a pocket mask that is the appropriate size. The mask must cover the person's mouth and nose completely without covering the eyes or extending below the bottom edge of the chin. Effective use of the pocket mask barrier device requires instruction and practice.

Figure 13. Adult, child, and infant pocket masks.

To use a pocket mask, position yourself at the person's side. This position is ideal for 1-rescuer CPR because you can give breaths and perform chest compressions without repositioning yourself every time you change from compressions to giving breaths.

Follow these steps to open the airway with a head tilt–chin lift and give breaths with a pocket mask:

1. Position yourself at the person's side.
2. Place the pocket mask on the person's face, using the bridge of the nose as a guide for correct positioning.
3. Seal the pocket mask against the face.
    a. Using your hand that is closer to the top of the person's head, place your index finger and thumb along the top edge of the mask.
    b. Place the thumb of your other hand along the bottom edge of the mask.
    c. Place the remaining fingers of your second hand along the bony margin of the jaw and lift the jaw. Perform a head tilt–chin lift to open the airway (Figure 11).
    d. While you lift the jaw, press firmly and completely around the outside edge of the mask to seal the pocket mask against the face (Figure 14).
4. Deliver each breath over 1 second, enough to make the person's chest rise.

It is important to ensure that there is an effective seal. Potential causes of a poor seal when using a pocket mask include facial hair, dentures, an ill-fitting mask, obesity, failure to lift the jaw, or the person having a small jaw or facial trauma. If you cannot get visible chest rise, let the head go back to its normal position. Then, reopen the airway and give another breath. Remember, do not stop compressions for more than 10 seconds to give breaths. If you continue to have trouble giving breaths, consider a possible airway obstruction.

Figure 14. Press firmly and completely around the outside edge of the mask to seal the pocket mask against the face.

Critical Concepts
Adult Breaths

Remember: When interrupting chest compressions to give 2 breaths with a barrier device, be sure that you

- Deliver each breath over 1 second
- Note visible chest rise with each breath
- Resume chest compressions in less than 10 seconds

Oxygen Content of Exhaled Air

The air we breathe in contains about 21% oxygen. The air we breathe out contains about 17% oxygen. This means that the breaths the rescuer provides have enough oxygen to help the person in cardiac arrest.

Bag-Mask Devices

Use a bag-mask device (Figure 15), if available, to provide positive-pressure ventilation to a person who is either not breathing or not breathing normally. The device comprises a ventilation bag attached to a face mask. If the bag is self-inflating, you may use it with or without an oxygen supply. If not attached to oxygen flow, it provides about 21% oxygen from room air. Some bag-mask devices include a 1-way valve. The type of valve may vary from one device to another.

Bag-mask devices are available in a variety of sizes. Common sizes are infant (small), child (medium), and adult (large). For a proper fit, the face mask should

- Extend from the bridge of the nose to just above the lower edge of the chin
- Cover the nose and mouth; make sure the mask does not apply pressure to the eyes (Figure 16)

The flexible, cushioned mask should provide an airtight seal. If the seal is not airtight, ventilation will be ineffective.

Bag-mask ventilation during CPR is more effective when 2 rescuers provide it together. One rescuer opens the airway and seals the mask against the face while the other squeezes the bag.

All BLS professionals should be able to use a bag-mask device. Proficiency in this ventilation technique requires practice.

If you are trained to use one, consider using an airway adjunct, such as an oropharyngeal airway or nasopharyngeal airway if one is available. Oropharyngeal airways and nasopharyngeal airways can be used by a trained professional to maintain a patent airway and facilitate appropriate ventilation by preventing the tongue from occluding the airway.

Figure 15. **Bag-mask device.**

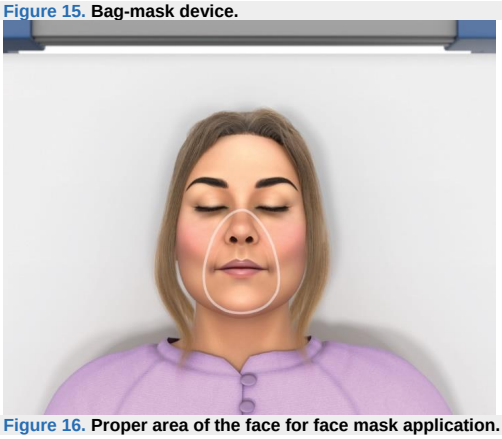

Figure 16. **Proper area of the face for face mask application. Note that the mask should not apply pressure to the eyes.**

Bag-Mask Device Technique for a Single Rescuer

To open the airway with a head tilt–chin lift and use a bag-mask device to give ventilations to the person, follow these steps:

1. Position yourself directly above the person's head.
2. Place the mask on the person's face, using the bridge of the nose as a guide for correct positioning. Use the E-C clamp technique to hold the mask in place while you lift the jaw to hold the airway open (Figure 17).

a. Perform a head tilt.
b. Place the mask on the face with the narrow portion at the bridge of the nose.
c. Use the thumb and index finger of one hand to make a “C” on the side of the mask, pressing the edges of the mask to the face.
d. Use the remaining fingers to lift the angles of the jaw (3 fingers form an “E”). Open the airway and press the face to the mask.

3. Squeeze the bag to give ventilations while watching for chest rise. Deliver each ventilation over 1 second, with or without the use of supplemental oxygen.

Be sure to avoid excessive ventilation. This could cause gastric inflation, which is air going into a person’s stomach instead of the lungs. Gastric inflation can cause vomiting and possible aspiration.

Figure 17A. E-C clamp technique of holding the mask while lifting the jaw. A, Side view.

Figure 17B. **Aerial view.**

Bag-Mask Device Technique for 2 or More Rescuers

When 3 or more rescuers are present, 2 of them working together can provide more effective and efficient bag-mask ventilation than 1 rescuer can. One person focuses on keeping the airway open and securing the mask while the second person squeezes the bag to deliver ventilations.

Two rescuers work together in this way (Figure 18):

1. Rescuer 1, positioned directly above the person, opens the airway and positions the bag-mask device, following the steps described in the Bag-Mask Device Technique for a Single Rescuer section.
    a. This rescuer should be careful to not press too hard on the mask because doing so could push the patient's jaw down and block the airway.
2. Rescuer 2, positioned at the person's side, squeezes the bag, delivering the ventilation.

Figure 18. Two-person bag-mask technique.

Ventilation for a Person With a Stoma or Tracheostomy Tube

When ventilating a person who has a stoma or tracheostomy tube, position the mask over the stoma or tube and use the previously described techniques. A pediatric mask may be more effective than an adult mask. If the chest doesn't rise, you may connect the bag-mask device directly to the tracheostomy tube. If the chest still does not rise, you may need to close the person's mouth while providing breaths over the stoma or tracheostomy tube.

Critical Concepts

Two Rescuers for Jaw Thrust and Bag-Mask Ventilation

During CPR, jaw thrust and bag-mask ventilation are more efficiently performed when 2 or more rescuers are providing ventilation. One rescuer must be positioned above the person's head and use both hands to open the airway, lift the jaw, and hold the mask to the face while the second rescuer squeezes the bag. The second rescuer is positioned at the person's side.

Adult 2-Rescuer BLS

When you encounter an unresponsive adult and other rescuers are available, work together to follow the steps outlined in the Adult BLS Algorithm for Health Care Professionals (Figure 4). When more rescuers are available for a resuscitation attempt, more tasks can be performed at the same time.

The first rescuer who arrives at the side of someone experiencing a potential cardiac arrest should quickly assess the scene for safety and check the person for responsiveness. This rescuer should send another rescuer to activate the emergency response system and get the AED. As more rescuers arrive, assign tasks. Additional rescuers can help with bag-mask ventilation, compressions, and using the AED.

Adult 2-Rescuer BLS Sequence

This is your step-by-step guide to providing high-quality CPR to an unresponsive adult when you are part of a multirescuer (2 or more) team. The numbered steps correspond to the steps on the Adult BLS Algorithm for Health Care Professionals (Figure 4).

The first rescuer who arrives at the side of a person with potential cardiac arrest should quickly perform Steps 1 and 2 and then begin high-quality CPR. As more rescuers arrive, assign tasks (refer to Roles and Responsibilities in Part 5). When more rescuers are available for a resuscitation attempt, they can perform more tasks at the same time.

Step 1: Verify scene safety.

- Make sure that the scene is safe for you and the person.

Step 2: Check for responsiveness, shout for nearby help, activate the emergency response system, and send someone to get an AED/defibrillator.

- Tap the person's shoulders and shout, "Hey! Are you OK? Are you OK?"
- If the person is not responsive, activate the emergency response system. Get the AED/defibrillator or send someone to do so.

Step 3: Look for no breathing or only gasping, and check pulse (simultaneously)

- Next, assess the person for normal breathing and a pulse (Figure 5) to determine next actions.
- *To minimize delay in starting CPR, you should assess breathing and pulse at the same time. This should take at least 5 but no more than 10 seconds*.
- For detailed instructions on checking for breathing and a pulse in an adult, refer to the Breathing and Checking for the Carotid Pulse on an Adult sections in this Part.

Step 4: If the person is breathing normally and a pulse is felt:

- Monitor until advanced care arrives.

Step 5: If the person has abnormal breathing and a pulse is felt:

- Provide breaths, with 1 breath every 6 seconds or 10 breaths per minute.

- Check pulse every 2 minutes; if there's no pulse, start CPR.
- If an opioid overdose is suspected, administer an opioid antagonist (eg, naloxone), if available.

Step 6: If the person is not breathing or is only gasping and a pulse is not felt:

- One rescuer starts CPR by performing cycles of 30 compressions and 2 breaths (refer to Critical Concepts: High-Quality CPR in Part 1 and Critical Concepts: Perform High-Quality Chest Compressions in this Part). Remove bulky clothing from the person's chest so that you can locate appropriate hand placement for compressions. Removing the clothing will also aid in more rapid AED pad placement when the AED/defibrillator arrives.
- Once the second rescuer returns and assists in providing 2-rescuer CPR, switch compressors frequently (about every 2 minutes or 5 cycles, typically when the AED/defibrillator is analyzing the rhythm). This helps ensure that compressor fatigue does not reduce CPR quality (refer to Critical Concepts: High-Performance Teams in this Part).

Step 7: The AED arrives.

- Turn on the AED and follow the prompts.

Step 8: Check rhythm. Is it shockable?

- Follow the AED prompts.

Step 9: Yes, the AED identifies a shockable rhythm.

- Give 1 shock. Immediately resume CPR for 2 minutes (until prompted by the AED/defibrillator to allow for a rhythm check).
- Continue until ALS professionals take over or the person starts to move.

Step 10: No, the AED identifies nonshockable rhythm.

- Immediately resume CPR for 2 minutes (until prompted by the AED/defibrillator to allow for a rhythm check).
- Continue until ALS professionals take over or the person starts to move.

Team Roles and Duties for 2 or More Rescuers

When more rescuers are available for a resuscitation attempt, they can perform more tasks at the same time. In 2-rescuer CPR (Figure 19), each rescuer has specific tasks.

Rescuer 1: Provide Compressions

Position yourself at the person's side.

- Make sure the person is faceup on a firm, flat surface.

- Perform chest compressions.
    - –Compress at a rate of 100 to 120/min.
    - –Compress the chest at least 2 inches (5 cm) for adults.
    - –Allow the chest to recoil completely after each compression; avoid leaning on the person's chest between compressions.
    - –Minimize interruptions in compressions (try to limit any interruptions in chest compressions to less than 10 seconds).
    - –Use a compression-to-ventilation ratio of 30:2.
    - –Count compressions out loud.
- Switch compressors about every 5 cycles or every 2 minutes (more frequently if fatigued). Take less than 5 seconds to switch. Immediately resume CPR.

Rescuer 2: Provide Breaths

Position yourself at the person's head.

- Maintain an open airway by using either
    - –Head tilt–chin lift
    - –Jaw thrust
- Give breaths, watching for chest rise and avoiding excessive ventilation.
- Encourage the first rescuer to
    - –Perform compressions that are deep enough and fast enough
    - –Allow complete chest recoil between compressions
- When only 2 rescuers are available, switch compressors about every 5 cycles of 30:2 (or every 2 minutes), taking less than 5 seconds to switch.

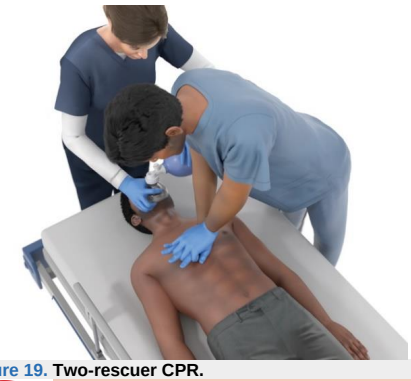

Figure 19. **Two-rescuer CPR.**

Critical Concepts
High-Performance Teams

- When giving compressions, rescuers should switch compressors after every 5 cycles of 30:2 CPR (about every 2 minutes) or sooner if fatigued.
- As additional rescuers arrive, they can help with bag-mask ventilation, compressions, and using the AED and other emergency equipment.

Effective Team Performance to Minimize Interruptions in Compressions

Effective teams communicate continuously. If the compressor counts out loud, the rescuer providing breaths can anticipate when to give breaths. This will help the rescuer prepare to give breaths efficiently and minimize interruptions in compressions. Also, the count will alert both rescuers when the time for a switch is approaching.

Delivering effective chest compressions is hard work. If the compressor tires, chest compressions will not be as effective. To reduce rescuer fatigue, switch compressors about every 5 cycles (or every 2 minutes) or sooner if needed. To minimize interruptions, switch roles when the AED is analyzing the rhythm. Take less than 5 seconds to switch.

Some BLS professionals have special training in coaching CPR to help the resuscitation team minimize interruptions in chest compressions. This role is called the *CPR Coach.* The CPR Coach is responsible for monitoring CPR skills and providing feedback on CPR to ensure high-quality BLS is maintained. Refer to Part 5: Team Dynamics for more information about the CPR Coach role.

Part 4

AED for Adults and Children 8 Years and Older

An *automated external defibrillator*, or AED, is a lightweight, portable, computerized device that can identify an abnormal heart rhythm that needs a shock. The AED can then deliver a shock that can stop the abnormal rhythm and allow the heart's normal rhythm to return. AEDs are simple to operate. They allow lay rescuers and health care professionals to attempt defibrillation safely.

Learning Objectives

At the end of this Part, you will be able to

- Describe the importance of early use of an AED
- Demonstrate how to use an AED

Defibrillation

The AED identifies abnormal heart rhythms as shockable or nonshockable. Shockable rhythms are treated with defibrillation. *Defibrillation* is the medical term for interrupting or stopping an abnormal heart rhythm by using controlled electrical shocks. The shock stops the abnormal rhythm. This resets the heart's electrical system so a normal (organized) heart rhythm can return.

If effective circulation returns, the person's heart muscle is once again able to pump blood. The person will have a heartbeat that produces a palpable pulse (a pulse that can be felt by the rescuer). This is called *return of spontaneous circulation*, or ROSC. Signs of ROSC include breathing, coughing, or movement and a palpable pulse or measurable blood pressure.

Early Defibrillation

Early defibrillation increases the chance of survival from cardiac arrest that is caused by an abnormal or irregular heart rhythm, or an *arrhythmia*. Arrhythmias occur when the electrical impulses that cause the heart to beat happen too quickly, too slowly, or erratically. Two life-threatening shockable arrhythmias that cause cardiac arrest are ventricular fibrillation and pulseless ventricular tachycardia (pVT).

- **Ventricular fibrillation:** In this arrest rhythm, the heart's electrical activity becomes chaotic. The heart muscles quiver in a fast, unsynchronized way so that the heart does not pump blood.
- **pVT:** When the lower chambers of the heart (ventricles) begin contracting at a very fast pace, a rapid heart rate known as *ventricular tachycardia* develops. In extremely severe cases, the ventricles pump so quickly and inefficiently that there is no detectable pulse (ie, the "pulseless" in pVT). Body tissues and organs, especially the heart and brain, no longer receive oxygen.

Early defibrillation, high-quality CPR, and all components of the Chain of Survival are necessary to improve chances of survival from ventricular fibrillation and pVT.

PAD Programs

To provide early defibrillation, rescuers need to have an AED immediately available. PAD programs increase AED availability and train laypeople how to use them. PAD programs place AEDs in public places where large numbers of people gather, such as office buildings, airports, convention centers, and schools. Some PAD programs coordinate with local EMS so that telecommunicators can direct callers to the nearest AED.

Cardiac Emergency Response Plans

The AHA recommends that all locations and organizations have a cardiac emergency response plan in place. A response plan outlines specifically who responds to and what to do in a cardiac emergency. For more information on cardiac emergency response plans, visit **cpr.heart.org/cerp** for an implementation guide, resources, and checklists.

Critical Concepts

Maintaining the AED and Supplies

AEDs should be properly maintained according to the manufacturer's instructions. Someone should be designated to do the following:

- Maintain the battery
- Order and replace supplies, including AED pads (adult and pediatric)
- Replace used equipment, including barrier devices (eg, pocket masks), gloves, razors (for shaving hairy chests), and scissors, which are sometimes kept in a separate emergency or first aid kit

AED Arrival

Once the AED arrives, place it at the person's side, near the rescuer who will operate it. This position provides ready access to AED controls and helps ensure easy placement of AED pads. It also allows a second rescuer to continue high-quality CPR from the opposite side of the person without interfering with AED operation. Ensure that AED pads are placed directly on the skin and are not placed over clothing, medication patches, or implanted devices.

Using the AED

Know Your AED

AED equipment varies according to the model and manufacturer. But all AEDs operate in basically the same way. The universal steps for operating an AED can guide you in most situations. However, you should still be familiar with the AED used in your setting. For example, it is important to know whether you must manually power on your AED or whether it powers on automatically when you open the lid.

Monitor/Defibrillator

ALS and other health care professionals may be trained in using a monitor/defibrillator. These devices have more complex features and require advanced training. They can monitor heart rhythms and deliver shocks when needed, often for more complex arrhythmias. Additionally, a monitor/defibrillator device may be used in AED mode, which is when it automatically analyzes the person's heart rhythm and advises whether a shock is needed. Familiarize yourself with the device used in your organization, and follow the protocols.

Operating an AED: Universal Steps

Begin by opening the AED. If needed, power it on. During a resuscitation attempt, follow the AED's prompts. These may be electronic voice prompts or digital screen prompts.

To reduce the time to shock delivery, try to perform the first 2 steps below within 30 seconds after the AED arrives at the person's side. This should be done while a second rescuer continues CPR:

1. Open the carrying case (if applicable). Power on the AED (Figure 20) if needed.
    a. Some devices power on automatically when you open the lid or case.
    b. Follow the AED prompts.
2. AED prompts, "Apply pads to patient's bare chest."

    a. Peel the backing away from the AED pads.
    b. Apply the pads to the patient's bare chest (Figure 21).
        - Avoid placing the pads over clothing, medication patches, or implanted devices. Choose adult pads for patients 8 years or older. Follow the placement diagrams on the pads (Figure 21). Refer to Critical Concepts: AED Pad Placement Options in this Part for common placement options.
    c. Plug in pads connector (some AEDs have preconnected cables).
3. AED prompts, "Analyzing heart rhythm. Do not touch the patient" (Figure 22).
    a. When the AED prompts you, clear the person for heart rhythm analysis. Be sure that no one is touching the person, not even the rescuer in charge of giving breaths.
    b. The AED may take a few seconds to analyze.
    c. The AED will tell you if the person needs a shock. If the AED prompts that no shock is advised, immediately resume CPR, starting with chest compressions.
4. AED prompts, "Shock advised. Charging. Stay clear of patient" (Figure 23A).
    a. Before delivering the shock, clear the person. Do this by making sure that no one is touching the person.
        - Loudly state a "clear the person" message, such as "Everybody clear!"
        - Look to be sure that no one is in contact with the person.
    b. AED prompts, "Deliver shock now. Press the Shock button now." The shock may produce a sudden contraction of the person's muscles (Figure 23B).
5. AED prompts, "Shock delivered. Start CPR."
    a. After a shock is delivered, immediately resume CPR, starting with chest compressions (Figure 24).
6. After about 5 cycles or 2 minutes of CPR, the AED will prompt you to repeat Steps 3 and 4.

Figure 20. Power on the AED.

Figure 21. **The AED operator attaches AED pads to the person and then attaches the pads connector to the AED, if applicable.**

Figure 22. **The AED operator clears the person for heart rhythm analysis.**

Figure 23A. **If a shock is advised, the AED operator clears the person before delivering a shock.**

Figure 23B. **When everyone is clear of the person, the AED operator presses the Shock button.**

Minimize Time Between Last Compression and Shock Delivery

Research has shown that the shorter the time between the last compression and shock delivery, the better the chances of ROSC. Minimizing interruptions requires practice and team coordination, especially between the rescuer proving compressions and the rescuer operating the AED.

Do Not Delay High-Quality CPR After AED Use

Immediately resume high-quality CPR, starting with chest compressions (Figure 24) after either of the following:

- The AED operator delivers a shock.
- The AED prompts, “No shock advised.”

After about 5 cycles or 2 minutes of high-quality CPR, the AED will prompt you to repeat Steps 3 and 4. Continue until ALS professionals take over or the person begins to breathe, move, or otherwise react.

Figure 24. If no shock is indicated and immediately after any shock is delivered, rescuers start CPR, beginning with chest compressions.

Critical Concepts
AED Pad Placement Options

Place AED pads by following the diagram on the pads.

Anterolateral Placement

As shown in Figure 25A, place both pads on the person’s bare chest. Place one pad vertically on the person’s right upper chest. The top of the pad should be just under the clavicle. Place the second pad horizontally on the person’s left lateral ribs. The middle of the pad should be below the axilla at the midaxillary line.

Anteroposterior (AP) Placement

Options for AP pad placement (Figure 25B) include

- Placing one pad in the center of the person's bare chest (anterior) and the other pad in the center of the person's back (posterior)
- Placing one AED pad on the left side of the chest, between the left side of the person's sternum and left nipple, and the other pad on the left side of the person's back, next to the spine

Always place pads directly on the skin and avoid contact with clothing, medication patches, and implanted devices.

Figure 25A. AED pad placement options on a person. A, Anterolateral placement.

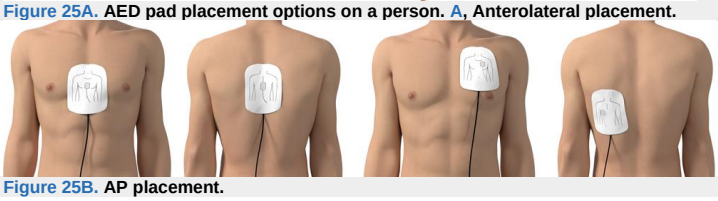

Figure 25B. AP placement.

Child AED Pads

Your AED may include smaller pads designed specifically for children younger than 8 years. Do not use the child pads for an adult. Child pads deliver a shock dose that is too low for an adult and will likely not be successful. It is better to provide high-quality CPR than to attempt to shock an adult person with child pads.

Special Circumstances

When placing AED pads, you may need to take additional actions when the person

- Has a hairy chest
- Is immersed in water or has water or liquid covering the chest

- Has an implanted defibrillator or pacemaker
- Has a transdermal medication patch or other object on the surface of the skin where you need to place the AED pads
- Is pregnant
- Is wearing jewelry or bulky clothing

Hairy Chest

The AED pads may stick to the chest hair and not to the skin on the chest. If this occurs, the AED will not be able to analyze the person's heart rhythm and will display a "check electrodes" or "check electrode pads" message.

Remember to note whether the person has a hairy chest *before you apply the pads*. Ask your employer, local health authority, or regulatory body about protocols for removing chest hair.

Some AED carrying cases may contain a razor or clippers to shave or trim the area where you will place the pads. If you do not have a razor but do have a second set of pads, use the first set to remove the hair. It is essential to ensure that you have 2 sets of appropriately sized pads before using pads for hair removal. Apply the first set of pads, press them down so they stick as much as possible, and quickly pull them off. Then apply the new second set of pads.

Presence of Water or Other Liquids

Water and other liquids conduct electricity. Do not use an AED in water.

- If the person is in water, pull the person out of the water.
- If the chest is covered with water or sweat, quickly wipe the chest before attaching the AED pads.
- If the person is lying on snow or in a small puddle, you may use the AED after quickly wiping the chest.

Implanted Defibrillators and Pacemakers

People with a high risk for sudden cardiac arrest may have implanted defibrillators or pacemakers that automatically deliver shocks directly to the heart. If you place an AED pad directly over an implanted medical device, the implanted device may interfere with the delivery of the shock.

These devices are easy to identify because they create a hard lump beneath the skin that is most often in the left upper chest but can also be found in the right upper chest or abdomen. The lump can range from the size of a silver dollar to half the size of a deck of playing cards.

If you identify an implanted defibrillator or pacemaker, avoid placing the AED pad directly over the implanted device, if possible. Then, follow the normal steps for operating an AED.

Transdermal Medication Patches

Do not place AED pads directly on top of a medication patch. The patch may interfere with the transfer of energy from the AED pad to the heart. This could also cause small burns to the skin. Examples of medication patches are nitroglycerin, nicotine, pain medication, and hormone replacement therapy patches.

If it will not delay shock delivery, remove the patch and wipe the area before attaching the AED pad.

To avoid the transfer of medication from the patch to you, wear protective gloves or use another type of barrier when removing the patch. Remember to avoid delays as much as possible.

Pregnancy

You should use an AED for a pregnant person in cardiac arrest as you would for anyone in cardiac arrest. Shock from the AED will not harm the fetus. Without lifesaving treatment to the pregnant person, the fetus will not likely survive.

If the person is revived, place them on their left side. This helps improve blood flow to their heart and, therefore, to the fetus.

Clothing and Jewelry

Quickly move bulky clothes out of the way. If a person’s clothes are difficult to remove, you can still provide compressions over clothing. If an AED becomes available, remove all clothes, including undergarments that cover the chest because pads must not be placed over clothing. You do not need to remove a person’s jewelry as long as it does not come into contact with the AED pads.

Part 5
Team Dynamics

As a BLS professional, you may be involved in a multirescuer resuscitation attempt. You may be on a team with rescuers who are trained in ALS. However, no matter the skill, procedure, or equipment used in a resuscitation event, BLS is the foundation of all resuscitation attempts. Effective team dynamics increase the chances of a successful resuscitation. Everyone on the team must understand not just *what* to do in a resuscitation attempt but *how* to communicate and perform effectively as part of a multirescuer team.

Learning Objectives

At the end of this Part, you will be able to

- Perform high-quality CPR for an adult, a child, and an infant
- Perform as an effective team member during multirescuer CPR

Elements of Effective High-Performance Teams

A successful resuscitation attempt depends on high-quality resuscitation skills, good communication, and effective team dynamics. All rescuers on the team must be able to respond rapidly and effectively in an emergency situation. Effective multirescuer team dynamics help give people the best chance of survival.

Team dynamics during a resuscitation attempt is an element of high-performance teams and includes 3 components:

- Roles and responsibilities
- Communication
- Debriefing

Roles and Responsibilities

Because every second matters during a resuscitation attempt, it is important to define clear roles and responsibilities as soon as possible.

When all team members know their jobs and responsibilities, the team functions more smoothly. Rescuers should clearly define roles as soon as possible and delegate tasks according to each team member's skill level. As soon as the person is identified as being pulseless, the Team Leader will identify themselves and assign the roles of BLS, including the Compressor, Airway, Monitor/Defibrillator/CPR Coach, and the Timer/Recorder (Figure 26).

Most often, the Team Leader will delegate tasks on the basis of each team member's skill level. Often, the Team Leader will be at the patient's feet but may need to move around and observe, evaluate skills, and provide feedback. A Team Leader may also assume responsibility for roles not defined.

There are 3 key BLS roles in the resuscitation triangle: the person who operates the monitor/defibrillator and acts as CPR Coach, the person managing the airway and ventilation, and the person performing compressions.

The Compressor role assesses the person, performs compressions according to local protocols, and rotates every 2 minutes or earlier if fatigued.

The Airway person should be positioned by the person's head. The Airway role opens the airway, provides bag-mask ventilation, and inserts airway adjuncts as appropriate. The Airway person should watch for chest rise and avoid excessive ventilation.

The Monitor/Defibrillator/CPR Coach brings and operates the AED or monitor/defibrillator and acts as the CPR Coach, if designated. The Monitor/Defibrillator should be positioned next to the device, follow the prompts, and ensure that all team members are clear of the patient before delivering a shock if one is needed.

If a monitor is used, it should be placed so it can be seen by the Team Leader (and most of the team). It is important to note that the Compressor role and the Monitor/Defibrillator/CPR Coach switch roles without physically moving to minimize pauses in compressions.

The Timer/Recorder keeps a record of the events that occur, including frequency and duration of interruptions in chest compressions, time of shock delivery, and medications administered. Remember, medication administration is not a part of BLS and it should be done by an advanced professional during a resuscitation attempt. The Timer/Recorder also announces when interventions are due.

Figure 26 shows an example of a team formation with assigned roles.

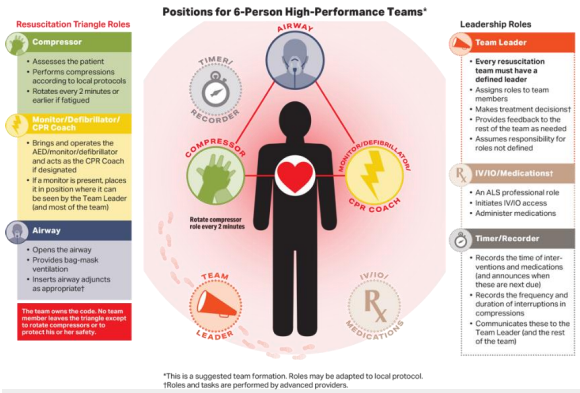

Figure 26. Team diagram, including both BLS and advanced support roles.

Know Your Limitations

All team members should know their limitations. The Team Leader needs to be aware of them as well. For example, ALS professionals may be able to perform tasks that BLS professionals would not be permitted to do. Some of these tasks are administering medications and performing intubation. Each team member should ask for assistance and advice early, before a situation starts to get worse.

Offer Constructive Intervention

Whether you are a team member or the Team Leader, there may be times when you need to point out another team member's incorrect or inappropriate actions. When this happens, it is important to intervene in a tactful and constructive way. This is especially important when someone is mistaken about a drug, a dose, or an intervention.

Anyone on the team should speak up to stop someone else from making a mistake, regardless of their roles.

Communication

Share Knowledge

Knowledge sharing is important for effective team performance. Doing so can help ensure that everyone fully understands the situation, and it can help the team treat patients more efficiently and effectively. A Team Leader should frequently ask for observations and feedback. This includes asking for good ideas about managing a resuscitation attempt as well as for observations about possible oversights.

Summarize and Reevaluate

Summarizing information aloud is helpful during a resuscitation attempt because it

- Provides an ongoing record of treatment
- Is a way to reevaluate the person's status, the interventions, and the team's progress within the algorithm of care
- Helps team members respond to the person's changing condition

Use Closed-Loop Communication

Closed-loop communication is an important technique used to prevent misunderstandings and treatment errors. It consists of the sender giving the message, the receiver repeating it back, and the sender then confirming it was heard correctly. To practice closed-loop communication, the Team Leader and team members should do the following:

Team Leader

- Call each team member by name and make eye contact when giving an instruction.
- Do not assign additional tasks until you are sure the team member understands the instruction.

Team members

- Confirm that you understand each task the Team Leader assigns you by verbally acknowledging that task.
- Tell the Team Leader when you have finished a task.

Give Clear Messages

To help prevent misunderstandings and keep everyone focused, all team members should

- Use clear, concise language
- Speak loudly enough to be heard
- Speak in a tone that's both calm and confident

Show Mutual Respect

All team members should display mutual respect and a professional attitude, regardless of each rescuer's skill level or training. Emotions can run high during a resuscitation attempt. It's especially important for the Team Leader to speak in a friendly, controlled voice and avoid shouting or aggression.

Coaching

The CPR Coach supports performance of high-quality BLS skills, allowing the Team Leader to focus on other aspects of clinical care. Studies have shown that resuscitation teams with a CPR Coach perform higher-quality CPR with higher CCF and shorter pause durations than teams that do not use a CPR Coach.

The CPR Coach does not need to be a separate role; it can be blended most effectively into the current responsibilities of the Monitor/Defibrillator. The CPR Coach's main responsibilities are to help team members provide high-quality CPR and minimize pauses in compressions. The CPR Coach needs a direct line of sight to the Compressor, so they should stand next to the defibrillator. Here is a description of the CPR Coach's actions:

Coordinate the start of CPR: As soon as a patient is identified as having no pulse, the CPR Coach says, "I am the CPR Coach" and tells rescuers to begin chest compressions. The CPR Coach can adjust the environment to help ensure high-quality CPR. They can lower the bedrails or the bed, get a step stool, or roll the person to place a backboard and defibrillator pads to better facilitate high-quality CPR.

Coach to improve the quality of chest compressions: The CPR Coach gives feedback about performance of compression depth, rate, and chest recoil. They state the CPR feedback device's data to help the Compressor improve performance. This is useful because visual assessment of CPR quality is often inaccurate.

State the midrange targets: The CPR Coach states the specific midrange targets so that compressions and ventilation are within the recommended range. For example, they should tell the Compressor to compress at a rate of 110/min instead of a rate between 100 and 120/min.

Coach to the midrange targets: The CPR Coach gives team members feedback about their ventilation rate and volume. If needed, they also remind the team about compression-to-ventilation ratio.

Help minimize the length of pauses in compressions: The CPR Coach communicates with the team to help minimize the length of pauses in compressions. Pauses happen when the team defibrillates, switches Compressors, and places an advanced airway.

Debriefing

After a resuscitation event, debriefing is an opportunity for the team to discuss how the resuscitation went, identify why the team took certain actions, and discuss whether anything can be improved in future events. Debriefing can occur immediately with the entire team or be scheduled at a later time with the team and others. It is an opportunity for evaluating process and CPR performance, reflecting on team dynamics, providing education for quality improvement, and processing of emotions after participation in a stressful event.

Resuscitation attempts can be traumatic for even the most experienced health care professionals. If you find yourself replaying the events, questioning your role in the resuscitation attempt, feeling sad or angry, or not sleeping, these can be signs of posttraumatic stress reactions. Make sure you ask for help immediately, so that a professional can help you process what you have experienced and what you are feeling.

Critical incident stress debriefing (or psychological debriefing) is used to prevent or limit posttraumatic stress symptoms and is a critical part of the debriefing process.

Debriefing has been shown to

- Help individual team members perform better
- Aid in identifying system strengths and deficiencies

Implementing debriefing programs may improve patient survival and the mental health of those involved after cardiac arrest.

High-Performance Teams

A high-performance team achieves specific performance metrics, such as high chest compression fraction, or CCF. CCF is the proportion of time during a resuscitation attempt when the person is receiving high-quality chest compressions. You can only achieve a high CCF by eliminating pauses during high-quality CPR. The higher the CCF, the more likely the chance of survival.

Targeting a high CCF of at least 60% is recommended, and a goal of 80% is often achievable with good teamwork. Research shows that a 10% increase in CCF is roughly equal to an 11% increase in survival. Pauses typically occur during intubation, rhythm analysis, pulse checks, compressor switches, and defibrillation.

Some best practices for minimizing pauses include the following:

- Whenever compressions are paused, be prepared to immediately resume compressions.

- If a compressor needs to switch because of fatigue, coordinate the switch to happen as fluidly as possible, such as while delivering ventilations or during a heart rhythm analysis.
- When switching compressors, the second compressor should take over on the same side as the initial compressor. For seamless transitions, it is best to switch between cycles every 2 minutes.
- It's best practice to use real-time feedback devices during CPR.
    - –However, if a feedback device isn't available, a metronome can help establish the proper rate. If your AED/defibrillator doesn't have a metronome, you can download a metronome app to your mobile device.

Calculating CCF

Health care professionals and instructors can use technology to obtain CCF mechanically after a case scenario or code by using a feedback device (eg, a monitor/defibrillator with appropriate pads) or with the use of a CCF app (eg, the AHA ACLS App). If neither of these is available, CCF can be calculated manually by using a phone that can run multiple timers at once or by using 2 timers. One timer measures the total code time from code start until code stop or ROSC, and a second timer measures the total chest compression time. To measure chest compression time, the second timer is started each time compressions begin or resume and is stopped during each pause in compressions. The chest compression time is then divided by the total code time to calculate CCF.

CCF = actual chest compression time/total code time

Part 6
BLS for Children and Infants

This section describes BLS for infants and children. In this course, infants are younger than 1 year (excluding the newly born) and children range from 1 year to puberty. Signs of puberty include chest or underarm hair on boys and any breast development in girls. For children with signs of puberty and older, follow adult BLS guidelines.

Table 2 shows key differences in CPR performed for infants and children.

Table 2. Differences in CPR for Infants and Children

Characteristics of high-quality CPR	Infant	Child
Age	Younger than 1 year, excluding the newly born	1 year to puberty
Pulse check location	Brachial	Carotid or femoral
Compression rate	100-120/min	100-120/min
Compression depth	At least one third the AP diameter of the chest, approximately 1½ inches (4 cm)	At least one third the AP diameter of the chest, approximately 2 inches (5 cm)
Compression technique	Heel of 1 hand or 2 thumb–encircling hands technique	Heel of 1 or 2 hands
1-Rescuer compression-to-ventilation ratio	30:2	30:2
2-Rescuer compression-to-ventilation ratio	15:2	15:2*

*If there are signs of puberty, treat the person as an adult and use a 30:2 ratio.

Learning Objectives

At the end of this Part, you will be able to

- Describe the importance of high-quality CPR and its impact on survival
- Apply the BLS concepts of the Chain of Survival
- Recognize the signs of someone needing CPR
- Perform high-quality CPR for an adult, a child, and an infant
- Perform chest compressions using correct hand placement at the correct rate and depth with chest recoil
- Demonstrate effective breaths or ventilation
- Describe the importance of early use of an AED
- Demonstrate how to use an AED
- Perform as an effective team member during multirescuer CPR

Pediatric BLS Algorithm—Single Rescuer

The Pediatric BLS Algorithm (Infants to Puberty) for Health Care Professionals—Single Rescuer outlines the steps for a single rescuer of an unresponsive infant or child (Figure 27). Once you learn the skills presented in this Part, use the algorithm as a quick reference.

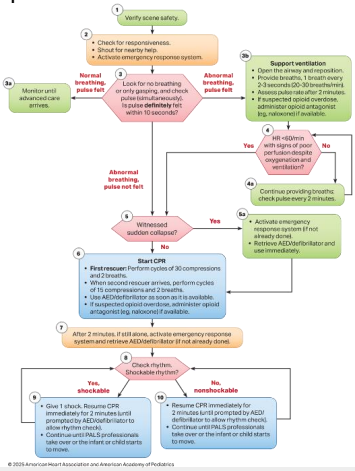

Figure 27. Pediatric BLS Algorithm (Infants to Puberty) for Health Care Professionals—Single Rescuer.

Pediatric BLS Sequence—Single Rescuer

This is your step-by-step guide to providing CPR to an unresponsive infant or child when you are the only rescuer. The numbered steps correspond to the numbered steps on the Pediatric BLS Algorithm (Infants to Puberty) for Health Care Professionals—Single Rescuer (Figure 27).

The first rescuer who arrives at the side of an unresponsive infant or child should quickly perform Steps 1 and 2 and then begin high-quality CPR.

Step 1: Verify scene safety.

Make sure the scene is safe for you and the infant or child.

Step 2: Check for responsiveness, shout for nearby help, and activate the emergency response system.

- Tap the infant's heel or the child's shoulders. Shout, "Hey! Are you OK? Are you OK?"
- If the infant or child is not responsive, shout for help and activate the emergency response system via a mobile device if appropriate.

Step 3: Assess for breathing and a pulse.

- Next, assess the infant or child for normal breathing and a pulse. This will help you determine the next appropriate actions.
- *To minimize delay in starting CPR, you should assess breathing and pulse at the same time. This should take at least 5 but no more than 10 seconds*.
    - –For detailed instructions on checking for breathing and a pulse in an infant and in a child, refer to High-Quality CPR Skills: Infants and Children in this Part.
- If abnormal breathing and pulse not felt, move to Step 5.

Steps 3a and 3b: Determine next action.

Determine next actions based on whether breathing is normal and if a pulse is felt:

- ***Step 3a: If the infant or child is breathing normally and a pulse is felt:***
    - –Monitor the infant or child until advanced care arrives
- ***Step 3b: If the infant or child has abnormal breathing but a pulse is felt, support ventilation:***
    - –Open the airway and reposition the head if necessary
    - –Provide breaths, with 1 breath every 2 to 3 seconds (20 to 30 breaths per minute)

- –Assess the pulse rate after 2 minutes
- –If suspected opioid overdose, administer antagonist (eg, naloxone) if available

Step 4: Assess the heart rate.

Is the heart rate less than 60/min with signs of poor perfusion despite oxygenation and ventilation?

- **Step 4a:** If no, continue providing breaths. Check for a pulse every 2 minutes.
- If yes, go to Step 5.

Step 5: Witnessed sudden collapse?

Determine whether the sudden collapse was witnessed.

- If yes, move to Step 5a.
  - –**Step 5a:** If you did witness the sudden collapse of a child, leave the child to go activate the emergency response system, if not already done, and get an AED. Then, return to the child to perform CPR and use the AED as soon as possible (Step 6).
- If no, move to Step 6.

Step 6: Start CPR.

- The first rescuer performs cycles of 30 compressions and 2 breaths.
- When the second rescuer arrives, they perform cycles of 15 compressions and 2 breaths.
- Use the AED/defibrillator as soon as it is available.
- If suspected opioid overdose, administer opioid antagonist (eg, naloxone) if available.

Step 7: After 2 minutes, if you are still alone, activate the emergency response system and get an AED/defibrillator if not already done.

Step 8: Check rhythm. Shockable rhythm?

Turn on the AED and follow the prompts. Use the AED/defibrillator to check the rhythm.

Step 9: If the AED detects a shockable rhythm, give a shock.

- Give 1 shock. Immediately resume CPR for 2 minutes (until prompted by the AED to allow a rhythm check).
- Continue CPR and using the AED until pediatric advanced life support (PALS) professionals take over or the infant or child begins to breathe, move, or otherwise react.

Step 10: If the AED detects a nonshockable rhythm, resume high-quality CPR.

- Immediately resume CPR for 2 minutes (until prompted by the AED to allow a rhythm check).
- Continue providing CPR and using the AED until PALS professionals take over or the infant or child begins to breathe, move, or otherwise react.

High-Quality CPR Skills: Infants and Children

Mastering all the skills outlined in this section will prepare you to provide high-quality CPR to an unresponsive infant or child.

Assess for Breathing and a Pulse

Checking the infant or child for normal breathing and a pulse will help you determine the next appropriate actions. You should assess breathing and pulse at the same time. Assess both for at least 5 but no more than 10 seconds so that you can start CPR quickly, if necessary.

Breathing

To check for breathing, scan the infant's or child's chest for rise and fall for at least 5 but no more than 10 seconds. Look for no breathing or only gasping and check for a pulse simultaneously. Agonal breathing may sound like gasps, snorts, snores, or groans. These may appear forceful or weak, and some time may pass between them. When that happens, rescuers should give breaths or ventilation without chest compressions. It's important to note that abnormal breaths, called *agonal gasps*, are common in the first few minutes of a cardiac arrest. Rescuers can sometimes mistake agonal breathing for normal breathing and fail to recognize cardiac arrest and initiate CPR.

- **If the infant or child is breathing:** Monitor them until additional help arrives.
- **If the infant or child is not breathing or is only gasping:** The infant or child has respiratory arrest or (if no detectable pulse) cardiac arrest. (Gasping is not normal breathing and is a sign of cardiac arrest. Refer to Critical Concepts: Agonal Gasps in Part 3.)

Pulse

Infant: To perform a pulse check in an infant, feel for a brachial pulse (Figure 28A). Here is how to check the brachial artery pulse:

1. Place 2 or 3 fingers on the inside of the upper arm, midway between the infant's elbow and shoulder.
2. Press your fingers down and attempt to feel the pulse for *at least 5 but no more than 10 seconds*.

Figure 28A. Pulse check. A, In an infant, feel for a brachial pulse.

Child: To perform a pulse check in a child, feel for a carotid or femoral pulse (Figures 28B and 28C).

Figure 28B. In a child, feel for either a carotid pulse.

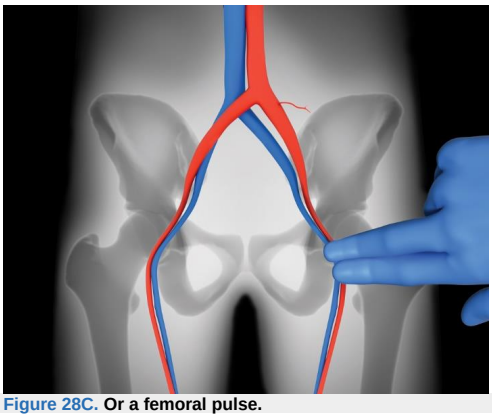

Figure 28C. Or a femoral pulse.

Here is how to check the carotid pulse:

1. Use 2 or 3 fingers to locate the child's trachea.
2. Slide your fingers into the groove just to the side of the trachea. Feeling for the carotid pulse is usually easier to perform on the child's side that is closest to you.
3. Check for a pulse for at least 5 but no more than 10 seconds.

Here is how to check the femoral artery pulse:

1. Place 2 or 3 fingers in the inner thigh, midway between the hip bone and the pubic bone and just below the crease where the leg meets the torso.
2. Check for a pulse for at least 5 but no more than 10 seconds.

It can be difficult to determine the presence or absence of a pulse in any person, particularly in an infant or child. If you *do not definitely feel a pulse within 10 seconds*, start high-quality CPR, beginning with chest compressions.

Signs of Poor Perfusion

Perfusion is the flow of oxygenated blood from the heart through the arteries to the body's tissues. To identify signs of poor perfusion, assess the following:

- **Temperature:** Cool extremities
- **Mental status:** Continued decline in consciousness/responsiveness

- **Pulses:** Weak pulses
- **Skin:** Paleness, mottling (patchy appearance), and, later, cyanosis (blue or gray coloring of the lips, nail beds, or skin)

Perform High-Quality Chest Compressions

High-quality chest compressions are the foundation of CPR. Perform compressions as described here to give an infant or child in cardiac arrest the best chance of survival.

Compression-to-Ventilation Ratio

The compression-to-ventilation ratio for single rescuers is the same in adults, children, and infants: **30:2**.

However, when 2 rescuers are attempting to resuscitate an infant or child, they should use a compression-to-ventilation ratio of **15:2**. This prioritizes ventilation because pediatric arrests are commonly due to respiratory causes.

Remember, for children showing signs of puberty, treat them as an adult and provide cycles of 30 compressions and 2 breaths.

Compression Rate

The universal rate for compressions in all people who experience cardiac arrest is 100 to 120/min.

Compression Depth

For an infant, compress at least one third the AP diameter of the infant's chest (approximately 1½ inches, or 4 cm). For a child, compress at least one third the AP diameter of the chest (approximately 2 inches, or 5 cm) with each compression.

Chest Recoil

During CPR, chest recoil (re-expansion of the chest) allows blood to flow into the heart. Incomplete chest recoil reduces the filling of the heart between compressions and reduces the blood flow that chest compressions create. To help ensure complete recoil, avoid leaning on the chest between compressions. Chest compression and chest recoil times should be about equal.

Interruptions in Chest Compressions

Minimize interruptions in chest compressions. Shorter duration of interruptions in chest compressions is associated with better outcomes.

Chest Compression Techniques

For child chest compressions, use 1 or 2 hands. For most children, the compression technique is the same as for an adult: 2 hands (heel of one hand with heel of other hand on top of the first hand) (Figure 29). For a small child, 1-handed compressions (heel of one hand in the center of the chest) may be adequate to achieve the desired compression depth. Whether you use one hand or both hands, compress at least one third the AP diameter of the chest (approximately 2 inches, or 5 cm) with each compression.

Figure 29A. Side view of correct positioning of the rescuer during chest compressions.

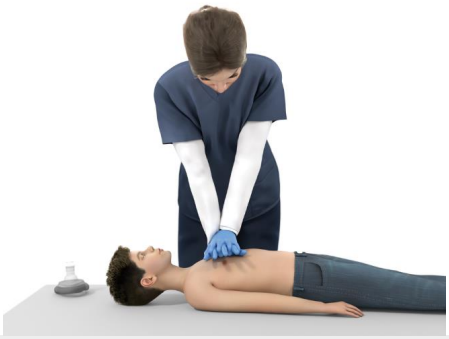

Figure 29B. Front view of correct positioning of the rescuer during chest compressions.

For infants, use either the heel-of-1-hand or the 2 thumb–encircling hands technique. If you cannot physically encircle the chest, it is recommended to compress the chest with the heel of 1 hand. These techniques are described below.

Infant and Child: Heel-of-1-Hand Technique

Follow these steps to give chest compressions to an infant or a child by using the heel of one hand:

1. Place the infant or child on a firm, flat surface.
2. Place the heel of 1 just below the nipple line, hand on the lower half of the sternum. Do not press the tip of the sternum (Figure 30).
3. Give compressions at a rate of 100 to 120/min.
4. Compress at least one third the AP diameter of the chest (approximately 1½ inches, or 4 cm).
5. At the end of each compression, make sure you allow the chest to completely recoil (re-expand); do not lean on the chest. Chest compression and chest recoil times should be about equal. Minimize interruptions in compressions (eg, to give breaths) to less than 10 seconds.

Figure 30. Infant compressions using the heel-of-1-hand technique.

Infant: 2 Thumb–Encircling Hands Technique

Follow these steps to give chest compressions to an infant by using the 2 thumb–encircling hands technique:

1. Place the infant on a firm, flat surface.

2. Place both thumbs side by side in the center of the infant's chest, on the lower half of the sternum. Your thumbs may overlap on very small infants. Encircle the infant's chest and support the infant's back with the fingers of both hands (Figure 31).
3. With your hands encircling the chest, use both thumbs to depress the sternum at a rate of 100 to 120/min.
4. Compress at least one third the AP diameter of the infant's chest (approximately 1½ inches, or 4 cm).
5. After each compression, release all pressure on the sternum and allow the chest to recoil completely.

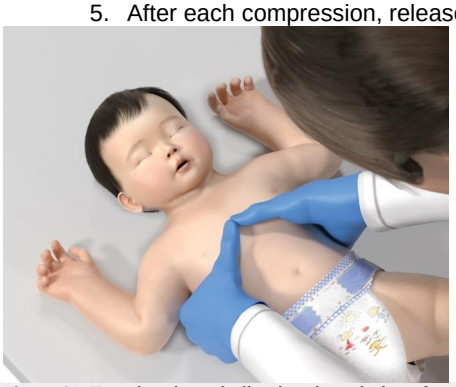

Figure 31. Two thumb-encircling hands technique for an infant.

Critical Concepts
Compression Depth in Infants and Children vs Adults and Adolescents

- Infants: At least one third the AP diameter of the chest, or approximately 1½ inches (4 cm)
- Children: At least one third the AP diameter of the chest, or approximately 2 inches (5 cm)
- Adults and adolescents: At least 2 inches, or 5 cm

Give Breaths

When cardiac arrest occurs suddenly, the blood's oxygen content is typically adequate to meet the body's oxygen demands for the first few minutes after the arrest. Thus, for witnessed *sudden* cardiac arrest, chest compressions alone can be an effective way of distributing oxygen to the heart and brain.

Infant and child cardiac arrests are more commonly due to respiratory causes. Infants and children who develop cardiac arrest often have respiratory failure or shock that reduces the oxygen content in the blood even before cardiac arrest occurs. As a

result, for most infants and children in cardiac arrest, giving chest compressions alone does not deliver oxygenated blood to the heart and brain as effectively as giving both compressions and breaths. *Thus, it is vitally important that infants and children receive both compressions and breaths during high-quality CPR*.

Opening the Airway

As discussed in Opening the Airway in Part 3, for breaths to be effective, the airway must be open. Two methods for opening the airway are the head tilt–chin lift and jaw-thrust maneuvers.

As with adults, if you suspect a neck injury, use the jaw-thrust maneuver. If the jaw thrust does not open the airway, use the head tilt–chin lift.

Critical Concepts

Keep Infant's Head in the Neutral Position

If you tilt (extend) an infant's head beyond the neutral (sniffing) position, the infant's airway may become blocked. Maximize an open airway by positioning the infant with the neck in a neutral position so that the external ear canal is level with the top of the infant's shoulder.

Delivering Breaths and Ventilations

Use a barrier device, such as a pocket mask, face shield, or a bag-mask device, for delivering breaths to an infant or child. Refer to Part 3: BLS for Adults for detailed instructions on how to use these devices.

When providing bag-mask ventilation for an infant or child, remember these key points:

1. Select a bag and mask of appropriate size. The mask must cover the infant's or child's mouth and nose completely without covering the eyes or extending below the bottom edge of the chin.
2. Position yourself directly above the infant's or child's head.
3. Perform a head tilt–chin lift to open the infant's or child's airway. For an infant, do not hyperextend the neck because tilting or extending an infant's head beyond the neutral or sniffing position may block the infant's airway.
4. Use the E-C clamp technique to hold the mask against their face. Press the mask to the face as you lift the jaw, creating a seal between the face and the mask (Figure 32).
5. Delivering ventilations to infants or small children requires less volume and force than giving breaths to adults. Breaths that are too forceful have greater potential to cause lung trauma in children. Still, ensure you provide enough air to see the chest rise.
6. Connect the bag-mask device to supplemental oxygen when available.

Figure 32. **Delivering ventilations to an infant using a bag-mask device while a second rescuer performs compressions.**

Pediatric BLS Algorithm—2 or More Rescuers

The Pediatric BLS Algorithm (Infants to Puberty) for Health Care Professionals—2 or More Rescuers outlines steps for a multirescuer team assisting an unresponsive infant or child (Figure 33).

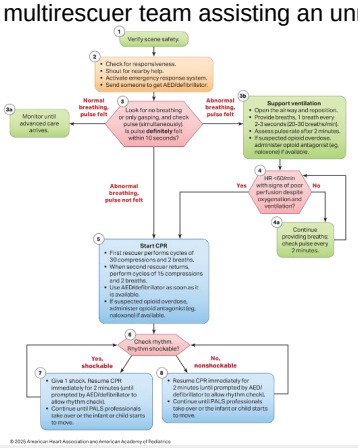

Figure 33. **Pediatric BLS Algorithm (Infants to Puberty) for Health Care Professionals—2 or More Rescuers.**

Pediatric BLS Sequence—2 or More Rescuers

This is your step-by-step guide to providing CPR to an unresponsive infant or child when you are part of a multirescuer (2 or more) team. The numbered steps correspond to the numbered steps on the Pediatric BLS Algorithm (Infants to Puberty) for Health Care Professionals—2 or More Rescuers (Figure 33).

The first rescuer who arrives at the side of an unresponsive infant or child should quickly perform Steps 1 and 2. As more rescuers arrive, assign roles and responsibilities. When more rescuers are available for a resuscitation attempt, they can perform more tasks at the same time.

Step 1: Verify scene safety.

Make sure that the scene is safe for you and the infant or child.

Step 2: Check for responsiveness, shout for nearby help, activate the emergency response system, and send someone to get the AED/defibrillator.

- Tap the infant's heel or the child's shoulders and shout, "Hey! Are you OK? Are you OK?"
- If the infant or child is not responsive, shout for help and activate the emergency response system via a mobile device, if appropriate.
- The first rescuer remains with the infant or child while the second rescuer activates the emergency response system and retrieves the AED/defibrillator.

Step 3: Assess for breathing and a pulse.

- Next, assess the infant or child for normal breathing and a pulse. This will help you determine the next appropriate actions.
- *To minimize delay in starting CPR, you should assess breathing and pulse at the same time. Assess both for at least 5 but no more than 10 seconds.*
- If the infant or child is not breathing normally and a pulse is not felt, move to step 5.

Steps 3a and 3b: Determine next actions.

Determine next actions based on whether breathing is normal and if a pulse is felt:

- ***Step 3a: If the infant or child is breathing normally and a pulse is felt:***
  - –Monitor the infant or child until advanced care arrives
- ***Step 3b: If the infant or child has abnormal breathing but a pulse is felt, support ventilation:***

- –Open the airway and reposition the head if necessary
- –Provide breaths, with 1 breath every 2 to 3 seconds, or 20 to 30 breaths per minute
- –Assess the pulse rate after 2 minutes
- –If suspected opioid overdose, administer antagonist (eg, naloxone) if available

Step 4: Assess the heart rate.

Is the heart rate less than 60/min (fewer than 6 beats in 10 seconds) with signs of poor perfusion despite oxygenation and ventilation?

- **Step 4a:** If no, continue providing breaths. Check for a pulse every 2 minutes. Reassess the heart rate.
- If yes, go to Step 5.

Step 5: Start CPR.

- First rescuer performs cycles of 30 compressions and 2 breaths.
- When second rescuer returns, perform cycles of 15 compressions and 2 breaths.
- Use the AED/defibrillator as soon as it is available.
- If suspected opioid overdose, administer opioid antagonist (eg, naloxone) if available.

Step 6: Check rhythm. Rhythm shockable?

Turn on the AED and follow the prompts. Use the AED/defibrillator to check the rhythm.

Step 7: If the AED detects a shockable rhythm, give a shock.

- Give 1 shock. Immediately resume CPR for 2 minutes (until prompted by the AED to allow a rhythm check).
- Continue CPR and using the AED/defibrillator until PALS professionals take over or the infant or child begins to breathe, move, or otherwise react.

Step 8: If the AED detects a nonshockable rhythm, resume high-quality CPR.

- Immediately resume CPR for 2 minutes (until prompted by the AED to allow a rhythm check).
- Continue CPR and using the AED/defibrillator until PALS professionals take over or the infant or child begins to breathe, move, or otherwise react.

Summary of High-Quality CPR Components for BLS Professionals

All components of high-quality CPR for adults and adolescents, children, and infants have been reviewed for BLS professionals. Table 3 shows all components of high-quality CPR.

Table 3. Summary of High-Quality CPR Components for BLS Professionals

Component	Adults (puberty and beyond)	Children (1 year of age to puberty)	Infants (younger than 1 year, excluding newborns)
Verifying scene safety	Make sure the scene is safe for rescuers and the person who needs help		
Recognizing cardiac arrest	Check for responsiveness Shout for nearby help No breathing or only gasping (ie, no normal breathing) No definite pulse felt within 10 seconds (Breathing and pulse check should be performed simultaneously for at least 5 but no more than 10 seconds)		
Activating emergency response system	**If a mobile device is available, call emergency services (911)**		
	If you are alone with no mobile device, leave the person to activate the emergency response system and get the AED/defibrillator before beginning CPR Otherwise, send someone else and begin CPR immediately; use the AED/defibrillator as soon as it is available	**Witnessed collapse, single rescuer** If you **are alone** and **witnessed** the sudden collapse and do not have a mobile device, leave the child or infant to activate the emergency response system and get the AED before beginning CPR **Unwitnessed collapse, single rescuer** If you **are alone** and **did not witness** the sudden collapse of the child or infant, perform 5 cycles, or 2 minutes, of 30 compressions and 2 breaths before you leave to activate the emergency response system and get an AED/defibrillator. Use the AED/defibrillator as soon as it is available	
Compression-to-ventilation ratio *without advanced airway*	**1 or 2 rescuers** 30:2	**1 rescuer** 30:2 **2 or more rescuers** 15:2	

Compression-to-ventilation ratio *with advanced airway*	Continuous compressions at a rate of 100-120/min Give 1 breath every 6 seconds (10 breaths/min)	Continuous compressions at a rate of 100-120/min Give 1 breath every 2-3 seconds (20-30 breaths/min)	
Compression rate	100-120/min		
Compression depth	At least 2 inches (5 cm)*	At least one third the AP diameter of the chest Approximately 2 inches (5 cm)	At least one third the AP diameter of the chest Approximately 1½ inches (4 cm)
Hand placement	2 hands in the center of the chest, on the lower half of the sternum	1 or 2 hands in the center of the chest, on the lower half of the sternum	Use the heel-of-1-hand or the 2 thumb–encircling hands technique
Chest recoil	Allow complete recoil of the chest after each compression; do not lean on the chest after each compression		
Minimizing interruptions	Limit interruptions in chest compressions to less than 10 seconds with a CCF goal of at least 60%		

*Compression depth should be no more than 2.4 inches (6 cm).

Part 7

AED for Infants and Children Younger Than 8 Years

Rescuers may use an AED when attempting to resuscitate infants and children younger than 8 years. This Part will help you understand how to use an AED for infants and children in this age range.

Learning Objectives

At the end of this Part, you will be able to

- Describe the importance of early use of an AED
- Demonstrate how to use an AED

Know Your AED

Although all AEDs operate in basically the same way, AED equipment varies according to model and manufacturer. You should be familiar with the AED used in your setting.

Refer to Operating an AED: Universal Steps in Part 4.

Pediatric-Capable AEDs for Reduced Shock Doses

Most AED models are designed for both pediatric and adult resuscitation attempts. These AEDs deliver a reduced shock dose when pediatric pads are used.

One common way to reduce a shock dose is by attaching a pediatric dose attenuator to the AED (Figure 34). An attenuator reduces the shock dose by about two thirds. Typically, an attenuator delivers the reduced shock via child pads. A pediatric dose attenuator frequently comes preconnected to the pediatric pads.

Figure 34. **A pediatric dose attenuator reduces the shock dose an AED delivers. This attenuator uses child pads.**

Choosing and Placing the AED Pads

Use child pads, if available, for infants and for children younger than 8 years. If child pads are not available, use adult pads. Make sure the pads do not touch each other or overlap. Adult pads deliver a higher shock dose, but a higher shock dose is better than no shock.

For pad placement, follow the AED manufacturer's instructions and the illustrations on the AED pads. Some AEDs require placing child pads in a front-and-back (AP) position (Figures 35A and 35B), while others require right-left (anterolateral) placement (Figure 35C). For infants, AP pad placement is common. Refer to Critical Concepts: AED Pad Placement Options in Part 4.

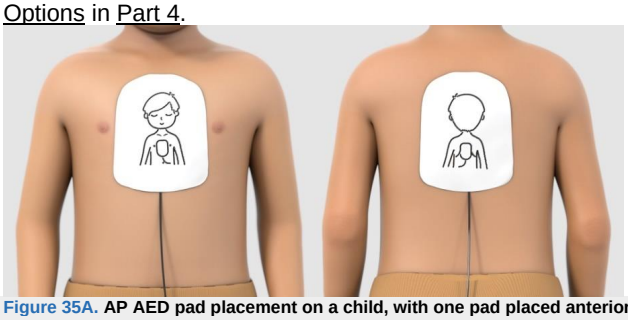

Figure 35A. **AP AED pad placement on a child, with one pad placed anteriorly in the center of the bare chest and the other pad placed posteriorly in the center of the back.**

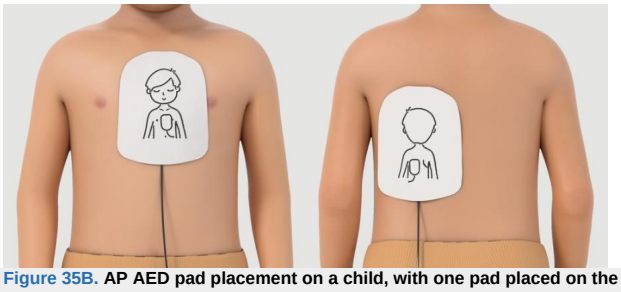

Figure 35B. AP AED pad placement on a child, with one pad placed on the left side of the chest between the left side of the sternum and the left nipple and the other pad placed on the left side of the back next to the spine.

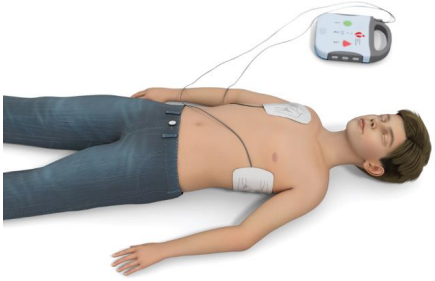

Figure 35C. Anterolateral AED pad placement on a child, with one pad placed vertically on the right upper chest, just under the clavicle, and the other pad placed horizontally on the left lateral ribs, with the middle of the pad below the axilla at the midaxillary line.

AED Use for Children 8 Years of Age to Puberty

- Use the AED as soon as it is available.
- Use adult pads (Figure 36). **Do not use child pads**—they will likely give a shock dose that is too low.
- Place the pads as illustrated on the pads.
- Place the pads directly on the skin. Do not allow the pads to touch or overlap, and do not place on or over clothing.

Figure 36. **Adult AED pads.**

AED Use for Infants and Children Younger Than 8 Years

- Use the AED as soon as it is available.
- Use child pads (Figure 37) if available. If you do not have child pads, you may use adult pads. Place the pads so that they do not touch each other.
- If the AED has a key or switch that will deliver a child shock dose, turn the key or switch.
- Place the pads as illustrated on the pads.
- Place the pads directly on the skin, and do not place on or over clothing.

Figure 37. **Child AED pads.**

AED Use for Infants

For infants, a manual defibrillator is preferred to an AED. A manual defibrillator has more capabilities than an AED and can provide the lower energy doses that infants often need. This course does not cover how to use a manual defibrillator, a skill that requires advanced training.

- When a manual defibrillator is not available, an AED equipped with a pediatric dose attenuator is the preferred alternative.
- If neither is available, you may use an AED without a pediatric dose attenuator.

Critical Concepts

Using Adult Pads or Adult Shock Dose Is Better Than No Defibrillation for an Infant or Child

AED Pads

If you are using an AED for an infant or for a child younger than 8 years and the AED does not have child pads, you may use adult pads. To ensure that the adult pads do not touch each other or overlap, you may need to place them in the AP position.

Shock Dose

If the AED you are using cannot deliver a pediatric dose, use the adult dose.

Part 8
Alternate Ventilation Techniques

As a BLS professional, you may be called on to help provide CPR in situations that require alternate ventilation techniques. If you are assisting ALS professionals, you will need to know modifications to compressions and breaths once an advanced airway is placed. If a person is unresponsive and not breathing but has a pulse, you will need to know how to provide breaths. If a bag-mask device is not available, you may need to give mouth-to-mouth or mouth-to-nose breaths.

Learning Objectives

At the end of this Part, you will be able to

- Demonstrate effective breaths or ventilation

Advanced Airways

This section explains the modifications to compressions and breaths that rescuers must make when an advanced airway is in place. Advanced airways prevent airway obstruction and can provide a route for more effective oxygenation and ventilation. Examples of advanced airways are laryngeal mask airway, supraglottic airway device, and endotracheal tube.

Table 4 summarizes the compression-to-ventilation ratio with and without an advanced airway for adults, children, and infants.

Table 4. Compression-to-Ventilation Ratio During CPR With and Without an Advanced Airway

Ventilation technique	Compressions to breaths (adult)	Compressions to breaths (infant and child)

No advanced airway in place
(eg, mouth-to-mouth, bag-mask device, pocket mask; with or without oral or nasal airways)
	• Compression rate of 100-120/min
	• Ratio of 30 compressions to 2 breaths
		• Compression rate of 100-120/min
		• Ratio:
		  ○ –1 rescuer: 30 compressions to 2 breaths
		  ○ –2 rescuers: 15 compressions to 2 breaths

Advanced airway in place
(eg, laryngeal mask airway, supraglottic airway device, endotracheal tube)
	• Compression rate of 100-120/min
	• Continuous compressions without pauses for ventilations
	• Ventilation:
	  ○ –Adult: 1 ventilation every 6 seconds
	  ○ –Infant and child: 1 ventilation every 2-3 seconds	

Breaths and Ventilations With a Pulse

Breaths are needed most commonly for anyone in cardiac arrest from respiratory-related emergencies. You will need to give breaths to an unresponsive person who has a pulse but is not breathing. You may give breaths by using a barrier device, such as a pocket mask, face shield, or a bag-mask device. If emergency equipment is not available, you may provide breaths by using the mouth-to-mouth technique or the mouth-to-mouth-and-nose technique.

How to Provide Breaths for Adults, Infants, and Children

For adults

- –Give **1 breath every 6 seconds**.
- –Give each breath over 1 second.
- –Each breath should result in visible chest rise.
- –Check for a pulse about every 2 minutes.

For infants and children

- –Give **1 breath every 2 to 3 seconds**.
- –Give each breath over 1 second.
- –Each breath should result in visible chest rise.
- –Check for a pulse about every 2 minutes.

When to Switch From Only Providing Breaths to Providing CPR in an Infant or a Child

When you are providing breaths only, start CPR (compressions *and* breaths) if you see the following:

- Signs of poor perfusion in an infant despite providing effective oxygenation and ventilation
- A pulse is no longer felt

Critical Concepts

Respiratory Arrest

- Respiratory arrest occurs when normal breathing stops, preventing essential oxygen supply and carbon dioxide exchange. Lack of oxygen to the brain eventually causes a person to become unresponsive.
- Rescuers can identify respiratory arrest if all of the following signs are present:
  - –The person is unresponsive
  - –The person is not breathing or is only gasping
  - –The person still has a pulse
- Respiratory arrest is an emergency. Without immediate treatment, it can result in brain injury, cardiac arrest, and death.
- In certain situations, including opioid-associated life-threatening emergencies, respiratory arrest is potentially reversible if rescuers treat it early. (Refer to Part 9 for more about opioids.)
- BLS providers must be able to quickly identify respiratory arrest, activate the emergency response system, and begin rescue breathing. Quick action can prevent the development of cardiac arrest.

Techniques for Giving Breaths Without a Barrier Device

Many cardiac arrests happen in settings where rescue equipment is not available. This section describes techniques for giving breaths when you do not have a barrier device, such as a pocket mask or a bag-mask device.

Breathing Techniques for Adults and Children

- Mouth-to-mouth

- Mouth-to-nose or mouth-to-stoma

Mouth-to-Mouth Breathing for Adults and Children

Mouth-to-mouth breathing is a quick, effective technique to provide oxygen to an unresponsive adult or child. Follow these steps to give mouth-to-mouth breaths to adults and children:

1. Hold the person's airway open with a head tilt–chin lift.
2. Pinch the nose closed with your thumb and index finger (using the hand on the forehead).
3. Take a regular (not deep) breath and seal your lips around the person's mouth, creating an airtight seal (Figure 38).
4. Deliver 1 breath over 1 second. Watch for the chest to rise as you give the breath.
5. If the chest does not rise, repeat the head tilt–chin lift.
6. Give a second breath (blow for about 1 second). Watch for the chest to rise.
7. If you are unable to ventilate the person after 2 attempts, promptly return to chest compressions.

Figure 38. Mouth-to-mouth breaths.

Breathing Techniques for Infants

Use one of the following techniques to give breaths in infants:

- Mouth-to-mouth-and-nose
- Mouth-to-mouth

The preferred technique for infants is mouth-to-mouth-and-nose. However, if you cannot cover the infant's nose and mouth with your mouth, use the mouth-to-mouth technique instead.

Mouth-to-Mouth-and-Nose Technique

1. Maintain a head tilt–chin lift to keep the airway open.
2. Place your mouth over the infant's mouth and nose and create an airtight seal (Figure 39).
3. Blow into the infant's mouth and nose (pausing to inhale between breaths), just enough to make the chest rise with each breath.
4. If the chest does not rise, repeat the head tilt–chin lift to reopen the airway, and then try again to give a breath that makes the chest rise. It may be necessary to move the infant's head through a range of positions to provide effective breaths. When the airway is open, give breaths that make the chest rise.

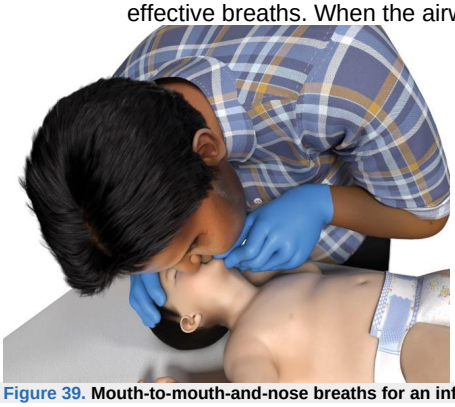

Figure 39. Mouth-to-mouth-and-nose breaths for an infant.

Mouth-to-Mouth Technique

1. Maintain a head tilt–chin lift to keep the airway open.
2. Pinch the infant's nose tightly with your thumb and forefinger.
3. Make a mouth-to-mouth seal.
4. Deliver each mouth-to-mouth breath, making sure the chest rises with each breath.
5. If the chest does not rise, repeat the head tilt–chin lift to reopen the airway. It may be necessary to move the infant's head through a range of positions to provide effective breaths. When the airway is open, give breaths that make the chest rise.

Caution: Risk of Gastric Inflation

If you give breaths too quickly or with too much force, air is likely to enter the stomach rather than the lungs. This can cause *gastric inflation* (filling of the stomach with air).

Gastric inflation frequently develops during mouth-to-mouth, mouth-to-mask, or bag-mask ventilation. It can result in serious complications. To reduce the risk of gastric inflation, avoid giving breaths too quickly, too forcefully, or with too much volume. But even if you give breaths correctly during high-quality CPR, gastric inflation may still develop.

To reduce the risk of gastric inflation

- Deliver each breath over 1 second
- Deliver just enough air to make the person's chest rise

Part 9
Opioid-Associated Emergency

Deaths related to opioid use are increasing. In the United States, drug overdose involving opioids is a leading cause of injury-related death. Opioid overdose can occur in anyone who takes opioids or has access to opioids. Unintentional overdose can happen at any time, to any person of any age, and in any place.

Given this ongoing crisis, it is important to know what to do if you suspect an opioid-associated emergency (opioid drug overdose) in an unresponsive person.

Learning Objectives

At the end of this Part, you will be able to

- Describe how to help someone in an opioid-associated emergency

What Are Opioids?

Opioid overdoses are one of the leading causes of cardiac arrest in young people. Opioids are a highly addictive class of drugs that are primarily prescribed for pain relief. Opioids can be prescribed medications, such as morphine, codeine, oxycodone, hydrocodone, fentanyl, hydromorphone, and buprenorphine.

Opioids, such as heroin and fentanyl, can also be produced or obtained illegally. Many illegal substances are mixed with opioids, so someone might take opioids without even knowing.

Opioids affect the brainstem, which controls a person's breathing. In high doses, opioids suppress the brain's natural drive to breathe, which causes respiratory depression, slows the heart rate, and can lead to cardiac arrest. This hypoxic state can cause damage to the brain even before the person's heart has stopped beating.

Naloxone is a medication that can reverse the effects of opioids and may restore normal breathing. It is safe to administer even if you're not sure what drug the person took. Common ways to give naloxone are intravenously, intramuscularly, and intranasally.

Opioid Misuse

Many people think that problematic opioid use happens only when someone takes an illegally produced or obtained opioid. Yet problems can occur when someone

- Takes more of a drug than is prescribed (either purposely or accidentally)
- Takes an opioid that was prescribed for someone else
- Combines opioids with alcohol or certain other drugs, such as tranquilizers or sleeping pills
- Has certain medical conditions, such as reduced liver function or sleep apnea
- Is older than 65 years

Identifying an Opioid-Associated Emergency

Scene Assessment

Scene assessment is an important tool for identifying whether opioids may be involved in a life-threatening emergency. It is critical to evaluate the scene and to assess potential dangers. To evaluate the scene for potential opioid overdose, use these strategies:

- Communicate with lay rescuers: Ask questions such as “Does anyone have any information about what happened?” and “Do you know if the person took anything?”
- Observe the person: Look for signs of injection on the skin, a medication patch, or other signs of opioid use.
- Assess the surroundings: Look for medication bottles or other signs of opioid use.
- Consider the need for appropriate PPE, such as gloves.

Signs of an Opioid Overdose

Look for the following signs of an opioid overdose:

- Slow, shallow, or no breathing
- Choking or gurgling sounds
- Drowsiness or loss of consciousness
- Small, constricted pupils
- Blue or gray coloring of the skin, lips, or nail beds

Do not delay lifesaving actions. After confirming scene safety, rescuers may perform the assessment at the same time as the resuscitation attempt.

Opioid Antagonists

Opioid antagonists can restore spontaneous respirations and protective airway reflexes in adults and children with respiratory depression or respiratory arrest from opioid overdose. Two opioid antagonists, naloxone and nalmefene, are currently available for reversal of an opioid overdose in the United States. Naloxone is currently available for purchase with or without a prescription in the United States and Canada. Intranasal nalmefene is available by prescription only. To date, the published clinical data are more robust for naloxone than for naloxone.

Naloxone: Antidote to Opioid Overdose

Naloxone is a medication that can reverse the effects of opioids and may restore normal breathing. It is safe to administer even if you're not sure what drug the person took. Common ways to give naloxone are intravenously, intramuscularly, and intranasally. Given the potency of opiates, you may need to give someone a second dose of naloxone if the person doesn't respond within 2 to 3 minutes after the first dose.

Naloxone Autoinjector

Naloxone handheld autoinjectors deliver a single dose via an intramuscular injection.

Intranasal Naloxone

An easy-to-use atomizer device delivers intranasal naloxone to the nose (Figure 40). There is no risk of needle-stick injuries with this method.

Figure 40. Easy-to-use atomizer device to deliver intranasal naloxone to the nose.

The body quickly absorbs intranasal naloxone because the nasal cavity has a relatively large surface of mucus membranes that are rich in capillaries.

Figure 41 shows how to administer naloxone. First, hold the canister with your thumb on the bottom of the plunger and your index and middle fingers on either side of the nozzle. Then, insert the tip of the nozzle onto the person's nostril. Press and hold the plunger to administer the entire dose. After you've emptied the canister, remove the nozzle from the person's nostril and discard. Each canister contains only a single dose, so you will need another canister to give a second dose.

Figure 41. Naloxone spray being administered.

Critical Concepts
What to Do for an Opioid-Associated Emergency

If you suspect an opioid-associated emergency, do the following:

- **If the person has a definite pulse but is not breathing normally:** Provide breaths and give naloxone according to package directions and per local protocol. Monitor for response.
- **If the person is in cardiac arrest and you suspect an opioid overdose:** Start CPR. Consider giving naloxone per package directions and per local protocol. Note that for those who are in cardiac arrest from opioid overdose, the effect of administering naloxone is not known and the priority should be on providing high-quality CPR.

Opioid-Associated Response Systems

The first rescuer who arrives at the side of an unresponsive person and suspects opioid use should quickly follow these steps. *As with any life-threatening emergency, do not delay lifesaving actions*.

For trained health care rescuers assisting with a suspected opioid overdose in an adult, do the following:

- If the person is not breathing normally but has a pulse
    - –Provide 1 breath every 6 seconds, or 10 breaths per minute
    - –Check the pulse every 2 minutes; if no pulse, start CPR
    - –If opioid overdose is suspected, administer opioid antagonist (eg, naloxone) if available
- If the person is not breathing normally and doesn't have a pulse
    - –Perform cycles of 30 compressions and 2 breaths
    - –Use the AED/defibrillator as soon as it is available
    - –If opioid overdose is suspected, consider opioid antagonist (eg, naloxone)

For lay rescuers assisting with a suspected opioid overdose in an adult, do the following:

- Activate the emergency response system and get an AED/defibrillator.
- Start CPR.
- Use the AED/defibrillator as soon as it is available.
- If opioid overdose is suspected, consider opioid antagonist (eg, naloxone).
- Resume CPR.

Part 10
Other Life-Threatening Emergencies

BLS providers may be called to respond to life-threatening medical emergencies that have not yet progressed to cardiac arrest. Some of these emergencies are heart attack, stroke, drowning, and anaphylaxis. You may save a life by recognizing what needs to be done and acting quickly.

Learning Objectives

At the end of this Part, you will be able to

- Recognize signs of a heart attack
- Describe actions to help someone having a heart attack
- Recognize signs of stroke
- Describe actions to help someone having a stroke
- Discuss examples of how to tailor rescue actions based on the cause of cardiac arrest
- Describe the Drowning Chain of Survival
- Describe actions to help a person experiencing cardiac arrest after drowning
- Recognize signs of a severe allergic reaction and anaphylaxis
- Describe actions to help someone having a severe allergic reaction and anaphylaxis
- Describe how to use an epinephrine autoinjector

Heart Attack

Heart disease has been the leading cause of death in the United States for both men and women for decades. Every 40 seconds, a person in the United States has a heart attack.

A heart attack occurs when a blockage forms or there is a severe spasm in a blood vessel that restricts the flow of blood and oxygen to the heart muscle. During a heart attack, the heart typically continues to pump blood. But the longer the person with a heart attack goes without treatment to restore blood flow, the greater the possible damage to the heart muscle. Sometimes, the damaged heart muscle triggers an abnormal rhythm that can lead to sudden cardiac arrest.

Signs of Heart Attack

The signs of a heart attack may differ depending on race, ethnicity, gender, and age. Signs of a heart attack may occur suddenly and be intense. Yet many heart attacks start slowly with mild pain or discomfort. Activate the emergency response system if someone is having signs of heart attack (Figure 42):

- **Chest discomfort:** Most heart attacks involve discomfort in the center of the chest that lasts more than a few minutes and often does not resolve with rest. The discomfort may go away with rest and then return. It can feel like uncomfortable pressure, squeezing, fullness, or pain.
- **Discomfort in other areas of the upper body:** Symptoms can include pain or discomfort in the left arm (commonly) but can occur in both arms, the upper back, neck, jaw, or stomach.
- **Shortness of breath:** This can occur with or without chest discomfort.
- **Other signs:** Breaking out in a cold sweat, nausea, vomiting, or light-headedness are other signs.

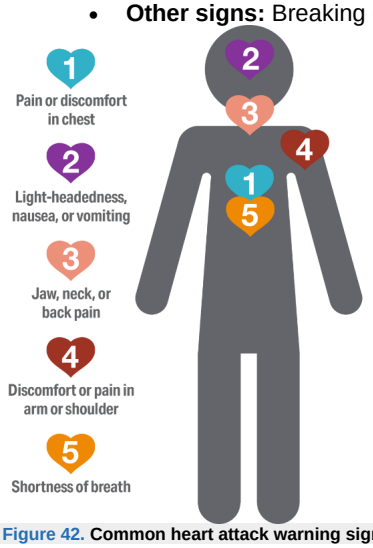

Figure 42. Common heart attack warning signs.

People who are female, are older, or have diabetes are more likely to have less typical signs of a heart attack, such as shortness of breath, weakness, unusual fatigue, cold sweat, and dizziness. Women who report chest discomfort may describe it as pressure, aching, or tightness rather than as pain.

Other less typical signs are heartburn or indigestion; an uncomfortable feeling in the back, jaw, neck, or shoulder; and nausea or vomiting. People who have trouble communicating may not be able to articulate signs of a heart attack.

Heart Attack and Sudden Cardiac Arrest

People often use the terms *heart attack* and *cardiac arrest* **interchangeably**, but they are not the same.

- A *heart attack* is a blood flow problem. It occurs because a blockage or spasm in a blood vessel severely restricts or cuts off the flow of blood and oxygen to the heart muscle.
- *Sudden cardiac arrest* is usually a rhythm problem. It occurs when the heart develops an abnormal rhythm. This abnormal rhythm causes the heart to quiver—or stop completely—and no longer pump blood to the brain, lungs, and other organs.

Within seconds, a person in cardiac arrest becomes unresponsive and is not breathing or is only gasping. Death occurs within minutes if the person does not receive immediate lifesaving treatment.

Heart attack happens more frequently than cardiac arrest. Although most heart attacks do not lead to cardiac arrest, they are a common cause. Other conditions that change the heart's rhythm may lead to cardiac arrest also.

Obstacles to Lifesaving Treatment

Early recognition, early intervention, and early transport of someone with a suspected heart attack is critical. Early access to the EMS system is often delayed because both the person and lay rescuers fail to recognize the signs of a heart attack. Lifesaving treatment can be delivered by emergency medical professionals on the way to the hospital, saving precious minutes and heart muscle.

Many people won't admit that their discomfort may be caused by a heart attack. People often say things like the following:

- "I'm too healthy." or "I'm too young."
- "I don't want to bother the doctor."
- "I don't want to frighten my spouse."
- "I'll feel silly if it isn't a heart attack."
- "It's just indigestion."

If you suspect that someone is having a heart attack, act quickly and activate the emergency response system. Don't hesitate, even if the person doesn't want to admit discomfort.

Actions to Help Someone Having a Heart Attack

Heart attack is a time-critical emergency. Every minute counts. If you think someone is having a heart attack, do the following:

1. Have the person sit and remain calm.
2. Activate the emergency response system or ask someone else to do so. Get the first aid kit and AED if available.
3. Encourage alert adults who are experiencing chest pain to chew and swallow aspirin (162-325 mg) unless they have a known aspirin allergy or have been told to not take aspirin by a health care professional. If uncertain if aspirin can be given to the person, wait for advanced care to arrive.
4. If the person becomes unresponsive and is not breathing or is only gasping, start CPR.

System of Care

Effective treatment of heart attack requires a well-coordinated, timely system of care. “Time is muscle!” Every minute counts. The longer someone having a heart attack waits for treatment, the more damage to the heart muscle. Timely interventions by health care professionals in the hospital to open the blocked coronary blood vessel can determine the amount of damage to the heart muscle. One common intervention is nonsurgical treatment in the cardiac cath lab. Administration of an intravenous medication in the ED is another intervention.

Actions of health care professionals during the first several hours after a heart attack determine how much the person will benefit from treatment. The goal is to decrease time from symptom onset until the blockage is resolved. Here are the steps in the out-of-hospital system of care for heart attack:

- **Early recognition and call for help:** The more quickly first responders or family recognize the warning signs of heart attack, the sooner treatment can begin. The emergency response system should be activated immediately for triage and transport. Family members should not drive the person with a suspected heart attack to the hospital, and that person should not drive themselves. Emergency responders can provide some interventions at the scene or during transport, thus lessening delay to definitive treatment in the hospital.
- **Early oxygen administration (if appropriate):** BLS providers should administer oxygen if the patient has difficulty breathing, obvious signs of heart failure, or an arterial oxygen saturation that is less than 90% or unknown. Adjust oxygen therapy to a noninvasively monitored oxyhemoglobin saturation of 90% or greater. The usefulness of supplemental oxygen therapy has not been established in patients with heart attack who have normal oxygen levels, so consider withholding oxygen in these patients.
- **Early EMS evaluation and 12-lead ECG:** The 12-lead ECG is the central component for triage of patients with chest discomfort. When EMS is able to perform a 12-lead ECG and transmit results to the receiving hospital, time to treatment is decreased. The ECG may be done at the scene or during transport.

- **Early heart attack identification:** Once EMS confirms a heart attack, they communicate with advanced care professionals and transport the patient to the most appropriate hospital.
- **Early notification:** EMS notifies the receiving facility as soon as possible of an incoming patient with heart attack. The cath lab team is activated before the patient's arrival. EMS activation of the cardiac cath lab speeds the time to diagnosis and intervention.
- **Early intervention:** Treatment interventions are time sensitive, and specific interventions have time-based goals to maximize effectiveness.

Critical Concepts

Time Is Heart Muscle

- Early recognition, early EMS activation, early transport by EMS, and early intervention for someone with a suspected heart attack is critical.
- Learn to recognize the signs of a heart attack. Activate the emergency response system without delay. Give aspirin if indicated. Be prepared to start CPR if the person becomes unresponsive.

Stroke

Stroke is a global health problem. It is the world's second leading cause of death. And it is the third leading cause of death and disability combined.

A stroke occurs when blood stops flowing to a part of the brain. Most strokes happen if an artery in the brain is blocked (ischemic stroke), but some happen when a blood vessel bursts (hemorrhagic stroke). Brain cells begin to die within minutes without blood and oxygen. Treatment in the first hours after a stroke can reduce damage to the brain and improve recovery.

Warning Signs of Stroke

Use the F.A.S.T. method to recognize and remember the warning signs of stroke (Table 5). F.A.S.T. stands for face drooping, arm weakness, speech difficulty, and time to call 911. If you see any of these signs, act F.A.S.T.

Table 5. Spot a Stroke F.A.S.T.

Letter	Stroke warning signs

F	**Face drooping:** Does one side of the face droop or is it numb? Ask the person to smile. Is the person's smile crooked?
A	**Arm weakness:** Is one arm weak or numb? Ask the person to raise both arms. Does one arm drift downward?
S	**Speech difficulty:** Is speech slurred? Is the person unable to speak or hard to understand? Ask the person to repeat a simple sentence like "The sky is blue." Is the sentence repeated correctly?
T	**Time to call 911 and note the time symptoms started:** If the person shows any of these symptoms, even if the symptoms go away, call 911 and get them to the hospital immediately. Remember to note the time symptoms started.

Other Signs of Stroke

Be alert for other common signs of stroke, such as

- Sudden dizziness, trouble walking, or loss of balance or coordination
- Sudden trouble seeing in one or both eyes
- Sudden severe headache with no known cause
- Sudden numbness of the face, arm, or leg
- Sudden weakness in part of the body
- Sudden confusion or trouble understanding others

In some cases, stroke symptoms may resolve on their own, such as in a transient ischemic attack (TIA). In a TIA, a clot that has blocked blood flow to the brain resolves spontaneously, allowing blood flow to resume. Patients with a suspected TIA should be treated with urgency and transported to the hospital for additional assessment.

Actions to Help a Person With Stroke

Stroke is a time-critical emergency. Every minute counts. If you think someone has had a stroke, do the following:

1. Quickly evaluate the person for signs of stroke by using the F.A.S.T. method (or other comparable assessment).
2. Activate the emergency response system or have someone else do so. Call 911 and get an AED, if available. If someone else is with you, have them call 911 and get the AED while you stay with the person who is having the stroke.
3. Help the person sit or lie down so that they are safe and not at risk of a fall or injury. Note time of symptom onset (last known normal).

4. Remain with the person until someone with more advanced training arrives and takes over.
5. If the person becomes unresponsive and is not breathing normally or is only gasping, **start CPR immediately and use the AED as soon as it arrives**.

System of Care

Effective stroke treatment requires a well-coordinated, timely system of care. Delay at any step limits treatment options. The longer a patient with stroke waits for treatment, the more brain tissue dies. Drugs and treatment interventions that break up a clot are time sensitive and have time-based goals to maximize effectiveness. BLS providers must know the last-known-well time. This is the point at which the patient was last known to be well without signs of stroke.

Here are the steps in the out-of-hospital system of care for stroke:

1. **Recognition:** The more quickly first responders or family recognize the warning signs of stroke (Table 5), the sooner treatment can begin. Delays in care can limit eligibility for certain types of therapy.
2. **EMS dispatch:** Someone should call 911 and get EMS on the way as quickly as possible. Family members should not transport the person with stroke to the hospital themselves.
3. **EMS identification, management, and transport:** EMS will determine if the patient is showing signs of a stroke and obtain important medical history. They will begin management and transport to the next level of care. EMS will call ahead to the receiving hospital to alert health care professionals that a patient with potential stroke will soon be arriving.
4. **Triage:** The patient should be triaged to the nearest appropriate facility for stroke care. Regional prehospital triage algorithms should help EMS decide where each patient should be sent for stroke care. Stroke care destinations may include Comprehensive Stroke Centers, Thrombectomy-Capable Stroke Centers, Primary Stroke Centers, or Acute Stroke Ready Hospitals. Transport decisions may be based on patient acuity, symptom severity, time of symptom onset, and time and distance to the destination.
5. **Evaluation and management:** Once the patient arrives at the ED, evaluation and management should proceed immediately. For patients with a suspected stroke, best practice is to bypass the ED and go straight to the brain imaging suite.
6. **Treatment decisions:** Health care professionals with stroke expertise will determine appropriate therapy.
7. **Therapy:** Drugs and treatment interventions that treat ischemic and hemorrhagic strokes are time sensitive. It is critical for someone having a stroke to quickly receive the appropriate treatment.

Critical Concepts

Time Is Brain

Stroke is a time-critical emergency. Every minute treatment is delayed, more brain tissue dies. Priorities are early recognition, limited scene time, and transport to the appropriate facility.

Drowning

The World Health Organization estimates there are about 236 000 deaths due to drowning worldwide each year. Significant efforts have focused on creating systems to prevent drowning, but an average of 4000 fatal and 8000 nonfatal drownings still occur annually in the United States—which is likely an underestimate.

In the United States, drowning is the leading cause of death for children ages 1 to 4 years and the second leading cause of injury death for children ages 5 to 14 years. Nonfatal drowning injuries can cause severe brain damage, resulting in disabilities and permanent loss of basic functioning.

Drowning Chain of Survival

Water competency is the ability to anticipate, avoid, and survive common drowning situations. It involves developing water skills, being water smart, and helping others. The Drowning Chain of Survival (Figure 43) can help you prevent drowning, respond quickly and effectively, and potentially save someone who is drowning.

Figure 43. Drowning Chain of Survival.

Modified from Szpilman D, Webber J, Quan L, et al. Creating a drowning chain of survival. *Resuscitation*. 2014;85:1149-1152. doi:10.1016/j.resuscitation.2014.05.034

Prevent Drowning

Developing skills like treading water, floating, swimming, and knowing how to enter and exit the water helps to keep people safe. Being water smart involves having pool fences, taking swimming lessons, closely watching small children around water, and wearing a US Coast Guard–approved life jacket around open water. The smartest action you can take is to never swim alone.

Recognize Distress

A swimmer in distress may be shouting, thrashing in the water, or otherwise showing signs that they are struggling to stay above water. To help a struggling swimmer, first, make sure the scene is safe and shout for help. Tell someone to call 911 and get the AED.

Provide Flotation

Provide the struggling swimmer with a rope, pole, or flotation device to grab onto. The safest way to help a drowning person is to remain out of the water yourself so that you don't become another person who will need help.

Remove From Water

If you're able to do so without putting yourself in danger, move the person to shallow water, ideally in a flat position with their head above water or out of the water completely.

Provide Care

If the person is not responding and not breathing, you'll need to open their airway by using the head tilt–chin lift maneuver and then give 2 rescue breaths. If for any reason you can't give mouth-to-mouth breaths, give mouth-to-nose breaths instead.

Keep in mind that someone who dove into a pool or water with hazards could have a head or spinal injury. If you are concerned about a possible injury, use the jaw-thrust maneuver instead of the head tilt–chin lift maneuver.

Check for a pulse for at least 5 but no more than 10 seconds.

Don't worry about clearing any water that the person may have breathed in—it's not necessary. If the person is still not breathing and not responding, they may be in cardiac arrest. Start CPR and use an AED as soon as a device is available.

Trained Rescuer vs Untrained Lay Rescuer

For the special circumstance of cardiac arrest after drowning, a *trained rescuer* is defined as an individual with appropriate training to perform the task discussed in a given recommendation. This is independent of the individual's occupation or ethical duty to respond. Lifeguards, swimming instructors, emergency medical technicians, paramedics, police, firefighters, other volunteers, and off-duty health care professionals, if appropriately trained for the task mentioned in the recommendation, would be considered trained rescuers and would be expected to respond in the manner recommended. Trained rescuers must have the appropriate expertise and training necessary for that specific resuscitation task and have access to the equipment necessary to perform the specific skill.

An *untrained lay rescuer* is an individual who lacks the expertise to safely perform a specific resuscitation task. A health care professional could be considered trained or untrained depending on the skill required for the task recommended. For example, an off-duty health care professional who has training in BLS and ALS would be expected to deliver chest compressions with rescue breathing. On the other hand, a health care professional who is not skilled at water rescue would be considered untrained for in-water rescue breathing. In-water rescue is a skill typically not learned by health care professionals but common to most aquatic first responder training (eg, lifeguards).

Actions to Help a Person After Cardiac Arrest Following Drowning

The BLS sequence for a person who has cardiac arrest after drowning is different from the one for sudden cardiac arrest. Cardiac arrest in a drowning person is caused by a severe lack of oxygen in the body (asphyxial arrest). The priority is to get oxygen to the brain, heart, and other tissues by beginning with breaths and then providing compressions. However, for a person experiencing sudden cardiac arrest, CPR begins with chest compressions and then breaths.

Follow these steps along with the adult or the pediatric BLS algorithm to help someone who has drowned and is in cardiac arrest:

1. Call for help. Ask someone to activate the emergency response system. The safest method to initiate help during a drowning involves remaining out of the water, calling for rescue services (ie, a lifeguard, EMS), throwing a flotation device, and waiting for a professional to arrive.
2. Check for breathing. If there is no breathing, open the airway.
3. Give 2 breaths that make the chest rise.
    a. Do not try to clear the airway of aspirated water. Most drowning people aspirate only a modest amount of water, and it is absorbed rapidly.

    b. Do not use abdominal thrusts to try to remove water from the breathing passages. These actions are not recommended and can be dangerous.
4. Check for a pulse after giving 2 effective breaths.
    a. If the person is not breathing normally but has a pulse, provide breaths only. Recheck for a pulse every 2 minutes.
    b. If you do not feel a pulse, start CPR.
5. Start CPR with cycles of 30 compressions and 2 breaths. Give 5 cycles of 30 compressions and 2 breaths (about 2 minutes) and then activate the emergency response system if not already done. Trained rescuers should provide oxygen if available to children and adults with cardiac arrest after drowning.
6. Use the AED as soon as it is available. Attach the AED once the person is out of the water. Dry the chest area quickly before applying the AED pads.
7. Follow the AED prompts. If no shock is needed and after any shock delivery, immediately resume CPR, starting with chest compressions.

Vomiting During Resuscitation

The person may vomit when you are providing breaths or chest compressions. If this happens, turn the person to the side. If you suspect a spinal cord injury, roll the person so that the head, neck, and torso are turned as a unit. This will help protect the cervical spine. Remove the vomit using your finger or a cloth. You may use suction if doing so is within your scope of practice.

Transport

Anyone who has experienced drowning should be transported by EMS to the ED for evaluation and monitoring. This includes people who needed only breaths or those who are alert and seem to have recovered. Although survival is uncommon in those who have been underwater for a long time, there have been cases of successful recovery, especially for those who were in cold water. For this reason, rescuers should provide CPR at the scene and the person should be transported in accordance with local protocols.

Critical Concepts

Breaths First

The first and most important action for someone who has experienced drowning is to give breaths as soon as possible. This action increases the person’s chance of survival.

Anaphylaxis

Most allergic reactions are mild. Some, however, worsen to a state of anaphylaxis. Anaphylaxis is a severe allergic reaction that can be life-threatening and requires urgent treatment. Treatment may include an epinephrine injection.

Prompt recognition is critical. You must be able to identify if an allergic reaction is mild or severe (anaphylaxis).

Mild Allergic Reaction

Signs of a Mild Allergic Reaction

Signs of a mild allergic reaction are

- Stuffy nose, sneezing, and itching around the eyes
- Itching of the skin or mucous membranes
- Raised, red rash on the skin (hives)

Actions for Mild Allergic Reaction

- Get help if needed.
- Remove the person from the allergen if known (move out of the environment, wash the affected skin).
- Ask about any history of allergy or anaphylaxis; look for a medical alert bracelet or necklace.
- Consider an oral dose of antihistamine.

Severe Allergic Reaction

A severe allergic reaction (anaphylaxis) can be life-threatening if not recognized and treated immediately. Anaphylaxis occurs suddenly after contact with an allergen. Some common allergens associated with anaphylaxis are medicines, latex, foods, and stinging insects. In anaphylaxis, 2 or more body systems are involved.

Signs of a Severe Allergic Reaction

Signs of a severe allergic reaction may include

- **Breathing:** Wheezing, a sensation of the throat closing, difficulty breathing
- **Skin:** Hives, rash, lip and facial swelling
- **Circulation:** Signs of poor perfusion (shock), which may include very fast heart rate, changes in skin color, cool skin, not alert, low blood pressure, dizziness
- **Gastrointestinal:** Stomach cramping, diarrhea, nausea, vomiting

Criteria for Anaphylaxis

Many rescuers have trouble recognizing anaphylaxis. Look for the following 4 criteria:

- Signs that come on quickly and rapidly get worse
- Skin changes, such as flushing, itching, and swelling of the lips, tongue, and face
- Life-threatening airway, breathing, or circulation problems
- Involvement of 2 or more body systems

Remember that skin changes alone are not a sign of an anaphylactic reaction.

Epinephrine Autoinjector for Anaphylaxis

Epinephrine is a drug that can temporarily relieve the life-threatening problems caused by anaphylaxis. The mainstay of immediate treatment for anaphylaxis is intramuscular epinephrine. It is available by prescription in a self-injectable device called an *epinephrine autoinjector*. People who are known to have anaphylaxis are encouraged to carry epinephrine autoinjectors with them at all times.

There are 2 types of epinephrine autoinjectors: spring activated and electronic. Doses are different for children and adults. The epinephrine injection is given in the side of the thigh, about halfway between the hip and the knee. This is the safest location for administration. Epinephrine can be given on bare skin or through clothing.

Someone who has an epinephrine autoinjector will generally know how and when to use it. If the person is unable, you may help give the injection if the medication has been prescribed by a physician and state law permits it.

Actions to Help Someone With Anaphylaxis

Anaphylaxis can be life-threatening. Follow these steps to help someone with suspected anaphylaxis:

1. Activate the emergency response system or ask someone else to do so. Send someone to get the person's epinephrine autoinjector(s).
2. Use or help the person use the epinephrine autoinjector as soon as possible (Figure 44). Refer to the How to Use an Epinephrine Autoinjector section.
3. Send someone to get an AED.
4. Give a second dose of epinephrine if the person's symptoms continue and advanced care will not arrive in 5 to 10 minutes.
5. If the person becomes unresponsive and is not breathing or is only gasping, start CPR.
6. If possible, save a sample of what caused the reaction. Give it to the advanced responders.

Critical Concepts: Lifesaving Action for Anaphylaxis

The first and most important action for someone with suspected anaphylaxis is to give an immediate injection of epinephrine using an epinephrine autoinjector.

How to Use an Epinephrine Autoinjector

You should know the correct technique for using an epinephrine autoinjector. Some devices give voice prompts to guide users through the administration of the epinephrine dose.

Device Safety

Before using the epinephrine autoinjector, quickly examine it to make sure it is safe to use.

Do not use it if the

- Solution is discolored (when it is possible to see the medicine)
- Clear window on the autoinjector is red

Steps for Using an Epinephrine Autoinjector

Follow these steps to use an epinephrine autoinjector correctly:

1. Follow the instructions on the device. Make sure you are holding the device in your fist without touching either end because the needle comes out of one end. You may give the injection through clothes or on bare skin. Take off the safety cap (Figure 44A).
2. Hold the leg firmly in place just before and during the injection. Press the tip of the injector hard against the side of the person's thigh, about halfway between the hip and the knee (Figure 44B).
3. Hold the injector in place for 3 seconds. Some other injectors may be held in place for up to 10 seconds. Be familiar with the manufacturer's instructions for the type of injector you are using.
4. Pull the injector straight out, making sure you do not put your fingers over the end that has been pressed against the person's thigh.
5. Either the person getting the injection or the one giving the injection should rub the injection spot for about 10 seconds.
6. Note the time of the injection. Properly dispose of the injector.
7. Ensure that EMS is on the way. If there is a delay greater than 5 to 10 minutes for advanced help to arrive, consider giving a second dose, if available.

Figure 44A. Using an epinephrine autoinjector. A, Take off the safety cap.

Figure 44B. Press the tip of the injector hard against the side of the thigh, about halfway between the hip and the knee.

Safe Disposal

It’s important to dispose of used needles correctly so that no one gets stuck. Follow the sharps disposal policy at your workplace. If you don’t know what to do with the used injector, give it to someone with more advanced training.

Part 11
Choking Relief for Adults, Children, and Infants

This section discusses how to recognize choking (from an FBAO) and then perform maneuvers to relieve the obstruction. Choking relief maneuvers are the same for adults and children (1 year and older). You will learn a different technique to relieve choking for infants (younger than 1 year).

The effectiveness and safety of suction-based airway clearance devices have not been established in infants and children. There is insufficient evidence to make a recommendation for infants and children.

Learning Objectives

At the end of this Part, you will be able to

- Describe how to relieve an FBAO for an adult, a child, and an infant

Signs of Choking

Early recognition of FBAO is the key to successful outcome. It is important to distinguish this emergency from fainting, stroke, heart attack, seizure, drug overdose, or other conditions that may cause sudden respiratory distress but require different treatment.

Foreign bodies may cause a range of signs from *mild* to *severe* airway obstruction (Table 6). Anyone experiencing signs of mild to severe airway obstruction should be seen by a health care professional, even if they're able to clear the object on their own.

Table 6. Signs of FBAO and Rescuer Actions for Adults, Children, and Infants

Type of obstruction	Signs	Rescuer actions
Mild airway obstruction	• Good air exchange • Can cough forcefully • May wheeze between coughs	• As long as good air exchange continues, encourage the person to continue coughing.

		• Do not interfere with the person's own attempts to relieve the obstruction. Stay with the person and monitor the condition. • If mild airway obstruction continues or progresses to signs of severe airway obstruction, activate the emergency response system.
Severe airway obstruction	• Clutching the throat with the thumb and fingers, making the universal choking sign (Figure 45) • Unable to speak or cry • Poor or no air exchange • Weak, ineffective cough or no cough at all • High-pitched noise while inhaling or no noise at all • Increased respiratory difficulty • Possible cyanosis (blue or gray coloring of the lips, nail beds, or skin)	• If the person is an adult or child, ask, "Are you choking?" If the person nods "yes" and cannot talk, severe airway obstruction is present. • Take steps immediately to relieve the obstruction and activate the emergency response system. • If severe airway obstruction continues and the person becomes unresponsive, start CPR. • If you are not alone, send someone to activate the emergency response system if not already done. • If you are alone and must leave to activate the emergency response system, provide about 2 minutes of CPR before leaving. For infants, you may carry the infant with you to go activate the emergency response system.

Figure 45. The universal choking sign indicates the need for help when someone is choking.

Choking Relief for Severe FBAO in Adults and Children

To relieve choking in a responsive adult or child, follow the steps as outlined in the Adult Foreign-Body Airway Obstruction Algorithm (Figure 46) and the Child Foreign-Body Airway Obstruction Algorithm (Figure 47).

Choking happens when something blocks a person's airway. In a severe airway obstruction, the person usually has signs of poor air exchange and difficulty breathing, such as a silent cough, an inability to speak or breathe, or cyanosis—that is, blue or gray coloring of the lips, nail beds, or skin.

To relieve choking in a responsive adult or child, perform 5 forceful back blows followed by 5 abdominal thrusts. You should also activate the emergency response system in case the person becomes unresponsive. If someone indicates that they're choking and can't talk, you must take action.

Adults or older children who are choking may clutch their neck with both hands, making the universal choking sign (Figure 45). For an adult or child who has signs of severe choking, ask them, "Are you choking?" If they nod "yes" and cannot talk, a severe airway obstruction is present and you need to take steps immediately to relieve the obstruction.

Perform 5 back blows by using the heel of your hand to forcefully strike the person's back between their shoulder blades. If back blows do not relieve the choking, perform 5 abdominal thrusts. Make a fist with one hand, grab it with your other hand, and press your fist into the person's abdomen with a quick, forceful upward thrust. Give each new thrust with a separate, distinct movement.

Continue alternating 5 back blows followed by 5 abdominal thrusts until the object is dislodged or the person becomes unresponsive.

Adult Foreign-Body Airway Obstruction Algorithm

To relieve choking in a responsive adult, follow the steps as outlined in the Adult Foreign-Body Airway Obstruction Algorithm (Figure 46).

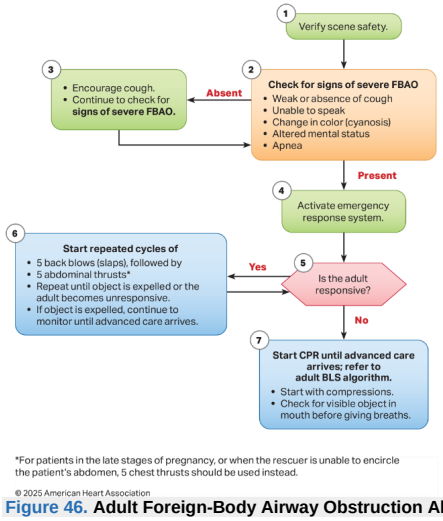

Figure 46. **Adult Foreign-Body Airway Obstruction Algorithm.**

Adult Foreign-Body Airway Obstruction BLS Sequence

This is your step-by-step guide when you encounter an adult experiencing an FBAO. The numbered steps correspond to the steps on the Adult Foreign-Body Airway Obstruction Algorithm.

Step 1: Verify scene safety.

Step 2: Check for signs of severe FBAO.

Signs of severe FBAO include

- Weak or absence of cough
- Inability to speak or talk
- Change in color (cyanosis)
- Altered mental status
- Apnea

Step 3: If signs of severe FBAO are absent:

- Encourage the person to cough.
- Continue to check for signs of severe FBAO.

Step 4: If signs of severe FBAO are present, activate the emergency response system.

Step 5: Check for responsiveness.

Step 6: If the adult is responsive:

- Start repeated cycles of 5 back blows (slaps) followed by 5 abdominal thrusts (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).
- Repeat until the object is expelled or the adult becomes unresponsive.
- If the object is expelled, continue to monitor until advanced care arrives.

Step 7: If the adult is unresponsive:

- Start CPR until advanced care arrives (refer to the Adult BLS Algorithm for Health Care Professionals).
    - –Start with compressions.
    - –Check for a visible object in the mouth before you give breaths.

Child Foreign-Body Airway Obstruction Algorithm

To relieve choking in a responsive child, follow the steps as outlined in the Child Foreign-Body Airway Obstruction Algorithm (Figure 47).

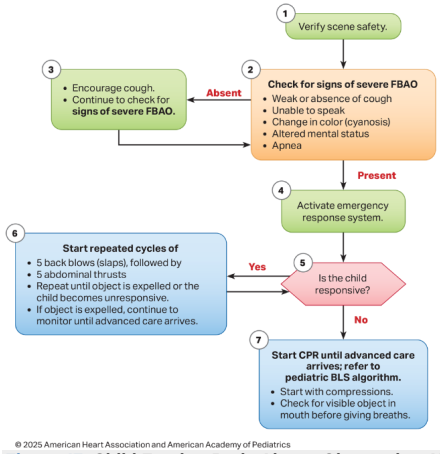

Figure 47. **Child Foreign-Body Airway Obstruction Algorithm.**

Child Foreign-Body Airway Obstruction BLS Sequence

This is your step-by-step guide when you encounter a child experiencing an FBAO. The numbered steps correspond to the steps on the Child Foreign-Body Airway Obstruction Algorithm.

Step 1: Verify scene safety.

Step 2: Check for signs of severe FBAO.

Signs of severe FBAO include

- Weak or absence of cough
- Inability to speak or talk
- Change in color (cyanosis)
- Altered mental status
- Apnea

Step 3: If signs of severe FBAO are absent:

- Encourage the child to cough.
- Continue to check for signs of severe FBAO.

Step 4: If signs of severe FBAO are present, activate the emergency response system.

Step 5: Check for responsiveness.

Step 6: If the child is responsive:

- Start repeated cycles of 5 back blows (slaps) followed by 5 abdominal thrusts (Figure 48).
- Repeat until the object is expelled or the child becomes unresponsive.
- If the object is expelled, continue to monitor until advanced care arrives.

Step 7: If the child is unresponsive:

- Start CPR until advanced care arrives (refer to the Pediatric BLS Algorithm for Health Care Professionals).
    - –Start with compressions.
    - –Check for a visible object in the mouth before you give breaths.

Figure 48A. Rescuer delivering back blows to a child.

Figure 48B. Rescuer performing abdominal thrusts on a child.

If you see an object that looks easy to remove, remove it with your fingers. If you don't see an object, don't blindly put your fingers in the person's mouth, also known as a *blind finger sweep*. Performing a blind finger sweep may cause the object to become lodged farther back in the airway.

You should make sure the person is seen by a health care professional even if they are able to clear the object on their own.

Choking Relief for Severe FBAO in a Responsive Pregnant or Obese Person or Someone in a Wheelchair

If you are unable to wrap your arms around the person's abdomen, if they are visibly pregnant, or if they are in a wheelchair, perform chest thrusts instead of abdominal thrusts (Figure 49). To perform chest thrusts, put your arms under their armpits, and place one fist, thumb side toward the body, in the middle of the chest on the lower half of the breastbone. With your other hand, grab the fist. Pull straight back to give chest thrusts instead of abdominal thrusts. If the person becomes unresponsive, start CPR until advanced care arrives and refer to the adult or pediatric BLS algorithm:

- Start with compressions.
- Check for a visible object in the mouth before giving breaths.

Figure 49. Perform chest thrusts instead of abdominal thrusts for a large person or someone who is pregnant or in a wheelchair.

Choking Relief in Infants

Choking is also a common emergency in infants. To relieve choking in a responsive infant, follow the steps as outlined in the Infant Foreign-Body Airway Obstruction Algorithm (Figure 50).

The steps to relieve choking in an infant are similar to those for adults and children, with a few key differences.

First, don't use abdominal thrusts on infants.

If you find an infant who's choking but is still responsive, activate the emergency response system. Kneel or sit with the infant in your lap. Hold the infant facedown with the head slightly lower than the chest and resting on your forearm.

Support the infant's head and jaw with your hand. Avoid compressing the soft tissue of the infant's throat. Rest your forearm on your lap or thigh to support the infant. With the heel of your other hand, deliver 5 forceful back blows between the infant's shoulder blades.

Deliver each back blow with sufficient force to attempt to dislodge the object. After delivering 5 back blows, place your free hand on the infant's back, supporting the head with the palm of your hand. This will cradle the infant between your 2 forearms, with the palm of one hand supporting the face and jaw while the palm of the other hand supports the back of the infant's head.

Turn the infant over while carefully supporting the head and neck. Hold the infant faceup, with your forearm resting on your thigh. Keep the infant's head lower than their trunk. Provide 5 quick downward chest thrusts with the heel of 1 hand in the

middle of the chest, over the lower half of the sternum. Deliver chest thrusts at a rate of about 1 per second, each with enough force to dislodge the object.

Repeat the sequence of up to 5 back blows and up to 5 chest thrusts until your actions have removed the object or the infant becomes unresponsive.

Infant Foreign-Body Airway Obstruction Algorithm

To relieve choking in a responsive infant, follow the steps as outlined in the Infant Foreign-Body Airway Obstruction Algorithm (Figure 50).

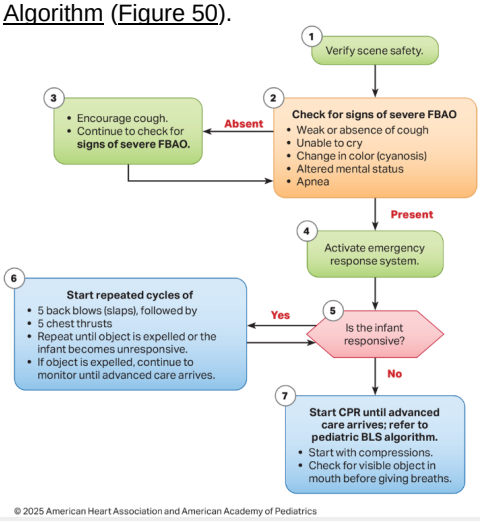

Figure 50. Infant Foreign-Body Airway Obstruction Algorithm.

Infant Foreign-Body Airway Obstruction BLS Sequence

This is your step-by-step guide when you encounter an infant experiencing an FBAO. The numbered steps correspond to the steps on the Infant Foreign-Body Airway Obstruction Algorithm (Figure 50).

Step 1: Verify scene safety.

Step 2: Check for signs of severe FBAO.

Signs of severe FBAO include

- Weak or absence of cough
- Inability to cry
- Change in color (cyanosis)
- Altered mental status
- Apnea

Step 3: If signs of severe FBAO are absent:

- Encourage the infant to cough.
- Continue to check for signs of severe FBAO.

Step 4: If signs of severe FBAO are present, activate the emergency response system.

Step 5: Check the infant for responsiveness.

Step 6: If the infant is responsive:

- Start repeated cycles of 5 back blows (slaps) followed by 5 chest thrusts (Figure 51).
- Repeat until the object is expelled or the infant becomes unresponsive.
- If the object is expelled, continue to monitor until advanced care arrives.

Figure 51A. Relief of choking in an infant. A, Back blows.

Figure 51B. **Chest thrusts.**

Step 7: If the infant is unresponsive:

- Start CPR until advanced care arrives (refer to the Pediatric BLS Algorithm for Health Care Professionals).
  - –Start with compressions.
  - –Check for a visible object in the mouth before you give breaths.

Critical Concepts

Infant Chest Thrusts

The heel-of-1-hand technique for chest thrusts is now recommended for infants with severe foreign-body airway obstruction because current CPR literature suggests that it generates greater compression depth than the previously recommended 2-finger technique.

While the heel-of-1-hand technique for chest thrusts resembles chest compressions used in CPR, there is no focus on the other components of high-quality CPR chest compressions (eg, rate, recoil) when performing chest thrusts for a foreign-body airway obstruction.

Unresponsive Infant

If the infant becomes unresponsive, start CPR immediately, starting with chest compressions. Do not perform a pulse check. Each time you open the airway, look for the object in the back of the throat. If you see an object and can easily remove it, remove it. After about 2 minutes of CPR, activate the emergency response system (if no one has done so) and get the AED/defibrillator.

Critical Concepts

No Blind Finger Sweeps

Do not perform a blind finger sweep because it may push the foreign body back into the airway, causing further obstruction or injury.

Giving Effective Relief When There Is an Airway Obstruction

When a choking person loses consciousness, the muscles in the throat may relax. This could convert a complete or severe airway obstruction to a partial obstruction. In addition, chest compressions may create at least as much force as abdominal thrusts, so they may help expel the object. Giving 30 compressions and then removing any object that's visible in the mouth may allow you to eventually give effective breaths.

Actions After Choking Relief

You will know you successfully removed an airway obstruction in an unresponsive person if you saw and removed a foreign body from the person's mouth and the person starts to breathe. However, you don't always have to remove the foreign body to successfully relieve the obstruction. If you can feel air movement and see the chest rise when you give breaths, the airway is no longer obstructed.

After you relieve choking in a person who is unresponsive, proceed as you would with any unresponsive person. Check again for responsiveness, check for breathing and a pulse, confirm that someone has activated the emergency response system, and provide high-quality CPR or breaths as needed.

Encourage a *responsive* person to seek immediate medical attention. A health care professional should evaluate the person for potential complications from abdominal thrusts.

Appendix

Basic Life Support
Adult CPR and AED Skills Testing Checklist

American Heart Association.

Student Name _____ Date of Test _____

In-Hospital Scenario: "You see a person who has suddenly collapsed in the hallway. You check that the scene is safe and then approach the person. Demonstrate what you would do next."

Out-of-Hospital Scenario: "You arrive on the scene for a suspected cardiac arrest. Hands-Only CPR is in progress. You approach the scene and ensure that it is safe. Demonstrate what you would do next."

Assessment and Activation

☐ Checks responsiveness ☐ Shouts for help/Activates emergency response system/Sends for AED
☐ Checks breathing ☐ Checks pulse

Once student shouts for help, instructor says, "Here's the barrier device. I am going to get the AED."

Cycle 1 of CPR (30:2) ***CPR feedback devices are required for accuracy***

Adult Compressions

☐ Performs high-quality compressions*:
- Hand placement in the center of the chest, on the lower half of the sternum
- 30 compressions, given at a rate of 100 to 120/min
- Compresses at least 2 inches (5 cm)
- Complete recoil after each compression

Adult Breaths

☐ Gives 2 breaths with a barrier device:
- Each breath given over 1 second
- Visible chest rise with each breath
- Resumes compressions in less than 10 seconds

Cycle 2 of CPR (repeats steps in Cycle 1) ***Only check box if step is successfully performed***

☐ Compressions ☐ Breaths ☐ Resumes compressions in less than 10 seconds

Rescuer 2 says, "Here is the AED. I'll take over compressions, and you use the AED."

AED (follows prompts of AED)

☐ Powers on AED ☐ Correctly attaches pads ☐ Clears for analysis
☐ Clears to safely deliver a shock ☐ Safely delivers a shock

Resumes Compressions

☐ Ensures compressions are resumed immediately after shock delivery
- Student directs instructor to resume compressions *or*
- Second student resumes compressions

STOP TEST

Instructor Notes

- Place a check in the box next to each step the student completes successfully.
- If the student does not complete all steps successfully (as indicated by at least 1 blank check box), the student must receive remediation. Make a note here of which skills require remediation (refer to instructor manual for information about remediation).

Test Results Circle **PASS** or **NR** to indicate pass or needs remediation:	**PASS**	**NR**

Instructor Initials _____ Instructor Number _____ Date _____

Basic Life Support

Adult CPR and AED

Skills Testing Critical Skills Descriptors

1. **Assesses the person and activates emergency response system (this must precede starting compressions) within 30 seconds. After determining that the scene is safe:**
    - Checks for responsiveness by tapping and shouting
    - Shouts for help/directs someone to call for help and get AED/defibrillator
    - Checks for no breathing or no normal breathing (only gasping)
        - –Scans from the head to the chest for at least 5 but no more than 10 seconds
    - Checks carotid pulse
        - –Should be done simultaneously with check for breathing
        - –Checks for at least 5 but no more than 10 seconds
2. **Performs high-quality chest compressions (initiates compressions immediately after recognition of cardiac arrest)**
    - Correct hand placement
        - –Lower half of sternum
        - –2-handed (second hand on top of the first or grasping the wrist of the first hand)
    - Compression rate of 100 to 120/min
        - –Delivers 30 compressions in 15 to 18 seconds
    - Compression depth and recoil—at least 2 inches (5 cm) and avoiding compressing more than 2.4 inches (6 cm)
        - –Use of a commercial feedback device or high-fidelity manikin is required
        - –Complete chest recoil after each compression
    - Minimizes interruptions in compressions
        - –Delivers 2 breaths so less than 10 seconds elapses between last compression of one cycle and first compression of next cycle
        - –Compressions resumed immediately after shock/no shock indicated
3. **Provides 2 breaths by using a barrier device**
    - Opens airway adequately
        - –Uses a head tilt–chin lift maneuver or jaw thrust
    - Delivers each breath over 1 second

- Delivers breaths that produce visible chest rise
- Avoids excessive ventilation
- Resumes chest compressions in less than 10 seconds

4. **Performs same steps for compressions and breaths for Cycle 2**
5. **AED use**
    - Powers on AED
        - –Turns AED on by pushing button or lifting lid as soon as it arrives
    - Correctly attaches pads
        - –Places proper-sized (adult) pads for the person's age in the correct location. Places one pad vertically on the person's right upper chest with the top of the pad just under the clavicle. Places the second pad horizontally on the person's left lateral ribs with the middle of the pad below the axilla at the midaxillary line
    - Allows for rhythm analysis according to device prompts and manufacturer instructions
        - –Some devices allow for analysis during compressions and others require a pause in compressions to allow for analysis
        - –Clears rescuers from the person for AED to analyze rhythm (pushes Analyze button if required by device)
        - –Communicates clearly to all other rescuers to stop touching the person
    - Clears to safely deliver shock
        - –Communicates clearly to all other rescuers to stop touching the person
    - Safely delivers a shock
        - –Resumes chest compressions immediately after shock delivery
        - –Does not turn off AED during CPR
6. **Resumes compressions**
    - Ensures that high-quality chest compressions are resumed immediately after shock delivery
        - –Performs same steps for compressions

Basic Life Support

Infant CPR
Skills Testing Checklist

Student Name _____ Date of Test _____

In-Hospital Scenario: "You see a person run through the door carrying an infant. They shout, 'Help me! My baby's not breathing.' You have gloves and a pocket mask. You send your coworker to activate the emergency response system and to get the emergency equipment."

Out-of-Hospital Scenario: "You arrive on the scene for an infant who is not breathing. Hands-Only CPR is in progress. You approach the scene and ensure that it is safe. Demonstrate what you would do next."

Assessment and Activation

- ☐ Checks responsiveness
- ☐ Shouts for help/Activates emergency response system
- ☐ Checks breathing
- ☐ Checks pulse

Once student shouts for help, instructor says, "Here's the barrier device."

Cycle 1 of CPR (30:2) ***CPR feedback devices are preferred for accuracy***

Infant Compressions

☐ Performs high-quality compressions*:

- Placement of the heel of 1 hand in the center of the chest, just below the nipple line
- 30 compressions in no less than 15 and no more than 18 seconds
- Compresses at least one third the AP diameter of the chest, approximately 1½ inches (4 cm)
- Complete recoil after each compression

Infant Breaths

☐ Gives 2 breaths with a barrier device:

- Each breath given over 1 second
- Visible chest rise with each breath
- Resumes compressions in less than 10 seconds

Cycle 2 of CPR (repeats steps in Cycle 1) ***Only check box if step is successfully performed***

☐ Compressions ☐ Breaths ☐ Resumes compressions in less than 10 seconds

Rescuer 2 arrives with bag-mask device and begins ventilation while Rescuer 1 continues compressions with 2 thumb–encircling hands technique.

Cycle 3 of CPR

Rescuer 1: Infant Compressions

☐ Performs high-quality compressions*:

- 15 compressions with 2 thumb–encircling hands technique
- 15 compressions in no less than 7 and no more than 9 seconds
- Compresses at least one third the AP diameter of the chest, approximately 1½ inches (4 cm)
- Complete recoil after each compression

Rescuer 2: Infant Breaths

This rescuer is not evaluated.

Cycle 4 of CPR

Rescuer 2: Infant Compressions

This rescuer is not evaluated.

Rescuer 1: Infant Breaths

☐ Gives 2 breaths with a bag-mask device:

- Each breath given over 1 second
- Visible chest rise with each breath
- Resumes compressions in less than 10 seconds

STOP TEST

Instructor Notes

- Place a check in the box next to each step the student completes successfully.
- If the student does not complete all steps successfully (as indicated by at least 1 blank check box), the student must receive remediation. Make a note here of which skills require remediation (refer to instructor manual for information about remediation).

Test Results Circle **PASS** or **NR** to indicate pass or needs remediation:	**PASS**	**NR**

Instructor Initials _____ Instructor Number _____ Date _____

Basic Life Support

Infant CPR

Skills Testing Critical Skills Descriptors

1. **Assesses the person and activates emergency response system (this must precede starting compressions) within 30 seconds. After determining that the scene is safe:**
    - Checks for responsiveness by tapping and shouting
    - Shouts for help/directs someone to call for help and get emergency equipment
    - Checks for no breathing or no normal breathing (only gasping)
        - –Scans from the head to the chest for at least 5 but no more than 10 seconds
    - Checks brachial pulse
        - –Can be done simultaneously with check for breathing
        - –Checks for at least 5 but no more than 10 seconds
2. **Performs high-quality chest compressions during 1-rescuer CPR (initiates compressions within 10 seconds after identifying cardiac arrest)**
    - Correct placement of heel of 1 hand in center of chest, just below the nipple line
        - –1 rescuer: heel of 1 hand just below the nipple line
    - Compression rate of 100 to 120/min
        - –Delivers 30 compressions in 15 to 18 seconds
    - Adequate depth for age
        - –Infant: at least one third the AP diameter of the chest (approximately 1½ inches [4 cm])
        - –Use of a commercial feedback device or high-fidelity manikin is preferred
    - Complete chest recoil after each compression
    - Appropriate ratio for age and number of rescuers
        - –1 rescuer: 30 compressions to 2 breaths
    - Minimizes interruptions in compressions
        - –Delivers 2 breaths so less than 10 seconds elapses between last compression of one cycle and first compression of next cycle
3. **Provides effective ventilations with bag-mask device during 2-rescuer CPR**
    - Opens airway adequately
    - Delivers each breath over 1 second
    - Delivers breaths that produce visible chest rise

- Avoids excessive ventilation
- Resumes chest compressions in less than 10 seconds

4. **Switches compression technique at appropriate interval as prompted by the instructor (for purposes of this evaluation). Switch should take no more than 5 seconds.**
5. **Performs high-quality chest compressions during 2-rescuer CPR**
    - Correct placement of 2 thumbs in center of chest, just below the nipple line
    - Compression rate of 100 to 120/min
        - –Delivers 15 compressions in 7 to 9 seconds
    - Adequate depth for age
        - –Infant: at least one third the AP diameter of the chest (approximately 1½ inches [4 cm])
    - Complete chest recoil after each compression
    - Appropriate ratio for age and number of rescuers
        - –2 rescuers: 15 compressions to 2 breaths
    - Minimizes interruptions in compressions
    - Delivers 2 breaths so less than 10 seconds elapses between last compression of one cycle and first compression of next cycle

Glossary

30:2 CPR: CPR that is provided in a ratio of 30 chest compressions to 2 breaths.

Abdominal thrusts: A procedure used to force a foreign object from a choking person's airway; sometimes called the *Heimlich maneuver*.

Adult and adolescent: Anyone with visible signs of puberty (chest or underarm hair; any breast development) and older.

Agonal gasps: An abnormal, reflexive breathing pattern that may be present in the first minutes after sudden cardiac arrest. The person with agonal gasps appears to be drawing in air very quickly. Gasps happen at a slow rate. They may sound like a snort, snore, or groan. Agonal gasps are not normal breathing and do not provide adequate oxygenation and ventilation.

Arrhythmia: An irregular rhythm or abnormal heartbeat that occurs when the electrical impulses that cause the heart to beat happen too quickly, too slowly, or erratically. This is sometimes referred to as *dysrhythmia*.

Automated external defibrillator (AED): A lightweight, portable, computerized device that can identify an abnormal heart rhythm that may need a shock. If the AED identifies a shockable rhythm, it can deliver an electrical shock through pads placed on the person's chest when a shockable rhythm is present. The shock can reset an abnormal heart rhythm.

AEDs are simple to operate. Laypeople and health care professionals can provide defibrillation safely by following the AED's visual or audible prompts.

Bag-mask device: A hand-held device comprising an inflatable bag attached to a face mask that is used to provide effective ventilation to a person with ineffective or absent breathing. A bag-mask device may be used with or without supplemental oxygen.

Cardiac arrest: The abrupt loss of heart function in a person who may or may not have been diagnosed with heart disease. It can come on suddenly or in the wake of other symptoms. Cardiac arrest is often fatal if appropriate steps aren't taken immediately.

Cardiac catheterization procedure: A procedure that uses diagnostic imaging equipment to evaluate blood flow in and through the heart. During the procedure, a catheter is inserted in an artery (most frequently the groin or wrist) and threaded through the blood vessels to the patient's heart so that health care professionals can visualize the arteries and chambers of the heart. Some cardiac problems, such as a blocked artery or other abnormality, can be treated during the procedure. The procedure is performed in a cardiac catheterization suite, also called a *cath lab*.

Cardiopulmonary resuscitation (CPR): A lifesaving emergency procedure for a person who has signs of cardiac arrest (ie, unresponsive, no normal breathing, no pulse). The 2 key components of CPR are chest compressions and breaths.

Chest compression fraction (CCF): The proportion of time that rescuers perform chest compressions during CPR. A CCF of at least 60% increases the likelihood of return of spontaneous circulation (ROSC) and survival to hospital discharge. With good teamwork, rescuers often can achieve 80% or greater.

Chest recoil: When the chest re-expands and returns to its normal position after a chest compression.

Child: 1 year of age to puberty (signs of puberty are chest or underarm hair in male individuals; any breast development in female individuals).

Defibrillation: Interrupting or stopping an abnormal heart rhythm by using controlled electrical shocks.

Gastric inflation (gastric distention): A filling of the stomach with air during CPR. It is more likely to occur when the person's airway isn't positioned properly and air from ventilation enters the stomach instead of the lungs. Another cause is when

rescuers give breaths too quickly or too forcefully. Gastric inflation often interferes with properly ventilating the lungs. It also can cause vomiting.

Hands-Only CPR: The process of providing chest compressions without rescue breathing during CPR.

Head tilt–chin lift: A maneuver used to open a person's airway before providing breaths during CPR.

Heart attack: When a blockage or spasm occurs in a blood vessel and severely restricts or cuts off the flow of blood and oxygen to the heart muscle. During a heart attack, the heart typically continues to pump blood. But the longer the person with a heart attack goes without treatment to restore blood flow, the greater the possible damage to the heart muscle.

In-hospital cardiac arrest: A cardiac arrest that occurs inside a hospital.

Infant: A child younger than 1 year (excluding newly born infants in the delivery room).

Jaw thrust: A maneuver used to open a person's airway before providing breaths during CPR; used when the person may have a spinal injury or when a head tilt–chin lift doesn't work.

Lateral uterine displacement (LUD): The process of using 1 or 2 hands to manually move the visibly pregnant abdomen of a person to the left side by either pushing or pulling. This action will move the fetus off of the large blood vessels that run from the lower body to the heart and help to improve blood flow provided by CPR.

Naloxone: An antidote that partially or completely reverses the effects of an opioid overdose, including respiratory depression. This medication may be given via several routes. The most common routes for emergency use in patients with known or suspected opioid overdose are intramuscularly by autoinjector or intranasally via nasal atomizer device.

Opioids: A class of drugs that produces narcotic effects of pain relief. Can be prescribed as medications, such as morphine, codeine, oxycodone, hydrocodone, fentanyl, hydromorphone, and buprenorphine; other opioids, such as heroin and fentanyl, can also be produced or obtained illegally. Misuse or overuse can cause respiratory depression and lead to cardiac arrest.

Out-of-hospital cardiac arrest: A cardiac arrest that occurs outside of a hospital.

Personal protective equipment (PPE): Equipment such as protective clothing, helmets, and goggles designed to protect the wearer's body from injury or infection. Some hazards addressed by PPE are airborne particulate matter, physical hazards, chemicals, and biohazards. Common PPE for health care professionals includes gloves, eye covering, masks, and gowns.

Pocket mask: A handheld device comprising a face mask with a 1-way valve; the rescuer places it over a person's nose and mouth as a barrier device when giving breaths during CPR.

Public access defibrillation (PAD): Having AEDs available in public places where large numbers of people gather, such as airports, office buildings, and schools, or where there are people at high risk for heart attacks. Programs may also include CPR and AED training for potential rescuers and coordination with local EMS.

Pulseless ventricular tachycardia (pVT): A life-threatening shockable cardiac rhythm that results in ineffective ventricular contractions. The rapid quivering of the ventricular walls prevents them from pumping so that pulses are not detectable (ie, the "pulseless" in pVT). Body tissues and organs, especially the heart and brain, no longer receive oxygen.

Respiratory arrest: A life-threatening emergency that occurs when normal breathing stops or when breathing is not effective. If untreated, it will lead to cardiac arrest, or it can occur at the same time as cardiac arrest.

Return of spontaneous circulation (ROSC): When a person in cardiac arrest resumes a sustained heartbeat that produces palpable pulses. Signs of ROSC include breathing, coughing, movement, a palpable pulse, or measurable blood pressure.

Shock: A life-threatening condition that occurs when the circulatory system can't maintain adequate blood flow; the delivery of oxygen and nutrients to vital tissues and organs is sharply reduced.

Telecommunicator-assisted CPR (T-CPR): Live, instant instructions provided over the phone by a telecommunicator (ie, dispatcher, emergency call taker) to a 911 caller. The telecommunicator helps the rescuer recognize a cardiac arrest and coaches them in how to provide effective CPR. For example, T-CPR assists the untrained rescuer in performing high-quality compression-only CPR. T-CPR coaches the trained rescuer in performing high-quality 30:2 CPR.

Ventricular fibrillation: A life-threatening shockable cardiac rhythm that results when the heart's electrical activity becomes chaotic. The heart muscles quiver in a fast, unsynchronized way so that the heart does not pump blood.

Recommended Reading

2025 Handbook of Emergency Cardiovascular Care for Health Care Professionals. American Heart Association; 2025.

American Heart Association. American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Web-based integrated guidelines site. October 22, 2025. **ECCguidelines.heart.org**

Dezfulian C, McCallin TE, Bierens J, et al; for the American Heart Association and the American Academy of Pediatrics. 2024 American Heart Association and American Academy of Pediatrics focused update on special circumstances: resuscitation following drowning: an update to the American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*. 2024;150(23):e501-e516. doi:10.1161/CIR.0000000000001274

Highlights of the 2025 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. American Heart Association; 2025. **ECCguidelines.heart.org**