Basic Life Support

Participant's Manual

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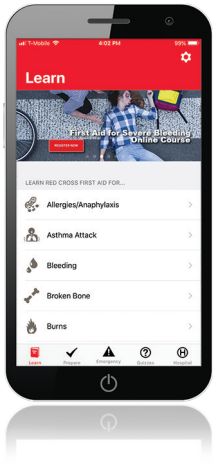

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This Participant's Manual is part of the American Red Cross Basic Life Support program. The emergency care procedures outlined in the program materials reflect the standard of knowledge and accepted emergency practices in the United States at the time this manual was published. It is the reader's responsibility to stay informed of changes in emergency care procedures.

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Science and Technical Content

The technical content within the American Red Cross Basic Life Support program is consistent with the most current science and treatment recommendations from:

- The International Liaison Committee on Resuscitation (ILCOR) 2015-2018 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations
- The 2015-2018 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

Dedication

This program is dedicated to the thousands of employees and volunteers of the American Red Cross who contribute their time and talent to supporting and teaching lifesaving skills worldwide and to the thousands of course participants who have decided to be prepared to take action when an emergency strikes.

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CHAPTER 1

Foundational Concepts

Introduction

This chapter reviews the foundational concepts that form the basis for responding to life-threatening emergencies.

Critical Thinking and Problem Solving

Critical thinking and problem solving are essential skills in healthcare, especially in emergency situations.

Critical Thinking

Critical thinking refers to thinking clearly and rationally to identify the connection between information and actions. When you use critical thinking, you are constantly identifying new information, adapting to the information logically in order to determine your best next actions and anticipating how those actions will affect the patient.

You use critical thinking when you:

- Perform a rapid assessment and determine a course of action.
- Anticipate roles and functions as part of a team based on the patient's presentation and condition.
- Re-evaluate a situation for changes, interpret these changes and modify care accordingly.

Problem Solving

Problem solving refers to the ability to use readily available resources to find solutions to challenging situations or issues that arise. In emergency situations, problems or issues can happen at any point. For example, the automated external defibrillator (AED) may be delayed in arriving or have a low battery. A parent may be upset and interfere with care. Problem solving often requires creativity and adaptability. Use whatever resources are at hand, including equipment, other team members or other healthcare facility staff.

Communication

Communication is essential when caring for a patient who is experiencing a life-threatening emergency. You need to communicate with your team, the patient and the patient's family.

Communicating with the Team

Communication includes verbal messages (spoken words) and nonverbal messages conveyed through body language (gestures and facial expressions) (Figure 1-1).

Figure 1-1 | Communicating with the team includes verbal and nonverbal cues.

Closed-loop communication is a technique used to prevent misunderstandings; it involves four key components:

- **Sender:** The person initiating the communication
- **Message:** The content of the communication; must be expressed clearly so that everyone involved knows exactly what the message is
- **Receiver:** The person for whom the message is intended
- **Feedback:** The confirmation by the receiver that the message is received and understood; an essential element of closed-loop communication (Figure 1-2)

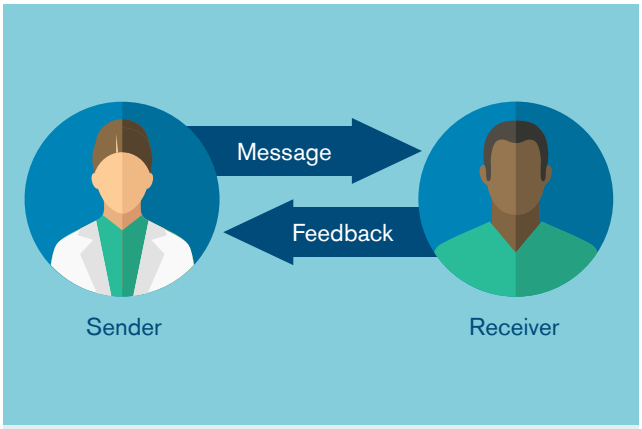

Figure 1-2 | Closed-loop communication is a process involving a sender, message, receiver and feedback.

When communicating (sending) information:

- Speak clearly and deliberately.
- Convey information in an organized fashion.
- "Close the loop" by waiting for feedback from the team member responsible for carrying out the action. If feedback is not provided, the team leader should seek it before continuing.

When receiving information:

- Provide confirmation that you have received the message and that you understand it by repeating the task back to the sender.
- Acknowledge initiation and completion of the task.
- Speak clearly in a calm tone of voice and avoid speaking over others.

Communicating with the Family

Patients requiring resuscitation are unresponsive, making communication with family or others who may be present very important. Remember, during emergencies, families are stressed and may not always hear or understand what you are saying (Figure 1-3).

To effectively communicate with the family, you should:

- Demonstrate credibility as well as confidence and empathy.
- Build rapport and establish trust.
- Speak slowly and in terms the family can understand.
- Be prepared to repeat information, if necessary.
- Be open and honest, especially about the patient's condition. Minimize family members' fears, as necessary, but avoid giving misleading information or false hope (e.g., "Everything is going to be OK").
- Reassure the family that everything that can be done is being done.

Communicating with the Family After a Patient's Death

In basic life support situations, patients may not survive, despite the team's best resuscitation attempts. As a healthcare provider, you may be involved in communicating with the family about a patient's death (Figure 1-4).

In this situation:

- Provide the information honestly and with compassion in a straightforward manner, and include information about events that may follow.
- Allow the family to begin processing the information.
- Allow time for the family to begin the grief process.
- Ask the family if they would like to contact or have you contact anyone, such as other family members or clergy.
- Anticipate a myriad of reactions by family members, such as crying, sobbing, shouting, anger, screaming or physically lashing out.
- Wait and answer any questions that the family may have.

Figure 1-3 | There are many components of good communication with family, including establishing trust, speaking slowly, and being open and honest.

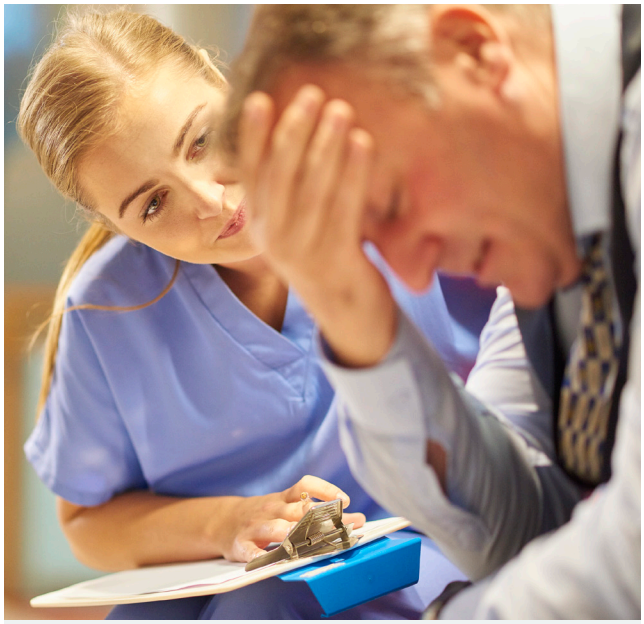

Figure 1-4 | Be compassionate, direct and honest when communicating with the family after a patient's death.

Teamwork

Teamwork involves a group of people with well-defined roles and responsibilities making a coordinated effort to achieve a common goal (Figure 1-5). Teamwork is crucial during resuscitation because the ultimate goal is to save a life, and an effective, coordinated effort by the basic life support (BLS) team improves patient outcomes. Coordination becomes even more important when emergency medical services (EMS), the **rapid response team** or the resuscitation team arrives.

As a member of the BLS team, it is important to understand the responsibilities of the team leader and other team members.

> The team leader ensures that everyone works as a team to help promote the best possible outcome for the patient.

Team Leader Responsibilities

The team leader oversees the entire emergency situation and ensures that everyone works as a team to help promote the best possible outcome for the patient.

The team leader:

- Assigns and understands team roles.
- Sets clear expectations.
- Prioritizes, directs and acts decisively.
- Encourages and allows team input and interaction.
- Focuses on the big picture.
- Monitors performance while providing support.
- Acts as a role model.
- Coaches the team.
- Re-evaluates and summarizes progress.
- Leads a debriefing session.

> All team members must demonstrate respect for one another and use clear, closed-loop communication.

Figure 1-5 | Each member of a team has well-defined roles and responsibilities.

Team Member Responsibilities

Team members provide care with skill and expertise.

Team members:

- Have the necessary knowledge and skills to perform their assigned role.
- Stay within their assigned role but assist others as needed, as long as they are able to maintain their own assigned responsibilities.
- Communicate effectively with the team leader if they:
  - Feel they are lacking any knowledge or skills to perform assigned roles.
  - Identify something the team leader may have overlooked.
  - Recognize a dangerous situation or need for urgent action.
- Share information with other team members.
- Focus on achieving the goals.
- Ask pertinent questions and share pertinent observations.

Crew Resource Management

Crew resource management emphasizes the use of all available resources, including people, equipment and procedures, to promote effective and efficient teamwork and reduce the likelihood of human error. Originally developed by the aviation industry in the 1970s in response to several airline disasters where human error and poor communication were found to be contributing factors, crew resource management has been adapted

for use as a tool in the healthcare setting as well. When following the principles of crew resource management, all members of the team demonstrate respect for one another and use clear, closed-loop communication.

Crew resource management centers around the team leader, who coordinates the actions and activities of team members so that the team functions effectively and efficiently. For example, when team members switch roles during an emergency, the team leader is responsible for coordinating these activities. Crew resource management also guides team members to communicate directly and openly with the team leader about dangerous or time-critical decisions.

When a problem arises, team members must get the attention of the team leader, state their concern, describe the problem as they see it and suggest a solution. The team leader then provides direction, enabling the team to work together to resolve the issue. Being a member of the team is just as important as being a team leader. Everyone on the team needs to have a voice and be encouraged to speak up if a problem arises.

Practicing and Debriefing

Members of effective high-performance teams keep their skills and knowledge current, and they practice together regularly. In addition, effective high-performance teams hold debriefing sessions after each resuscitation event (Figure 1-6). The purpose of the debriefing session is to take a closer look at the decisions that were made and the actions that were taken with the goal of identifying opportunities for improvement at the system, team and individual levels.

The team leader leads the debriefing session, which typically follows a consistent format:

- **Review:** The team leader provides a brief recap of the emergency and the interventions that were used.
- **Analyze:** The team reviews and evaluates the objective data obtained during the resuscitation effort.
- **Reflect:** The team reflects on the actions they took and why, discusses the pros and cons of those actions and identifies changes that could be made to improve future outcomes.
- **Summarize:** The team recaps the main takeaway points and develops a list of action items.

Figure 1-6 | Debriefing is an important strategy for improving performance and patient outcomes.

CHAPTER 2

Systematic Approach to Assessing, Recognizing and Caring for Adults

Introduction

When an emergency event occurs, it is important to perform a rapid assessment in order to recognize a life-threatening emergency and provide appropriate care. This chapter reviews the systematic approach to assessing, recognizing and caring for adults experiencing life-threatening emergencies. See Chapter 4 for more information on children and infants.

Emergencies Can Happen Anywhere

An emergency situation can happen anywhere in a healthcare facility. The interventions you provide, accessible resources and equipment, and the team members available may vary depending on the location of the emergency situation. For example, responding to an emergency situation in a common area of a healthcare facility will be distinct from responding to one occurring at the patient's bedside.

As a healthcare provider, you have a **duty to act** when a patient experiences a life-threatening emergency in a healthcare facility. Your facility may have specific protocols for how to respond to an emergency situation. These protocols may vary depending on the setting and your role. In addition, the scope and practice of your individual position may further determine appropriate actions. You may also face life-threatening emergencies outside the healthcare facility. Although a duty to act may not always exist when outside of a healthcare facility, being prepared and willing to respond is essential.

Consult your state and local rules and regulations related to liability protections and other legal considerations when responding to an emergency. See *Appendix A: Common Legal Considerations* for more details.

Assess, Recognize and Care

The **Assess, Recognize and Care concept** is a systematic, continuous approach for rapid assessment, accurate recognition and immediate care in emergency situations (Figure 2-1). An acutely ill patient's condition can change rapidly, and deterioration can follow; therefore, frequent assessment, recognition and care are critical. Some steps are completed simultaneously, and you should repeat these steps until the patient is stabilized and/or transferred to a higher level of care for further management. For example, once you've performed an intervention, you need to reassess to identify whether that measure has been effective, then determine through recognition whether the initial presenting problem continues, or whether any new problems are identified. This would then be followed by applying another appropriate care measure; and the cycle continues.

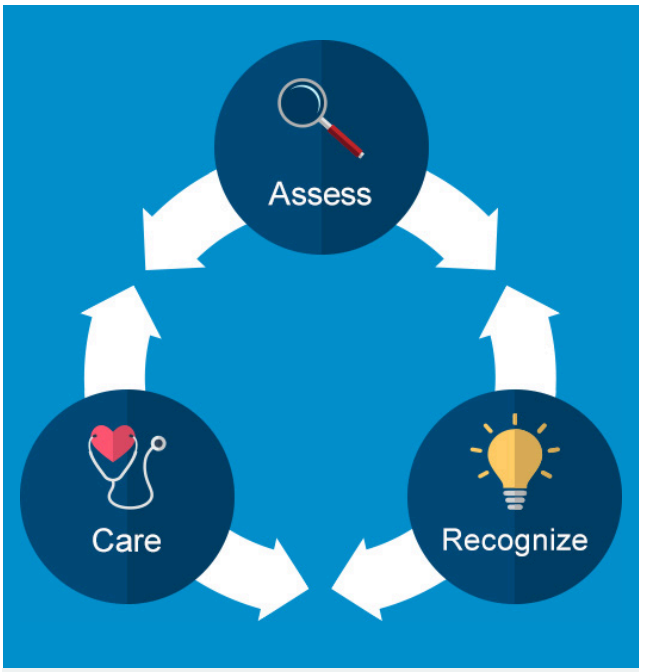

Figure 2-1 | The Assess, Recognize and Care concept is a systematic, continuous approach for responding to emergency situations.

Rapid Assessment

The Assess, Recognize and Care concept begins with a **rapid assessment**, which includes performing a visual survey, checking responsiveness, opening the airway and simultaneously checking for breathing and a pulse. The information gathered during the rapid assessment provides critical information and helps you to recognize whether a life-threatening emergency is occurring so that you can provide effective care.

Always follow standard precautions when performing a rapid assessment. **Standard precautions** are safety measures to prevent disease transmission based on the assumption that all body fluids may be infectious. See *Appendix B: Standard Precautions* for further information.

Perform a Visual Survey

You must keep in mind basic critical steps when conducting a quick **visual survey** of an emergency situation: assess for safety, formulate an initial impression of the patient and determine the need for additional resources (Figure 2-2).

When responding outside of clinical practice, it is important to conduct a thorough scene size-up. See *Learn More: Scene Size-Up*.

LEARN MORE

Scene Size-Up

Conduct a scene size-up to determine whether the situation is safe, the number of patients involved and the nature of the illness/mechanism of injury.

Safety
If you are responding to an emergency situation outside of routine clinical practice, it is especially important to make sure that the environment is safe for you and any individuals present during the emergency.

> Be sure to check for anything unsafe or hazardous in the area, such as the smell of gas, a chemical or biological spill, or any items that can threaten your or your patient's safety.

If you need to move the patient(s) because of immediate danger, to give proper care or because you need to reach another patient who may have a more serious illness or injury, move the patient as quickly and carefully as possible.

In all other situations, do not move a patient if you suspect head, neck, spinal or pelvic injury, or if moving the patient becomes a danger to you.

Number of Patients
It is important to determine how many patients are involved in the emergency event. Take a complete 360-degree view of the surroundings and ask individuals present whether anyone else was involved in the incident.

Nature of Illness or Mechanism of Injury
To determine the nature of the illness or mechanism of injury, look for clues to what may have caused the emergency and how the patient became ill or injured—for example, the patient's position, bleeding, broken glass or a spilled bottle of medication. Think critically about the situation and ask yourself whether what you see makes sense. Quickly ask individuals who are present what happened and use the information to determine a likely cause. Keep in mind that a patient may have moved or been moved before you arrived.

Figure 2-2 | The purpose of a visual survey is to assess for safety, formulate an initial impression of the patients and determine the need for additional resources.

Figure 2-3 | Use the shout-tap-shout sequence to check for responsiveness.

In any emergency, you need to first make sure the environment is safe—for you, your team and anyone else there. When assessing for safety, ask yourself:

- Are any immediate dangers present?
- What guidance needs to be given to family members or others who may be present?

Next, form your initial impression of the patient. Remember, the initial impression is about suspicion. Ask yourself:

- Does the patient look sick or unresponsive?
- Does the patient's skin appear pale, mottled or cyanotic?
- Does the patient appear to be breathing?
- Is there severe, life-threatening bleeding?

ALERT

If you see severe, life-threatening bleeding, immediately use any available resources to control the hemorrhage, including a tourniquet or hemostatic dressing if one is available.

Then, quickly determine what additional resources are needed.

- Who is available to help?
- Do you need any additional equipment, such as an AED?

Check for Responsiveness

Once the visual survey is complete, the next step is to check for responsiveness. This may be obvious from your initial impression. For example, the patient may be able to speak to you or may be moaning, crying or moving around. If the patient is responsive, obtain consent and provide care as appropriate.

If the patient appears unresponsive, use the **shout-tap-shout sequence** to obtain a response to a verbal or tactile stimulus (Figure 2-3). Observe for the patient's response to the stimulus. It may be subtle—some slight movement or momentary eye opening. If the patient is unresponsive, call for someone to activate the emergency response system and get an AED if you have not already done so.

Open the Airway

If the patient is unresponsive, open the airway, making sure the patient is in a **supine** (face-up) position. If they are face-down, you must roll them onto their back, taking care not to create or worsen a suspected injury. Then, open the airway using the head-tilt/chin-lift technique. Or use a modified jaw-thrust maneuver if a head, neck or spinal injury is suspected.

> If the patient is unresponsive, call for someone to activate the emergency response system and get an AED if you have not already done so.

Head-Tilt/Chin-Lift Technique

To perform the head-tilt/chin-lift on an adult:

- Press down on the forehead with one hand while pulling up on the bony underside of the chin with two to three fingers of the other hand.
- Tilt the head to a past-neutral position to open the airway (Figure 2-4, A).

Modified Jaw-Thrust Maneuver

When a patient has a suspected head, neck or spinal injury, use the modified jaw-thrust maneuver to open the airway. For this maneuver, position yourself above the patient's head and:

- Put one hand on each side of the patient's head with your thumbs near the corners of the mouth and pointed toward the chin. Use your elbows for support.
- Slide your fingers under the angles of the jawbone without moving the patient's head or neck.
- Thrust the jaw up (again without moving the head or neck) to lift the jaw and open the airway (Figure 2-4, B).

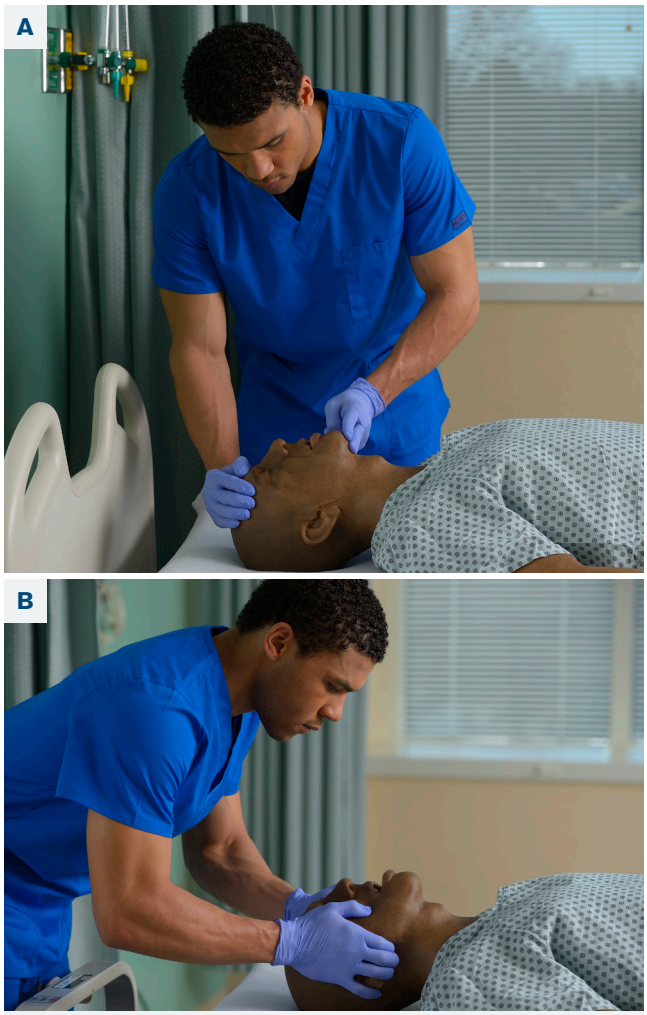

Figure 2-4 | Open the airway with (A) the head-tilt/chin-lift technique or, if necessary, (B) the modified jaw-thrust maneuver.

Check Breathing and Pulse

Simultaneously check for breathing and a carotid pulse for at least 5 seconds but no more than 10.

When you check for breathing, look to see if the patient's chest is rising and falling, listen for escaping air and feel for breathing against the side of your cheek (Figure 2-5). Remember, normal breathing is quiet, regular and effortless. **Agonal breaths**, or isolated or infrequent gasps, are not normal breathing.

Figure 2-5 | Simultaneously check for breathing and a carotid pulse for at least 5 seconds but no more than 10.

When you check the pulse of an adult patient, palpate the carotid artery by sliding two fingers into the groove of the patient's neck. Be careful not to reach across the neck and obstruct the airway.

Recognize and Care

You've gathered information about the patient and the emergency throughout the **rapid assessment**. Now, you'll use the results of your assessment to recognize the emergency condition and determine your immediate course of action. Emergencies requiring basic life support may include injury or illness, respiratory arrest, **cardiac arrest**, obstructed airway and opioid overdose.

> After you complete your rapid assessment, provide care based on the conditions found.

Injury or Illness

If the patient is responsive (e.g., speaking, moaning, crying or moving around), obtain their consent to provide care, reassure them and take steps to find out what occurred.

If the patient is unresponsive or experiencing an altered level of consciousness, is breathing normally and has a pulse, follow these steps:

- If you have not already done so, call for help to activate EMS, the rapid response team or the resuscitation team, as appropriate, and call for an AED.
- If you do not suspect a head, neck, spinal or pelvic injury, place them in a side-lying recovery position.
- If you suspect a head, neck, spinal or pelvic injury, maintain the patient in their current position. Avoid further moving the patient unless it is absolutely necessary. For example, if you need to leave the patient to call for help and/or get additional resources, place the patient in a side-lying recovery position.
- Monitor the patient until EMS, the rapid response team or the resuscitation team arrives.

See *Learn More: Recovery Positions* for more details.

Respiratory Arrest

If the patient is unresponsive, is not breathing normally (or only gasping) but has a pulse, they are in **respiratory arrest**. Deliver 1 ventilation every 5 to 6 seconds; each ventilation should last about 1 second and make the chest begin to rise. See Chapter 3 for more information.

Cardiac Arrest

If the patient is unresponsive, is not breathing normally (or only gasping) and does not have a pulse, they are in **cardiac arrest**. Start CPR within 10 seconds of recognizing cardiac arrest and use an AED when it is available (Figure 2-6). See Chapter 3 for more information.

Cardiac arrest is different from myocardial infarction (or heart attack); however, a myocardial infarction can lead to cardiac arrest. See Learn More: Myocardial Infarction for more information.

Figure 2-6 | Cardiac arrest claims the lives of thousands of people in the United States every year. If someone goes into cardiac arrest, their heart suddenly stops beating, stopping blood flow to the brain and other vital organs. Every second counts when a person is in cardiac arrest; immediately beginning CPR and using an AED increases that person's chances of survival.

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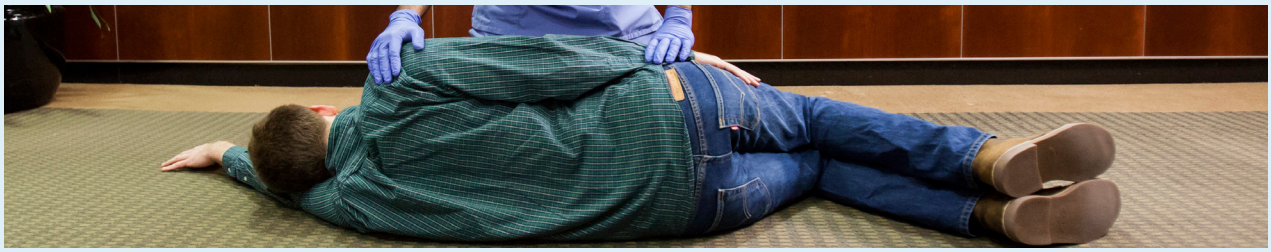
Recovery Positions



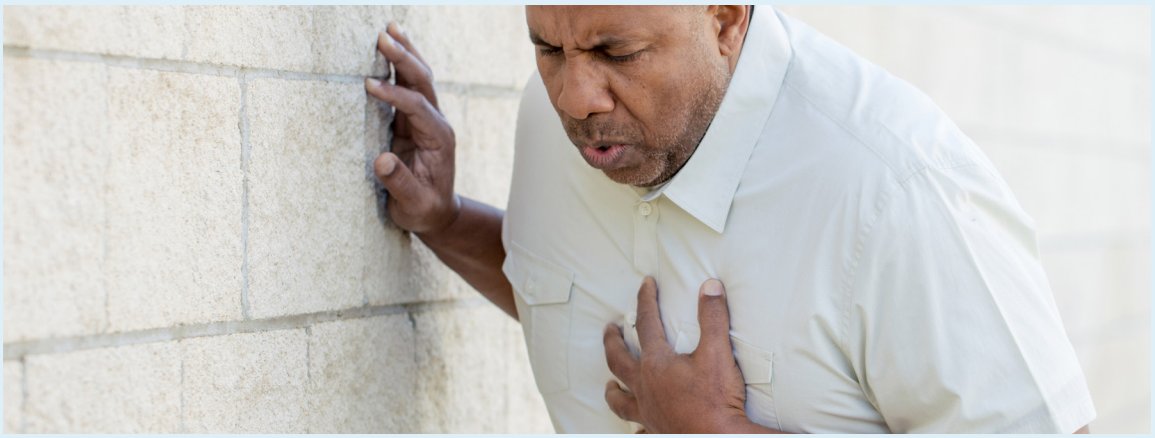
To place an adult patient in a recovery position:

- Kneel at the patient's side.
- Lift the patient's arm closest to you up next to their head.
- Place the patient's arm farthest from you next to their side.
- Grasp their leg closest to you, flex it at the hip and bend the knee toward their head.
- Place one of your hands on the patient's shoulder and your other hand on their hip farthest from you.
- Using a smooth motion, roll the patient toward you by pulling their shoulder and hip with your hands. Make sure the patient's head remains in contact with their extended arm.
- Stop all movement when the patient is on their side.
- Place their knee on top of the other knee so that both knees are in a bent position.
- Place the patient's free hand under their chin to help support their head and airway.

Always follow your facility's protocols.

LEARN MORE

Myocardial Infarction



A **myocardial infarction (MI)**, or heart attack, refers to the necrosis (death) of heart tissue as a result of insufficient delivery of oxygenated blood to the heart. The sooner the signs and symptoms are recognized and treated, the lesser the degree of damage to the heart. Even patients who have had an MI before may not recognize the signs because each MI may present differently.

Signs and Symptoms

- Chest discomfort or pain that is severe, lasts longer than 3 to 5 minutes, goes away and comes back, or persists even during rest
- Discomfort, pressure or pain that is persistent and ranges from discomfort to an unbearable crushing sensation in the chest, possibly spreading to the shoulder, arm, neck, jaw, stomach or back, and usually not relieved by resting, changing position or taking medication
- Chest pain that comes and goes (such as angina pectoris)
- Difficulty breathing, such as at a faster rate than normal or noisy breathing
- Pale or ashen skin, especially around the face
- Sweating, especially on the face
- Dizziness or light-headedness
- Possible altered mental status or level of consciousness
- Nausea or vomiting

Although women may experience the most common signs and symptoms of MI, such as chest pain, discomfort, nausea or vomiting, they may also experience common atypical warning signs, such as:

- Shortness of breath.
- Stomach, back or jaw pain.
- Unexplained fatigue or malaise.

These warning signs may occur with or without chest pain. When women do experience chest pain, it may be atypical—sudden, sharp but short-lived pain outside the breastbone. Like women, other individuals such as those with diabetes or older adults may present with atypical signs and symptoms.

Immediate Care

In cases of suspected MI, administer two to four low-dose (81-mg) aspirin or one 325-mg adult aspirin based on your facility's protocols.

ALERT

Make sure that the patient chews the medication.

Depending on your level of training, additional care may include administration of oxygen, other medications and diagnostic tests. Each healthcare facility establishes interventions and standard protocols for adult patients who are suspected or confirmed to be experiencing an MI. It is important to be familiar with your own facility's protocols.

Obstructed Airway

If the patient is responsive but cannot cough, speak or breath, they are choking. Obtain consent and immediately begin care for an **obstructed airway**. See Chapter 5 for more information.

Opioid Overdose

If the patient is unresponsive and shows signs and symptoms of opioid overdose, follow these steps:

- If you have not already done so, call for help to activate EMS, the rapid response team or the resuscitation team, as appropriate, and call for an AED and naloxone.
- Provide care for the condition found. This will be similar to the care you must provide during any respiratory or cardiac arrest. Administer naloxone when available.

See Chapter 6 for more information.

Reassess and Document

After providing care, reassess the patient and the effectiveness of your interventions to determine next steps based on your findings. Always document to establish a record of the events that took place, the care you provided and the facts you discovered.

Cardiac Chain of Survival

The Cardiac Chain of Survival describes five actions that, when performed in rapid succession, increase the patient's likelihood of surviving sudden cardiac arrest. The five links in the Cardiac Chain of Survival vary slightly, depending on where the cardiac arrest occurs.

In-Hospital Cardiac Arrest

While the majority of total cardiac arrests in the United States occur outside the hospital, it's important to understand these actions for an in-hospital cardiac arrest (Figure 2-7). The Adult In-Hospital Cardiac Chain of Survival includes:

- **Surveillance and prevention.** Hospitalized patients often show changes in vital signs and other clinical parameters in the minutes and hours leading up to cardiac arrest. Closely monitoring for changes in the patient's condition that could be warning signs of impending arrest and activating the rapid response team as appropriate may allow providers to intervene and prevent the arrest from occurring.
- **Recognition of a cardiac emergency and activation of the emergency response system.** Recognizing cardiac arrest and summoning advanced help in the form of the resuscitation team or emergency medical services (EMS) provides the patient with access to necessary personnel, equipment and interventions as soon after arrest as possible.
- **Early CPR to keep oxygen-rich blood flowing and to help delay brain damage and death.** CPR, starting with compressions, should be initiated immediately once cardiac arrest is recognized.

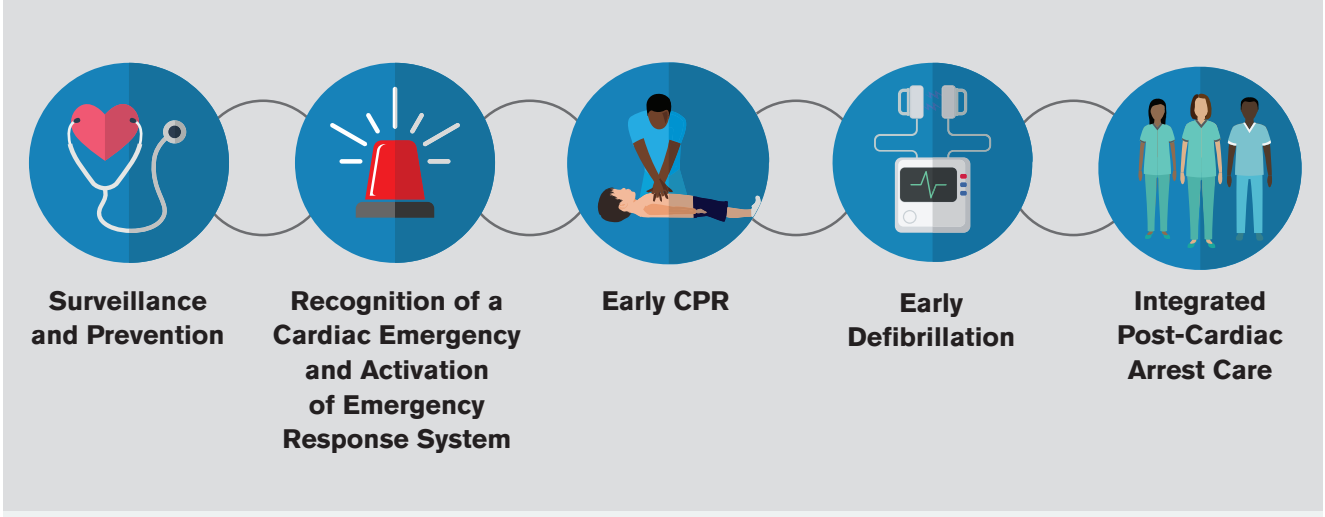


Figure 2-7 | The five links of the Adult In-Hospital Cardiac Chain of Survival

- **Early defibrillation to help restore an effective heart rhythm and significantly increase the patient's chance for survival.** Defibrillation may restore an effective heart rhythm, increasing the patient's chance for survival.
- **Integrated post-cardiac arrest care to optimize ventilation and oxygenation and treat hypotension immediately after the return of spontaneous circulation.** After return of spontaneous circulation (ROSC), survival outcomes are improved when providers work to stabilize the patient, minimize complications, and diagnose and treat the underlying cause.

Out-of-Hospital Cardiac Arrest

Most sudden cardiac arrests occur outside of the hospital. When this is the case, the patient relies on members of the community, emergency medical services and healthcare providers to implement the Cardiac Chain of Survival. The Adult Out-of-Hospital Cardiac Chain of Survival (Figure 2-8) includes:

- **Recognition of a cardiac emergency and activation of the emergency response system.** Immediate recognition of cardiac arrest and activation of the EMS system provides the patient with access to necessary personnel, equipment and interventions as soon after arrest as possible.
- **Early CPR to keep oxygen-rich blood flowing and to help delay brain damage and death.** CPR, starting with compressions, should be initiated immediately once cardiac arrest is recognized.
- **Early defibrillation to help restore an effective heart rhythm and significantly increase the patient's chance for survival.** Use of an AED may restore an effective heart rhythm, increasing the patient's chance for survival.
- **Advanced life support using advanced medical personnel who can provide the proper tools and medication needed to continue the lifesaving care.** Early advanced life support provided by EMS personnel at the scene and en route to the hospital provides the patient with access to emergency medical care delivered by trained professionals.
- **Integrated post-cardiac arrest care to optimize ventilation and oxygenation and treat hypotension immediately after the return of spontaneous circulation.** After ROSC, survival outcomes are improved when providers work to stabilize the patient, minimize complications, and diagnose and treat the underlying cause.

> When a cardiac arrest occurs outside of the hospital, the patient relies on the members of the community, emergency medical services and healthcare providers to implement the Cardiac Chain of Survival.

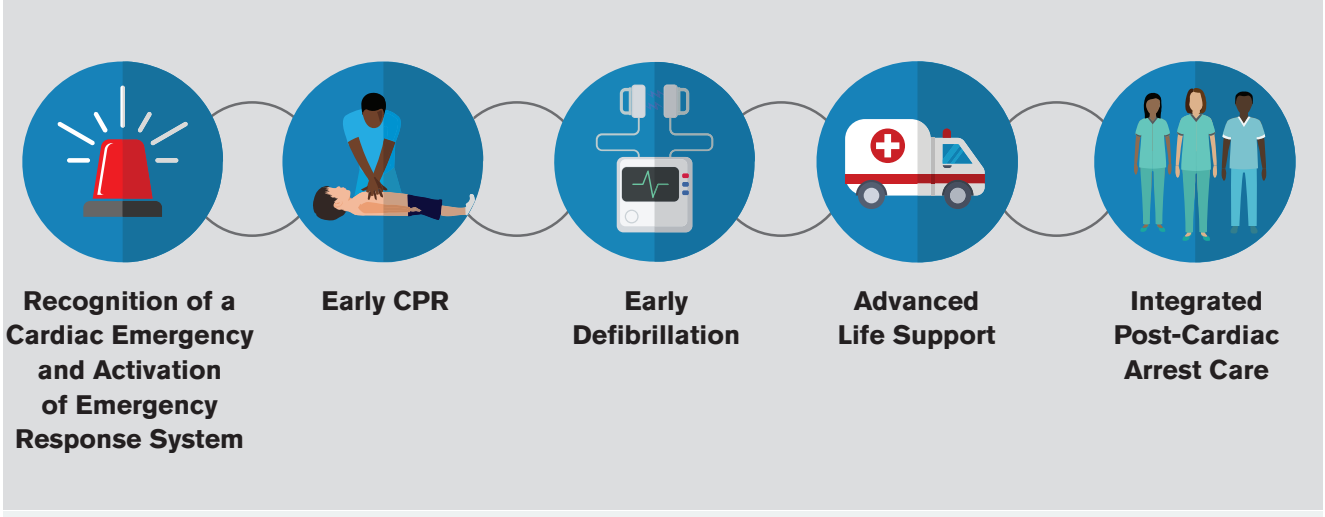


Figure 2-8 | The five links of the Out-of-Hospital Cardiac Chain of Survival

SKILL SHEET

Rapid Assessment for Adults

Step 1 Perform a visual survey

- Make sure the environment is safe—for you, your team and any individuals present during the emergency.
- Gather an initial impression of the patient, which includes looking for severe, life-threatening bleeding.
- Quickly determine the need for additional resources.

⚠ Alert

If you see severe, life-threatening bleeding, immediately use any available resources to control the hemorrhage, including a tourniquet or hemostatic dressing if one is available.

Step 2 Check for responsiveness

- Shout, "Are you OK?" Use the patient's name if you know it.
- Tap the patient's shoulder and shout again (shout-tap-shout).
- If the patient is unresponsive and you are alone, call for help to activate EMS, the rapid response team or the resuscitation team, as appropriate, and call for an AED.
- If the patient is unresponsive and you are with another provider, the first provider stays with the patient. Other providers activate EMS, the rapid response team or the resuscitation team, as appropriate, and retrieve the AED, BVM and other emergency equipment.

Step 3 Simultaneously check for breathing and pulse

- Make sure the patient is in a supine (face-up) position. If they are face-down, you must roll them onto their back, taking care not to create or worsen a suspected injury.
- Open the airway to a past-neutral position using the head-tilt/chin-lift technique; or, use the modified jaw-thrust maneuver if you suspect a head, neck or spinal injury.
- Simultaneously check for breathing and a carotid pulse for at least 5 seconds but no more than 10.

Step 4 Provide care based on the conditions found

CHAPTER 3

Basic Life Support for Adults

Introduction

When the heart and normal breathing have stopped, the patient is in cardiac arrest and CPR is needed to circulate blood containing oxygen to the patient's vital organs. Basic life support (BLS) for a patient in cardiac arrest includes high-quality CPR and the use of an AED. BLS also includes the delivery of ventilations to patients in respiratory arrest. BLS care for children and infants is discussed in Chapter 4.

High-Quality CPR for Adults

Even at its best, **CPR** (chest compressions and ventilations) provides only a fraction of the normal blood flow to the brain and heart. To optimize patient outcomes and increase the likelihood of return of spontaneous circulation (ROSC), providers must strive to provide the highest quality CPR at all times.

Knowing how to correctly perform high-quality CPR helps you provide appropriate, effective care until the advanced cardiac life support team arrives.

> If provided in the first few minutes of cardiac arrest, high-quality CPR can double or triple a patient's chance of survival.

For adult patients, **high-quality CPR** includes 30 chest compressions followed by 2 ventilations. When an advanced airway is in place, the 30:2 ratio does not apply. See Adjuncts to Ventilations (page 22) for more information. When drowning or other hypoxic events are suspected as the cause of cardiac arrest, deliver 2 initial ventilations before starting CPR. Remember, smoothly transition between compressions and ventilations to minimize interruptions in compressions to less than 10 seconds. See Skill Sheet: CPR for Adults.

The key components of high-quality CPR are summarized in Box 3-1.

Box 3-1 | Key Components of High-Quality CPR

KEY COMPONENTS OF HIGH-QUALITY CPR

- Compress the chest at a rate of 100 to 120 compressions per minute.
- Compress the chest to a depth of at least 2 inches (5 cm), but no more than 2.4 inches (6 cm).
- Allow for full chest recoil.
- Minimize interruptions to chest compressions to less than 10 seconds.
- Avoid excessive ventilations. Each ventilation should last about 1 second and deliver just enough volume to make the chest begin to rise.

Chest Compressions

When providing **chest compressions** for an adult, proper technique is critical:

- Ensure that the patient is on a firm, flat surface. In a healthcare setting, use a bed with a CPR feature, or place a CPR board under the patient. In other settings, move the patient to the floor or ground before beginning CPR.
- If the patient is on a bed, adjust it to the appropriate working height or use a step stool. Lower the bed side rail closest to you. If the patient is on the ground, kneel beside them.
- Expose the patient's chest so you can ensure proper hand placement and visualize chest recoil.
- Place the heel of one hand in the center of the patient's chest on the lower half of the sternum. Place your other hand on top of the first and interlace your fingers or hold them up so that they are not resting on the patient's chest (Figure 3-1, A).
- Position yourself so your shoulders are directly over your hands (Figure 3-1, B).

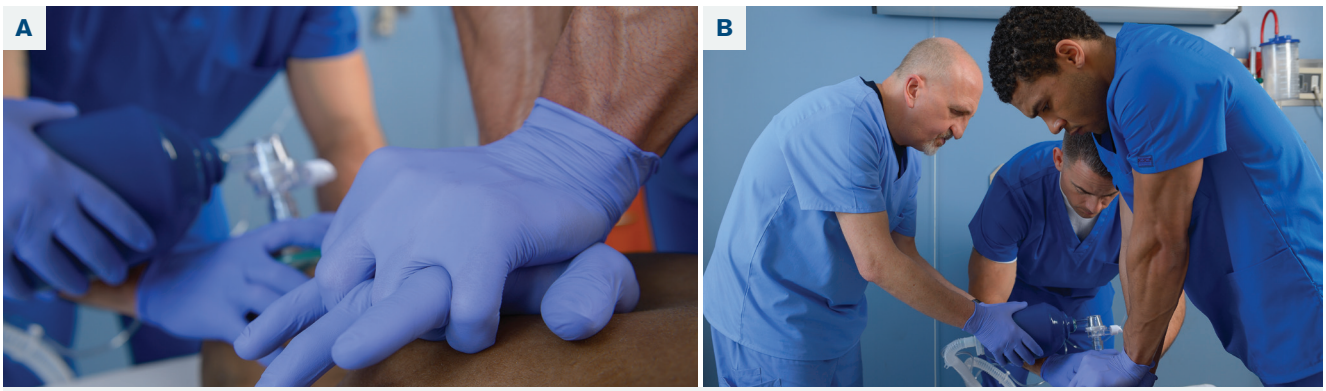


Figure 3-1 | Proper technique is critical in CPR. (A) Place your hands in the center of the patient's chest on the lower half of the sternum. Interlace your fingers or hold them up so that they are not resting on the patient's chest. (B) Position yourself so your shoulders are directly over your hands with your elbows locked.

SCIENCE NOTE

Compression Depth

Evidence shows that providing chest compressions at a rate greater than 120 per minute detrimentally affects compression depth because providers are less likely to compress the chest to the minimum depth of at least 2 inches (5 cm) for an adult. Additional evidence shows that compressing the chest to a depth greater than 2.4 inches (6 cm) leads to increased non-life-threatening injuries (such as rib fractures) in the average adult and should be avoided. The upper limits for the rate and depth of compressions exist to improve patient outcomes, but it is also critical to maintain a rate greater than 100 compressions per minute and a depth of at least 2 inches (5 cm). Both rate and depth of compressions are best measured using a feedback device if available.

- Keep your arms straight and lock your elbows.
- Compress the chest using a straight up-and-down motion. This allows you to use your body weight rather than your muscular strength, which is more effective and less tiring.
- For an adult, compress the chest to a depth of at least 2 inches (5 cm). If you are using a feedback device, make sure the compressions are no more than 2.4 inches (6 cm) deep.
- Provide smooth compressions at a rate of at least 100 per minute but not more than 120 per minute.
- Allow the chest to return to its normal position after each compression, achieving complete **chest recoil**. Avoid leaning on the patient's chest during compressions because doing so impedes **venous return** and prevents the heart from filling completely. This, in turn, decreases cardiac output.

Ventilations

Ventilations supply oxygen to a patient who is not breathing. Like compressions, ventilations require proper technique:

- For a patient in *cardiac arrest*, deliver 2 ventilations that last approximately 1 second each and make the chest begin to rise.
- For a patient in *respiratory arrest*, deliver 1 ventilation every 5 to 6 seconds; each ventilation should last about 1 second and make the chest begin to rise. Check the pulse and breathing about every 2 minutes. If the patient does not have a pulse, begin CPR.
- Do not hyperventilate or overventilate the patient.

Using CPR breathing barriers, such as a pocket mask or bag-valve-mask resuscitator, can protect you from coming in contact with a patient's blood, vomitus and saliva, or from breathing the patient's exhaled air. If a CPR breathing barrier is not available, you may need to provide mouth-to-mouth or mouth-to-nose ventilations.

ALERT

When delivering ventilations during CPR, if the chest does not rise after the first breath, reopen the airway, make a seal and try a second ventilation. If the second ventilation is not successful, move directly back to compressions and check the airway for an obstruction before attempting subsequent ventilations. If an obstruction is found, remove it and attempt ventilations. Never perform a blind finger sweep.

Additionally, adjuncts to ventilations may be used to facilitate ventilations. These include supplemental oxygen, basic airways and advanced airways.

Pocket Mask Ventilations

Use of a pocket mask is recommended during single-provider CPR to limit interruptions in chest compressions. This allows you to remain at the side of the patient and limit unnecessary movement, which could delay your return to chest compressions.

Make sure to use a pocket mask that matches the size of the patient; for example, use an adult pocket mask for an adult and an infant pocket mask for an infant. Always position and seal the mask properly before blowing into it. To use a pocket mask:

- Assemble the mask and valve.
- Starting from the bridge of the patient's nose, place the top of the mask over the patient's mouth and nose, then place the bottom of the mask below the mouth to the chin (the mask should not extend past the chin).
- To seal the mask, place the "webbing" between your index finger and thumb on the top of the mask above the valve; then place your remaining fingers on the side of the patient's face. Place the thumb of your other hand (the hand closest to the patient's chest) along the base of the mask while placing your bent index finger under the patient's chin, lifting the patient's face into the mask.
- Simultaneously, open the patient's airway to a past-neutral position while sealing the mask (for more information about opening the airway, see Chapter 2).
- Take a normal breath, make a complete seal over the mask valve with your mouth and blow into the mask to deliver 1 ventilation over 1 second, enough to make the chest begin to rise (Figure 3-2).
- Quickly break the seal and take a breath. Then reseal your mouth over the mask valve and deliver a second ventilation.

Figure 3-2 | When using a pocket mask, make a complete seal over the mask valve and deliver 1 ventilation over 1 second, enough to make the chest rise.

BVM Resuscitator Ventilations

A **bag-valve-mask (BVM) resuscitator** is a handheld device used to ventilate patients during respiratory arrest or multiple-provider CPR. During single-provider CPR, use of a BVM resuscitator is not recommended because it will increase the time between sets of chest compressions, resulting in poor outcomes.

Unlike a pocket mask, a BVM resuscitator delivers ambient air rather than the provider's exhaled air. So, the patient receives a higher concentration of oxygen (approximately 20% to 21%) with BVM ventilations than with pocket mask or mouth-to-mouth ventilations (approximately 16% to 17%). If your facility's protocols allow, supplemental oxygen should be attached to the BVM resuscitator as soon as appropriate and when enough resources are available. Doing so can increase oxygen concentration to approximately 90% to 100%.

SCIENCE NOTE

Overventilation

During cardiac arrest, the body's metabolic demand for oxygen is decreased. With each ventilation, the intrathoracic pressure increases, causing atrial and ventricular filling to decrease and reducing the **coronary perfusion pressure (CPP)**, which is the difference between the pressure in the aorta and the pressure in the right atrium during diastole.

Overventilation further increases the intrathoracic pressure, which in turn further decreases atrial and ventricular filling and reduces coronary perfusion pressure. CPP is a reflection of myocardial blood flow, and maintaining adequate CPP has been shown to increase the likelihood of return of spontaneous circulation (ROSC) and survival.

One Provider Operating the BVM

To use a BVM resuscitator when only one provider is present:

- Select the appropriately sized BVM resuscitator and mask for the patient's size. Then, assemble the BVM resuscitator.
- Position yourself behind the patient's head (cephalic position) and open the airway to a past-neutral position.
- Place the mask at the bridge of the nose and then lower it over the patient's nose, mouth and chin. The mask should not extend past the patient's chin.
- To hold the mask in place, use an **E-C hand position**. Place one hand around the mask, forming an "E" with the last three fingers and a "C" with your thumb and index finger (Figure 3-3).
- Seal the mask completely around the patient's mouth and nose and open the airway to a past neutral position by lifting the jaw into the mask. Be sure to maintain the mask seal and open airway. (For more information about opening the airway, see Chapter 2.)
- With the other hand, depress the bag about halfway to deliver a volume of 400 to 700 mL.
- Provide smooth, effortless ventilations that last about 1 second and make the chest begin to rise. Remember, ventilations that are too fast or have too much volume can be dangerous.
- For an adult in respiratory arrest, provide 1 ventilation about every 5 to 6 seconds—or about 10 to 12 ventilations per minute.
- For an adult in cardiac arrest who does not have an advanced airway in place, each CPR cycle consists of 30 chest compressions followed by 2 ventilations. Remember to transition smoothly between compressions and ventilations and to minimize interruptions in compressions to no more than 10 seconds.

Two Providers Operating the BVM

Although one provider may operate a BVM resuscitator, evidence shows that two providers are needed to most effectively operate the equipment. One provider maintains the mask seal and open airway in a past-neutral position, while the second provider delivers ventilations by depressing the bag about halfway to make the chest begin to rise.

Figure 3-3 | When one provider operates the BVM, they maintain the mask seal and open airway with one hand in the E-C hand position. With the other hand, they depress the bag halfway to deliver ventilations.

ALERT

BVM resuscitators can hold more than 1000 mL of volume and should never be completely deflated when providing ventilations. Doing so could lead to overventilation. Pay close attention to any increasing difficulty when providing ventilations using a BVM resuscitator. This difficulty may indicate an increase in intrathoracic pressure, inadequate airway opening or other complications. Be sure to share this information with the team for corrective actions.

To use a BVM resuscitator when two providers are present:

- Select the appropriately sized BVM resuscitator and mask for the patient's size. Then, assemble the BVM resuscitator as needed.
- Provider 1 gets into position behind the patient's head (cephalic position).

Figure 3-4 | When two providers operate the BVM, one provider maintains the mask seal and open airway with two hands in the E-C hand position, while the other provider depresses the bag halfway to deliver ventilations.

- Provider 1 places the mask at the bridge of the nose and then lowers it over the patient's nose, mouth and chin. The mask should not extend past the patient's chin.
- To hold the mask in place, Provider 1 positions one hand around the mask, forming an "E" with the last three fingers and a "C" with the thumb and index finger—the E-C hand position (Figure 3-4).
- Provider 1 seals the mask completely around the patient's mouth and nose and opens the airway to a past-neutral position by lifting the jaw into the mask.
- Provider 1 maintains the mask seal and open airway.
- Provider 2 depresses the bag about halfway to deliver a volume of 400 to 700 mL.
- Provider 2 delivers smooth, effortless ventilations that last about 1 second and make the chest begin to rise. Remember, ventilations that are too fast or have too much volume can be dangerous.
- For an adult in respiratory arrest, Provider 2 delivers 1 ventilation about every 5 to 6 seconds—or about 10 to 12 ventilations per minute.
- For an adult in cardiac arrest who does not have an advanced airway in place, each CPR cycle consists of 30 chest compressions followed by 2 ventilations. Remember to smoothly transition between compressions and ventilations to minimize interruptions in compressions to no more than 10 seconds.

Mouth-to-Mouth Ventilations

If a pocket mask or BVM resuscitator is not available, you may need to provide mouth-to-mouth ventilations.

- Open the airway to a past-neutral position.
- Pinch the patient's nose shut. Take a normal breath, make a complete seal over the patient's mouth with your mouth and blow into the patient's mouth to deliver 1 ventilation over 1 second until you see the chest begin to rise (Figure 3-5).

Figure 3-5 | For mouth-to-mouth ventilations, make a seal over the patient's mouth with your mouth, pinch the nose shut and deliver ventilations as you would using a pocket mask.

- After each ventilation, break the seal and take a breath before resealing your mouth over the patient's mouth. Then deliver the next ventilation.

Mouth-to-Nose Ventilations

If you are unable to make a complete seal over the patient's mouth, you may need to use mouth-to-nose ventilations instead.

- With the patient's head tilted back, close the mouth by pushing up on the chin.
- Seal your mouth around the patient's nose and breathe into the nose.
- If possible, open the patient's mouth between ventilations to allow air to escape.

SCIENCE NOTE

Mouth-to-Mouth Ventilations

With mouth-to-mouth ventilations, the air the patient receives contains approximately 16% to 17% oxygen; the oxygen concentration of ambient air is approximately 20%. Breaking the seal after each ventilation and taking a breath can help maintain an oxygen concentration of approximately 16% to 17%. If you do not break the seal and take a breath between ventilations, the second ventilation may contain an oxygen concentration of 0% and a high concentration of carbon dioxide.

Adjuncts to Ventilations

Supplemental oxygen, basic airways and advanced airways may be used to facilitate ventilations during cardiac and respiratory arrest. Always follow your facility's protocols when using adjuncts to ventilations.

A trained and authorized provider can provide supplemental oxygen or insert an advanced airway as long as it does not delay the administration of compressions, ventilations or defibrillation.

Although a BLS provider is not always responsible for providing supplemental oxygen or inserting an advanced airway, you do need to know how to provide ventilations and monitor airways when they are in place.

Ventilations using a BVM resuscitator deliver approximately 20% to 21% oxygen concentration to the patient. Attaching high-concentration supplemental oxygen to a BVM resuscitator can increase the oxygen concentration to approximately 90% to 100% and is recommended as soon as it is available (Figure 3-6, A). When supplemental oxygen is attached to a BVM resuscitator, ventilations are performed the same way. If a basic airway is in place, such as an oropharyngeal airway, CPR is performed the same way. However, if an advanced airway is in place, such as a supraglottic airway device or an endotracheal tube, care must be performed a little differently. If the patient is in respiratory arrest, deliver 1 ventilation every 6 seconds (Figure 3-6, B). If the patient is in cardiac arrest, a minimum of two providers must be present. One provider delivers 1 ventilation every 6 seconds while the other provider delivers continuous chest compressions (i.e., providers do not pause for ventilations). Therefore, the compression-to-ventilation ratio of 30:2 does not apply because compressions and ventilations are delivered continuously with no interruptions.

Figure 3-6 | (A) Attaching high-concentration supplemental oxygen to a BVM resuscitator can increase the oxygen concentration to approximately 90% to 100%. (B) When an advanced airway is in place during respiratory arrest, deliver 1 ventilation every 6 seconds.

Automated External Defibrillators

An **automated external defibrillator (AED)** is a portable electronic device that automatically analyzes the patient's heart rhythm and provides **defibrillation**, an electrical shock that may help the heart re-establish a perfusing rhythm. AEDs deliver defibrillation(s) to patients with two specific arrhythmias: ventricular fibrillation (VF) and ventricular tachycardia (VT). When a patient experiences cardiac arrest, an AED should be applied as soon as it is readily available (Figure 3-7). Early use of an AED greatly increases the patient's chance of survival.

AED models function differently. Always follow the manufacturer's instructions for the AED in use in your facility.

Practice Note

If a monitor defibrillator is available, it may have an AED function. Although the device may look different, follow the same steps.

Practice Note

Upon achieving ROSC, supplemental oxygen should be used based on your facility's protocols to maintain a normal oxygen saturation level while avoiding hyperoxygenation. Providers should use a pulse oximeter to monitor oxygen saturation.

Figure 3-7 | For a patient in cardiac arrest, use an AED as soon as one is available. If multiple providers are present, continue CPR until the AED is ready to analyze the rhythm.

> For every 1-minute delay in CPR and defibrillation, a patient's chance of survival is reduced by 7% to 10%.

Using an AED

If CPR is in progress, continue CPR until the AED is turned on, the AED pads are applied and the AED is ready to analyze the heart rhythm. If you are alone and an AED is available, you should use it once you have determined the patient is in cardiac arrest. See Skill Sheet: AED Use for Adults.

To use an AED:

- Turn the AED on and follow the prompts. Some AEDs turn on as soon as you open the case or lid. For others, you have to press a power button or pull a handle.
- Remove or cut away clothing and undergarments to expose the patient's chest. If the patient's chest is wet, dry it using a towel or gauze pad. Do not use an alcohol wipe to dry the skin because alcohol is flammable.
- Apply pads appropriately sized for the patient's age in the proper location on the bare chest.
  - Use adult AED pads or energy levels. Never use pediatric AED pads or a pediatric electrical setting on an adult, because the shock delivered will not be sufficient.
  - Place one pad on the upper right chest, below the right clavicle to the right of the sternum. Place the other pad on the left side of the chest, on the midaxillary line a few inches below the left armpit. This is an anterior/lateral placement. If the AED pads have a feedback device, make sure it's placed in the center of the chest.
  - Some AED models use an anterior/posterior pad placement for adult patients. In this case, place one pad to the center of the patient's chest—on the sternum—and one pad on the patient's back between the scapulae. Always follow the manufacturer's instructions.
- Plug in the connector and push the analyze button, if necessary. Most AEDs available today have pads that are already connected and will automatically analyze once the pads are applied to the chest. Make sure you understand how the AED you are using operates.
- Tell everyone to "clear" while the AED is analyzing to ensure accurate analysis. Make sure that no one, including you, is touching the patient while the AED is analyzing the heart rhythm because this could result in a faulty reading. During the AED analysis, the provider responsible for compressions should prepare to begin compressions immediately after a shock is delivered or if the AED advises that a shock is not indicated. Remaining in position with the hands a few inches above the patient's chest, or **hovering**, during analysis and while delivering the shock minimizes interruptions to chest compressions (Figure 3-8).
- If the AED advises that a shock is indicated, tell everyone to "clear" prior to depressing the shock button. The AED delivers an electrical current that could injure anyone in contact with the patient. The provider responsible for giving compressions should prepare to begin compressions immediately after the shock is delivered.
- After the shock is delivered or if no shock is advised, immediately resume CPR, starting with chest compressions. You don't need to wait for the AED to prompt you. Perform about 2 minutes of CPR (about 5 cycles of 30 compressions to 2 ventilations) until

Practice Note

Various models of AEDs and manual defibrillators function differently. For example, some AEDs and manual defibrillators use the anterior/lateral pad placement for adult patients. However, other models use the anterior/posterior pad placement. Also, some AEDs and manual defibrillators allow for compressions after the device analyzes the rhythm, while it is charging. Providers may perform compressions from the time the shock-advised prompt is noted through the time that the "clear" prompt occurs, just before depressing the shock button. Be sure to follow the manufacturer's recommendations and your facility's protocols.

Figure 3-8 | During the analysis and while delivering the shock, the compressor hovers their hands a few inches above the patient's chest to minimize interruptions in chest compressions.

the AED prompts that it is reanalyzing, the patient shows signs of ROSC or the team leader or other trained providers instruct you to stop. Each time the AED analyzes the heart rhythm, providers should switch positions to relieve the compressor.

AED Safety

Patient Considerations

- **Pregnancy.** It is safe to use an AED on a woman who is pregnant. Remember, the baby's best chance of survival is the mother's survival.
- **Trauma.** When a patient is experiencing cardiac arrest as a result of traumatic injuries, an AED should be used, following your facility's protocols. Often, traumatic events are preceded by medical events.
- **Pacemakers and implantable cardioverter-defibrillators (ICDs).** You should use an AED if a patient is in cardiac arrest and has a pacemaker or ICD. However, you should adjust the pad placement to avoid placing the AED pads directly over the device, because doing so may interfere with the delivery of the shock. Note: A pacemaker or ICD may be placed in the right upper chest near the clavicle or in the abdomen.
- **Transdermal medication patches.** Before applying AED pads, remove any medication patches with a gloved hand and wipe away any remaining medication from the skin.
- **Chest hair.** Time is critical in a cardiac arrest situation and chest hair rarely interferes with pad adhesion. However, if the patient has a great deal of chest hair that could interfere with pad-to-skin contact, quickly shave the areas where the pads will be placed before attaching the AED pads.
- **Jewelry and body piercings.** A patient's jewelry or body piercings do not need to be removed before using an AED, but avoid placing the AED pads directly over any metallic jewelry or piercings. Adjust pad placement if necessary.

> It is important to check AEDs regularly according to the manufacturer's instructions or your facility's policy to ensure that they are in good working order and ready to use whenever they are needed.

Environmental Considerations

- **Flammable or combustible materials.** Do not use an AED around flammable or combustible materials such as free-flowing oxygen.
- **Metal surfaces.** It is safe to use an AED when a patient is lying on a metal surface, as long as appropriate precautions are taken. Do not allow the AED pads to contact the metal surface, and ensure that no one is touching the patient when the shock is delivered.
- **Water.** If the patient is lying in a large puddle or submerged in water, remove them from the water before using an AED. However, if they are lying in a small puddle or wet surface, you do not need to remove them—providing you and the AED are not in the small puddle. Also, remove a patient's wet clothing from the chest and wipe the patient's chest dry before placing the AED pads. Avoid getting the AED or AED pads wet.
- **Inclement weather.** AEDs are safe to use in all weather conditions, including rain and snow. Provide a dry environment if possible, but do not delay defibrillation to do so. Remove a patient's wet clothing from the chest and wipe the patient's chest dry before placing the AED pads. Avoid getting the AED or AED pads wet.

AED Maintenance

As with any biomedical device, routine maintenance is necessary to ensure that the device performs properly and safely. AEDs require minimal maintenance, but it is important to check them regularly according to the manufacturer's instructions or your facility's policy to ensure that they are in good working order and ready to use whenever they are needed.

To provide routine maintenance:

- Familiarize yourself with the owner's manual and follow the manufacturer's instructions for maintaining the equipment.
- Familiarize yourself with the method the AED uses to indicate the status of the device. Many AEDs have a status indicator that displays a symbol or illuminates to indicate that the AED is in proper working order and ready to respond.
- Make sure the battery is properly installed and within its expiration date.
- Make sure AED pads are adequately stocked, stored in a sealed package and within their expiration date.
- After using the AED, make sure that all supplies are restocked and that the device is in proper working order.
- If at any time the AED fails to work properly or warning indicators illuminate or beep, take the AED out of service based on manufacturer's recommendations and contact the manufacturer or the appropriate person at your facility, according to your facility's policy.

Single and Multiple Providers

When you are the only provider present, you must complete the rapid assessment, perform CPR (30:2) and use the AED, if one is available. CPR can be exhausting, so you should attempt to find additional resources as soon as possible during the rapid assessment.

When multiple providers are available, the first provider performs the rapid assessment and initiates CPR (30:2), starting with chest compressions. Meanwhile, another provider calls for additional resources and gets and prepares the AED, if available. If additional providers are available, they assist with ventilations. Providers smoothly switch positions about every 2 minutes. This should take less than 10 seconds. The compressor calls for a position change by saying "switch" in place of the number 1 in the compression cycle.

For single- and multiple-provider CPR, you should continue CPR/AED use until:

- Other trained providers arrive and relieve you.
- You see signs of return of spontaneous circulation (ROSC), such as spontaneous movement or breathing.
- You are presented with a valid do not resuscitate (DNR) order.
- You are too exhausted to continue.
- The situation becomes unsafe.

See *Appendix C: Basic Life Support Sequences*—for more information on BLS for adults.

Practice Note

If an advanced airway is in place, the compression-to-ventilation ratio of 30:2 does not apply because compressions and ventilations are delivered continuously with no interruptions.

High-Performance Resuscitation Teams

High-performance resuscitation teams work together in a well-organized effort to provide high-quality CPR during a cardiac arrest. Characteristics of a high-performance team include well-defined roles and responsibilities; clear, closed-loop communication; and respectful treatment of others.

Coordinated, efficient and effective teamwork is essential to provide high-quality CPR, improve patient outcomes and deliver expert care (Figure 3-9).

Think about all of the activities performed during a resuscitation. For example:

- AED pads are applied.
- AED must charge.
- Pocket mask or BVM may need to be repositioned.
- Airway may need to be reopened.
- Other personnel arrive on scene.
- Providers switch positions.
- Advanced airway may need to be inserted.
- Pulse checks might be done.

All of these activities could affect your ability to maintain contact with the patient's chest.

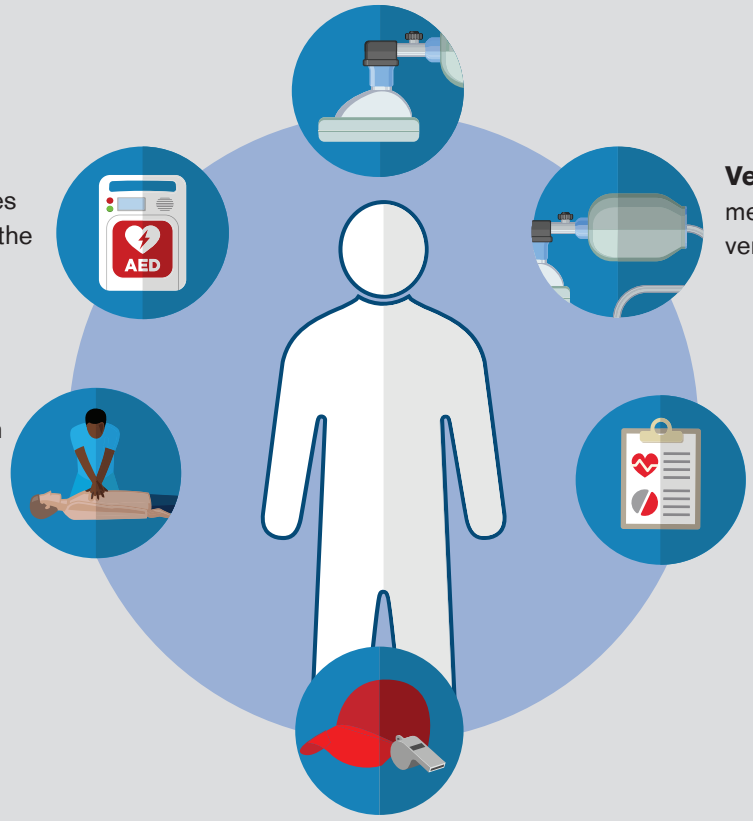
Figure 3-9 | A high-performance team provides high-quality CPR, improves patient outcomes and delivers expert care.

Team Roles

During resuscitation, numerous team members might be involved in an emergency response. When the team leader and all of the team members, in their assigned roles, work together as a high-performance team, they deliver expert care and improve outcomes.

Depending on the number of available resources, team members might perform more than one role (e.g., the airway manager might also operate the AED or ventilate the patient).

Airway manager. This team member maintains an open airway and seals the mask.



AED operator. This team member manages the AED and relieves the compressor.

Ventilator. This team member provides ventilations.

Compressor. This team member is responsible for chest compressions.

Recorder. This team member records and communicates key data during the resuscitation effort—for example, data related to interruptions to chest compressions.

Team leader. The team leader assigns roles, sets clear expectations, prioritizes, directs, encourages team input and interaction, monitors the delivery of CPR/AED, makes adjustments in real time and focuses on the big picture.

Figure 3-10 | Good team coordination is extremely important when other trained providers, such as the code team, arrive on the scene.

Integration of Other Trained Providers

Coordination becomes even more important when other trained providers, such as an advanced life support team or code team, arrive to take over care (Figure 3-10). This coordination of all involved is necessary to:

- Ensure that all individuals involved work as a team to help promote the best outcome for the patient.
- Promote effective perfusion to the vital organs.
- Minimize interruptions of chest compressions to less than 10 seconds, which has been shown to improve survival.

Ultimately, the team leader is responsible for this coordination. When other trained providers arrive, the team leader communicates with them, providing them with a report of the patient's status and events.

Continuous Quality Improvement

Healthcare providers and their employers have a responsibility to ensure that they provide the highest quality CPR throughout every resuscitation event. To achieve this goal, it is necessary to gather data and use that data to inform improvements in individual and team performance. Methods of evaluating CPR quality include visual observation and the use of feedback devices, calculations such as the chest compression fraction, and capnography. Additionally, debriefing after the resuscitation event allows the team to make any necessary changes in order to positively affect the outcome of future resuscitation events.

SCIENCE NOTE

Minimize Interruptions

Current research indicates that survival following resuscitation is significantly affected by the quality of CPR performed. One important aspect is to minimize interruptions in chest compressions to less than 10 seconds, which helps to maximize the blood flow generated by the compressions.

> Data collected about the effectiveness of CPR allows for continuous improvement, both "in the moment" and during future resuscitation events.

Visual Observation

Visual observation is an important qualitative measure of high-quality CPR. Visual observation allows for in-the-moment adjustments to technique based on feedback from the team leader or another team member. For example, the team leader may observe that the provider giving compressions is tiring or that compressions are not being delivered at the correct rate or depth. These observations allow the team leader to redirect the team as necessary to get back on track.

Feedback Devices

Feedback devices use technology to gather data about CPR performance and provide real-time feedback. These devices collect objective data such as the rate at which compressions and ventilations are being delivered, the depth of compressions and the amount of chest recoil. Many different types of feedback devices are available, ranging from apps on smartwatches to self-contained systems, some with attachments to place on the patient. All feedback devices are designed to act as "virtual coaches," guiding providers to adjust technique in order to perform effective, high-quality CPR. In addition, most feedback devices record data that can be analyzed after the resuscitation event, enabling improvements to be implemented for future resuscitation events (Figure 3-11).

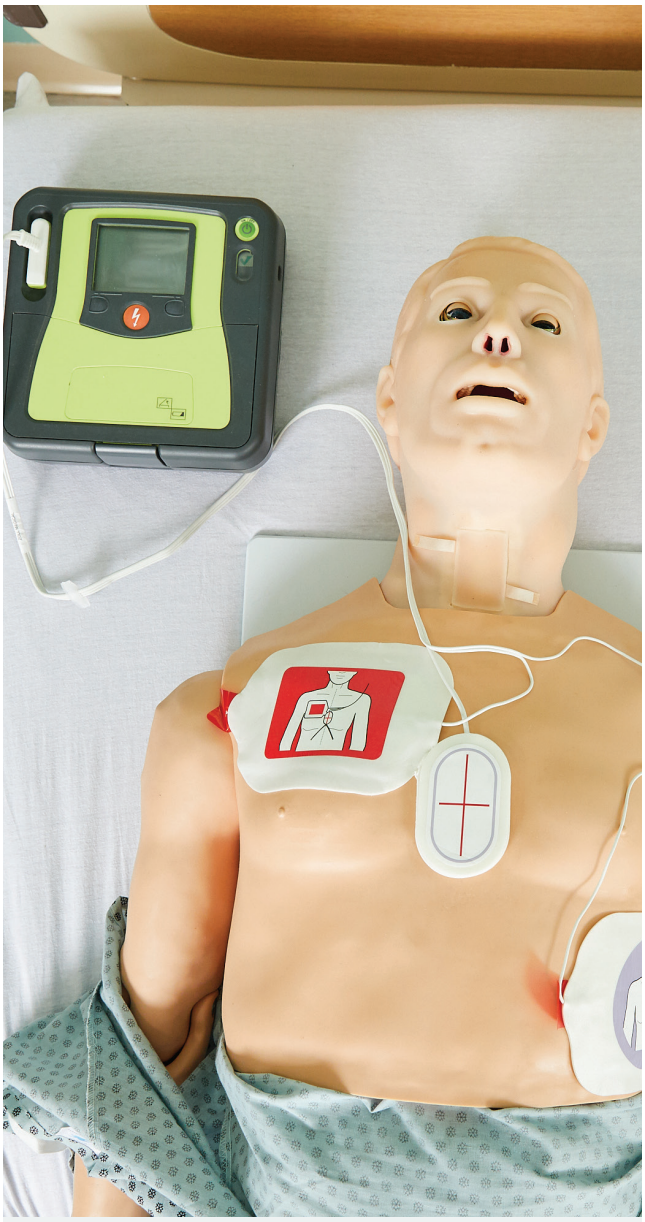


Figure 3-11 | Feedback devices are designed to act as "virtual coaches," guiding providers to adjust technique in order to perform effective, high-quality CPR. The feedback device shown here is placed in the center of the patient's chest. When compressed, data is sent to the defibrillator and communicated in real-time to the providers.

Chest Compression Fraction

The **chest compression fraction (CCF)** represents the amount of time spent performing compressions, and it is another way to gain objective feedback about the quality of CPR. It is calculated by dividing the time that providers are in contact with the patient's chest by the total duration of the resuscitation event, beginning with the arrival of the resuscitation team and ending with the achievement of ROSC or the cessation of CPR. According to expert consensus, a CCF of at least 60% is needed to promote optimal outcomes, and the goal should be 80%. Many feedback devices are able to calculate the CCF based on the data they collect. When a feedback device is not in use, a team member may be assigned to record data that can be used to calculate the CCF, such as the duration of interruptions to CPR and the duration of the entire resuscitation event.

Capnography

Capnography, which measures the end-tidal carbon dioxide ($ETCO_2$) level, is a noninvasive way of obtaining an objective measure of compression quality with every ventilation (Figure 3-12). An adapter attached to a BVM or advanced airway, or a nasal cannula uses sensors to detect $ETCO_2$ levels, which are displayed as waveforms on a monitor.

Carbon dioxide delivery to the lungs depends on cardiac output. When circulation is adequate, a predictable amount of carbon dioxide should be exhaled. So, the end-tidal carbon dioxide ($ETCO_2$) level is a quantitative measure of cardiac output—and by extension, the effectiveness of compressions. An end-tidal carbon dioxide level in the expected range also suggests that ventilations are effective.

The $ETCO_2$ level can be measured using an adapter attached to a BVM resuscitator or advanced airway, or a nasal cannula can be applied under a mask.

Normally, end-tidal carbon dioxide levels are in the range of 35 to 45 millimeters of mercury (mmHg). But in low-perfusion states such as cardiac arrest, the levels are much lower. When high-quality CPR is provided, end-tidal carbon dioxide levels should be in the range of 15 to 20 mmHg. If the levels fall below 10 mmHg, there could be a problem with the rate of ventilations or with the rate or quality of compressions.

Capnography is also an effective tool to determine ROSC and to help the resuscitation team decide when to discontinue CPR. A spike in $ETCO_2$ levels (up to 40 mmHg) is a strong indicator that the patient has achieved ROSC. Conversely, if $ETCO_2$ levels remain less than 10 mmHg in an intubated patient who has been receiving high-quality chest compressions for at least 20 minutes, the likelihood that the patient will achieve ROSC is decreased, and the decision may be made to terminate the resuscitation effort. If, however, $ETCO_2$ levels remain greater than 15 mmHg, the patient has an increased chance to achieve ROSC and resuscitation efforts should continue.

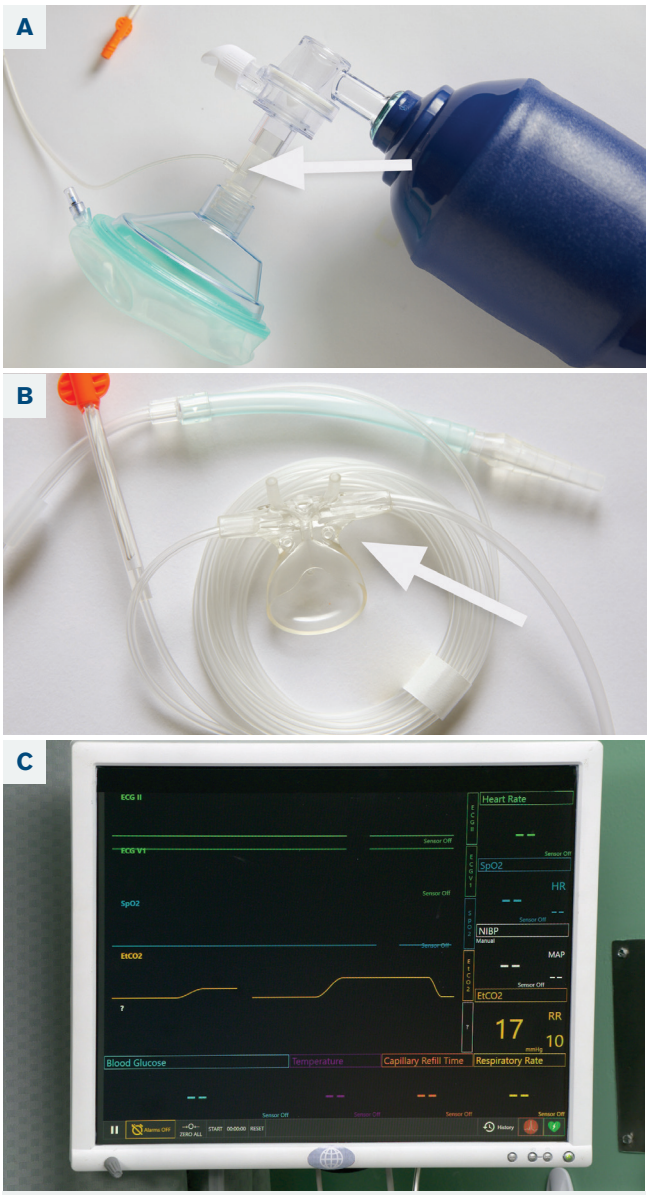


Figure 3-12 | Capnography is a noninvasive way to objectively measure compression quality. (A) To measure the $ETCO_2$ level, attach an adapter to a BVM. (B) Alternatively, attach an adapter to the nasal cannula and place it under the mask. (C) When high-quality CPR is provided, $ETCO_2$ levels should be in the range of 15 to 20 mmHg.

SKILL SHEET

CPR for Adults

Step 1 Conduct a rapid assessment

- Perform a quick visual survey, check for responsiveness, open the airway, and simultaneously check for breathing and a carotid pulse for at least 5 seconds but no more than 10.
- If the patient is unresponsive, isn't breathing normally and doesn't have a pulse, begin CPR.

Step 2 Place the patient on a firm, flat surface

- In a healthcare setting, use a bed with a CPR feature, or place a CPR board under the patient.
- Adjust the bed to an appropriate working height or use a step stool. Lower the bed side rail closest to you.
- In other settings, move the patient to the floor or ground and kneel beside them.

Step 3 Position your hands correctly

- Expose the patient's chest to ensure proper hand placement and visualize chest recoil.
- Place the heel of one hand in the center of the patient's chest on the lower half of the sternum.
- Place your other hand on top of the first and interlace your fingers or hold them up so that they are not resting on the patient's chest.

SKILL SHEET

CPR for Adults *(continued)*

Step 4 Position your body effectively

- Position yourself so your shoulders are directly over your hands. This position lets you compress the chest using a straight up-and-down motion.
- To help keep your arms straight, lock your elbows.

> **Practice Note**
>
> If drowning or another hypoxic event is the suspected cause of cardiac arrest, deliver 2 initial ventilations before starting CPR.

Step 5 Perform 30 chest compressions

- For an adult, compress the chest to a depth of at least 2 inches (5 cm). If you are using a feedback device, make sure the compressions are no more than 2.4 inches (6 cm) deep.
- Provide smooth compressions at a rate of 100 to 120 per minute.
- Allow the chest to fully recoil after each compression. Avoid leaning on the patient's chest at the top of the compression.

Step 6 Seal the mask and open the airway

- Use an adult pocket mask for single-provider CPR or a BVM for multiple-provider CPR.
- Seal the mask and simultaneously open the airway to a past-neutral position using the head-tilt/chin-lift technique.
- Or, use the modified jaw-thrust maneuver if you suspect a head, neck or spinal injury.

Step 7 Provide 2 ventilations

- While maintaining the mask seal and open airway, provide smooth, effortless ventilations. Each ventilation should last about 1 second and make the chest begin to rise. Avoid excessive ventilation.
- If you do not have a pocket mask or BVM, provide mouth-to-mouth or mouth-to-nose ventilations.

SKILL SHEET

CPR for Adults *(continued)*

Practice Note

If an advanced airway is in place, one provider delivers 1 ventilation every 6 seconds. At the same time, a second provider performs compressions at a rate of 100 to 120 per minute. In this case, the compression-to-ventilation ratio of 30:2 does not apply because compressions and ventilations are delivered continuously with no interruptions.

Step 8 Switch positions every 2 minutes

- When providing CPR with multiple providers, smoothly switch positions about every 2 minutes. This should take less than 10 seconds.
- The compressor calls for a position change by saying "switch" in place of the number 1 in the compression cycle.

Step 9 Continue CPR

Continue providing CPR until:

- You see signs of ROSC, such as patient movement or normal breathing.
- Other trained providers take over and relieve you from compression or ventilation responsibilities.
- You are presented with a valid do not resuscitate (DNR) order.
- You are alone and too exhausted to continue.
- The situation becomes unsafe.

Practice Note

Upon achieving ROSC, supplemental oxygen should be used based on your facility's protocols to maintain a normal oxygen saturation level while avoiding hyperoxygenation. Providers should use a pulse oximeter to monitor oxygen saturation.

SKILL SHEET

AED Use for Adults

Step 1 Turn on the AED and follow the prompts

- Because AED models function differently, follow your facility's protocols and the manufacturer's instructions for the AED you have.

Step 2 Expose the chest

- Expose the chest and wipe it dry, if necessary.

Step 3 Attach the pads

- Use an anterior/lateral pad placement, according to the manufacturer instructions:
  - Place one pad on the upper right chest, below the right clavicle to the right of the sternum.
  - Place the other pad on the left side of the chest along the midaxillary line a few inches below the armpit.
- Or, use an anterior/posterior placement, according to the manufacturer instructions:
  - Place one pad to the center of the patient's chest—on the sternum.
  - Place one pad to the patient's back between the scapulae.

⚠ Alert

Do not use pediatric AED pads or pediatric levels of energy on an adult or on a child older than 8 years or weighing more than 55 pounds.

SKILL SHEET

AED Use for Adults *(continued)*

Step 4 Prepare to let the AED analyze the heart's rhythm

- If necessary, plug in the connector and push the analyze button.
- Instruct everyone to stand clear while the AED analyzes. No one, including you, should be touching the patient.
- As the AED analyzes, switch positions if you are working with a team. The provider giving compressions should hover their hands above the patient's chest.

Step 5 Deliver a shock, if the AED determines one is needed

- If the AED advises a shock, again instruct everyone to stand clear. The compressor should continue to hover their hands over the patient's chest in preparation for CPR.
- Press the shock button to deliver the shock.

Step 6 After the AED delivers the shock, or if no shock is needed

- Immediately begin CPR. You do not need to wait for the AED prompt.
- Continue for about 2 minutes until:
  - The AED prompts that it is reanalyzing.
  - The patient shows signs of return of spontaneous circulation.
  - The team leader or other trained providers instruct you to stop.
- If you are working with a team, rotate roles during the analysis to prevent fatigue as needed.

CHAPTER 4

Basic Life Support for Children and Infants

Introduction

Children and infants, just like adults, may experience life-threatening cardiac and respiratory emergencies requiring basic life support (BLS) care. Although the differences in BLS care for children and infants may seem subtle, it is important to understand them in order to achieve the best possible outcomes.

Defining Adolescents, Children and Infants

Children are not small adults. Therefore, they need to be cared for differently in a life-threatening emergency. It is essential to identify which age-dependent CPR and AED guidelines to follow (Figure 4-1).

When determining which CPR/AED protocol to follow, use these guidelines:

- An **infant** is defined as someone under the age of 1. When providing BLS care, follow **infant** guidelines and use appropriately sized equipment.
- A **child** is defined as someone from the age of 1 to the onset of puberty as evidenced by breast development in girls and underarm hair development in boys (usually around the age of 12). When providing BLS care, follow **child** guidelines and use appropriately sized equipment. The use of pediatric versus adult AED pads or settings for children varies by age and weight.
- An **adolescent** is defined as someone from the onset of puberty through adulthood. When providing BLS care, follow **adult** guidelines and use appropriately sized equipment.

Figure 4-1 | CPR/AED guidelines are age dependent. An infant is someone under age 1. A child is someone from age 1 to the onset of puberty. An adolescent is someone from the onset of puberty through adulthood.

Pediatric Cardiac Chain of Survival

The Pediatric Cardiac Chain of Survival (Figure 4-2) is similar to the Adult Cardiac Chain of Survival, but it focuses on prevention. The most common causes of cardiac arrest in children include respiratory emergencies, congenital heart disorders and trauma.

The five links in the Pediatric Cardiac Chain of Survival are:

- **Prevention of arrest.** Prevention is key because cardiac arrest in children often occurs as the result of a preventable injury (such as trauma, drowning, choking or electrocution).
- **Early, high-quality CPR.** CPR, starting with compressions, should be initiated within 10 seconds of recognizing cardiac arrest.
- **Rapid activation of the emergency medical services (EMS) system or response team.** Immediate recognition of cardiac arrest and activation of the EMS system or response team quickly gives the patient access to necessary personnel, equipment and interventions as soon as possible after arrest.
- **Effective, advanced life support.** Effective, advanced life support gives the patient access to emergency medical care delivered by specially trained professionals.
- **Integrated post-cardiac arrest care.** After return of spontaneous circulation (ROSC), survival outcomes are improved when providers work to stabilize the patient, minimize complications, and diagnose and treat the underlying cause.

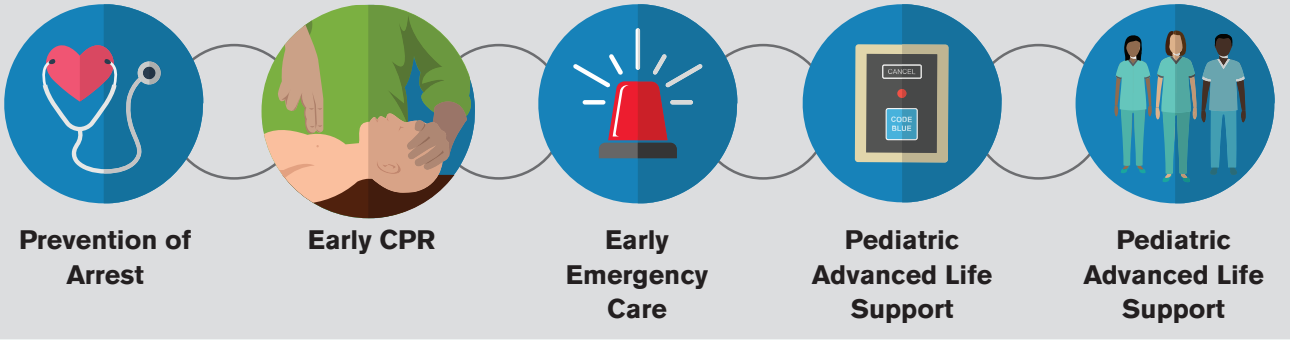


Figure 4-2 | The Pediatric Cardiac Chain of Survival

The Pediatric Cardiac Chain of Survival focuses on prevention because cardiac arrest in children often occurs as the result of preventable injury.

BLS Differences Among Adults, Children and Infants

Key differences in technique exist when providing BLS care to adults, children and infants. These differences include rapid assessment, compression technique, compression depth, ventilations, use of appropriately sized breathing barriers, CPR with an advanced airway in place, and use of an AED. See *Appendix D* for a summary of BLS differences among adults, children and infants.

Rapid Assessment

Rapid assessment for a child or infant is similar to rapid assessment for an adult with a few key differences. See Skill Sheet: Rapid Assessment for Children and Infants.

Shout-Tap-Shout Sequence

If the child or infant appears unresponsive, follow the shout-tap-shout sequence. Shout, "Are you OK?" or use the child or infant's name if known, as you do with an adult. Tap the child on the shoulder similar to an adult (Figure 4-3, A); however, tap the infant on the *bottom of the foot*. Then shout again. (Figure 4-3, B).

Additional Resources

As with an adult, if a child or infant is unresponsive follow these steps:

- Call for someone to activate EMS, the rapid response team or the resuscitation team, as appropriate and retrieve the AED, bag-valve-mask (BVM) resuscitator and other emergency equipment.
- If you are alone with a child or infant and do not have a mobile phone or other form of communication, you must decide to call first or care first. See *Learn More: Call First or Care First*?

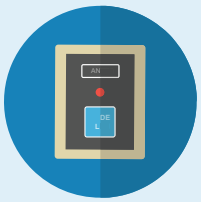
Figure 4-3 | If a child or infant appears unresponsive, follow the shout-tap-shout sequence. (A) For a child, tap the shoulder as you do for an adult. (B) For an infant, tap the bottom of the foot instead.

LEARN MORE

Call First or Care First?

Although it is rare in the professional healthcare setting to be alone with a child or infant or to be unable to call for additional resources, you should follow certain steps if this is ever the case.

If you are alone and do not have a mobile phone or other method of communication, you must decide to call first or care first.



Call First

For a child or an infant whom you witnessed suddenly collapse, or for an unresponsive child or infant with a known cardiac condition:

- Call for help to activate EMS, the rapid response team or the resuscitation team, as appropriate, and call for an AED.
- Then, provide care based on the conditions found.

Care First

For an unresponsive child or infant whom you did not see collapse:

- Provide 2 minutes of care based on the conditions found.
- Then, call for help to activate EMS, the rapid response team or the resuscitation team, as appropriate, and call for an AED.

Practice Note

Because most child- or infant-related cardiac arrests occur as a result of a hypoxic event (e.g., an asthma exacerbation, an airway obstruction or a drowning), ventilations and appropriate oxygenation are important for successful resuscitation. Laryngeal spasm may occur in these situations, making passive ventilation during chest compressions minimal or nonexistent. Therefore, it is critical to make sure the child or infant's brain is oxygenated before leaving them to get additional resources.

ALERT

If you are caring for an infant, bring them with you to get additional resources.

Open the Airway

To open the airway of a child or infant, use the same head-tilt/chin-lift technique or jaw-thrust maneuver as for an adult. However, when using the head-tilt/chin-lift technique, only tilt the head to a slightly past-neutral position for a child (Figure 4-4, A) or a neutral position for an infant (Figure 4-4, B).

Take care to avoid any hyperextension or flexion in the neck. Be careful not to place your fingers on the soft tissues under the chin or neck to open the airway.

Check for Breathing and a Pulse

Subtle differences in positioning are applied when opening the airway of a child or infant compared with an adult. Simultaneously check for breathing a pulse for at least 5 seconds but no more than 10. Check the carotid pulse for a child (Figure 4-5, A). However, for an infant, check the *brachial pulse* with two fingers on the inside of the upper arm. Do not use your thumb because it has its own detectable pulse. You will need to expose the arm to accurately feel a brachial pulse (Figure 4-5, B).

Recognize and Care

After completing your rapid assessment, obtain **consent** (Box 4-1) and provide care based on conditions found. Always follow your facility's protocols.

- If the child or infant is unresponsive or experiencing an altered level of consciousness, is breathing normally and has a pulse: Place them in recovery position to help maintain a clear airway and monitor them until EMS, the rapid response team or the resuscitation team arrives. See *Learn More: Recovery Positions for Children and Infants.*
- If the child or infant is in respiratory arrest: Deliver 1 ventilation every 3 to 5 seconds. See Respiratory Arrest (page 46) for more information.
- If the child or infant is in cardiac arrest: Begin CPR within 10 seconds and initiate AED use as soon as one is available. See Skill Sheet: CPR for Children, Skill Sheet: CPR for Infants and Skill Sheet: AED Use for Children and Infants.

ALERT

If drowning or another hypoxic event is the suspected cause of cardiac arrest, deliver 2 initial ventilations before starting CPR.

Figure 4-4 | Use the head-tilt/chin-lift to open the airway. (A) For a child, tilt the head to a slightly past-neutral position. (B) For an infant, only tilt the head to a neutral position.

Figure 4-5 | As part of rapid assessment, simultaneously check for breathing and a pulse. (A) For a child, check at the carotid artery, as you do for an adult. (B) For an infant, check at the brachial artery.

Box 4-1 | Obtaining Consent for Children and Infants

OBTAINING CONSENT FOR CHILDREN AND INFANTS

Legally, adults who are awake and alert can consent to treatment; if they are not alert, consent is implied. However, for most infants and children up to the age of 17 years, you must obtain consent from the child's parent or legal guardian if he or she is present regardless of the child's level of consciousness.

To gain consent, state who you are, what you observe and what you plan to do when asking a parent or legal guardian permission to care for his or her child. If no parent or legal guardian is present, consent is implied in life-threatening situations. Always follow your local laws and regulations as they relate to the care of minors.

Compression Technique for Children

The technique for providing chest compressions are similar for an adult and child: Position one hand on top of the other with your fingers interlaced and off the chest centered on lower half of the sternum. (Figure 4-6, A). However, for a smaller child, you may opt to use the one-hand technique to deliver compressions (Figure 4-6, B).

Compression Technique for Infants

The technique of providing compressions to an infant is different from an adult and child because of the infant's smaller size. Technique also differs based on the number of providers involved.

LEARN MORE

Recovery Positions for Children and Infants

For children, use the same approach and technique for recovery positions as you would for an adult.

Technique may differ for infants. Infants with a suspected head, neck, spinal, hip or pelvic injury should not be placed in a recovery position unless you are unable to manage the airway effectively or you are alone and do not have a mobile phone or other form of communication.

To place an infant in a recovery position, use the same technique you would apply for an older child. You also can hold an infant in a recovery position by:

- Carefully positioning the infant face-down along your forearm.
- Then supporting the infant's head and neck with your other hand while keeping the infant's mouth and nose clear.

Figure 4-6 | (A) Compressions technique for a child is the same as for an adult. (B) The one-hand technique may be a better method for smaller children.

When initiating CPR for an infant, use a firm, flat surface. Obtain a CPR board or use a CPR-ready crib or bed. Make sure the crib is at an appropriate working height or use a step stool. Lower the crib side rail closest to you. If you are not at the infant's bedside, use a stable surface such as a table or countertop because it is usually easier to perform compressions from a standing position rather than kneeling at the infant's side.

Two-Finger Technique

To perform compressions for an infant when you are the only provider, use the two-finger technique. Using your hand closet to the infant's feet, place two fingers in the center of the exposed chest, just below the nipple line on the sternum. The fingers should be oriented so that they are parallel, not perpendicular, to the sternum (Figure 4-7, A). You can use your index and middle fingers or your middle and fourth fingers to provide compressions. Fingers that are more similar in length tend to make compressions easier to deliver.

Encircling Thumbs Technique

When multiple providers are caring for an infant in cardiac arrest, the positioning and chest technique for providing compressions differs from those used for an adult or child. The provider performing chest compressions will be positioned at the infant's feet, while the provider providing ventilations will be at the infant's head. Compressions are delivered using the encircling thumbs technique (Figure 4-7, B).

- Place both thumbs (side-by-side) on the center of the infant's chest, just below the nipple line.
- Use the other fingers to encircle the infant's chest toward the back, providing support.
- Using both thumbs at the same time, compress the chest about 1 ½ inches at a rate of at least 100 but no more than 120 compressions per minute. Let the chest return to its normal position after each compression.

Compression Rate and Depth for Children

The compression rate of 100 to 120 per minute is the same for a child as for an adult. The depth of compression, however, is different. For an adult, compress the chest *at least* 2 inches but no more than 2.4 inches; however, for a child, compress the chest *about* 2 inches (or one-third the anterior-posterior diameter of the chest). Make certain you compress the chest with sufficient depth. Use a feedback device during CPR to objectively measure your compression rate and depth. For more information on feedback devices, see Chapter 3.

Compression Rate and Depth for Infants

Compressions are delivered at the same rate used for adults and children—that is, between 100 and 120 compressions per minute. However, for an infant, only compress the chest about 1½ inches (or one-third the anterior-posterior diameter of the chest).

Ventilation Technique for Children and Infants

The technique for providing ventilations to a patient in cardiac arrest is the same for adults, children and infants. Provide smooth, effortless ventilations that last about 1 second and make the chest begin to rise.

The rate for providing ventilations to a patient in respiratory arrest is different in children and infants compared with adults. For both infants and children in respiratory arrest, deliver 1 ventilation every 3 to 5 seconds.

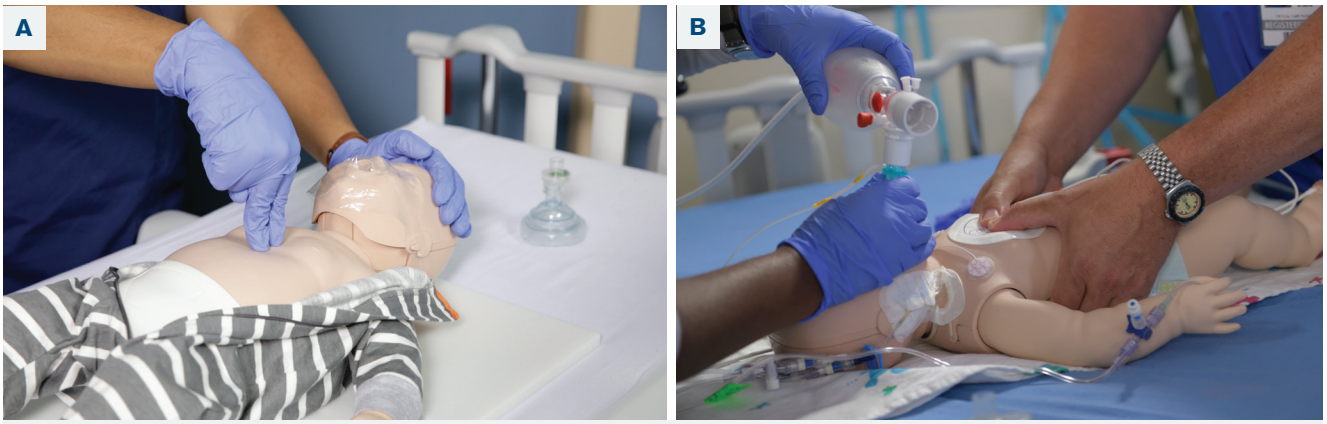


Figure 4-7 | The chest compression technique for an infant differs between single and multiple providers. In both situations, the compression depth for an infant is about 1½ inches. (A) Single providers should use the two-finger technique. (B) However, multiple providers should use the encircling thumbs technique.

Appropriately Sized Breathing Barriers

When providing BLS care to a child or infant, it is essential that you use appropriately sized equipment. Always follow the manufacturer's guidelines and your facility's protocols.

Pocket Masks

If you are using a pocket mask, make sure it is sized appropriately. Some pocket masks are one-size-fits-all for adults and children. In this case, the mask can be rotated so that the narrow end fits over the child's chin. In other instances, separate pocket masks are available for use with children. For infants, you must use a specifically sized infant pocket mask. However, do not delay care while searching for a barrier device.

Bag-Valve-Mask Resuscitators

One of the most difficult aspects of bag-valve-mask (BVM) ventilation can be ensuring an effective seal. Therefore, you must use an appropriately sized BVM (Figure 4-8). You may select from sizes for a newborn, infant and child, or options may include small, medium and large. A circular mask may be more appropriate for children and infants.

Verify that you have selected the correct size by checking that the mask does not cover the patient's eyes and that it does not extend beyond the chin. Like the pocket mask, the narrow end of the BVM device fits over the nose. The bags on the device also deliver smaller volumes for infants and young children.

Some BVMs for children and infants also include a pressure relief or "pop-off" valve that helps to prevent excessive pressure during ventilations.

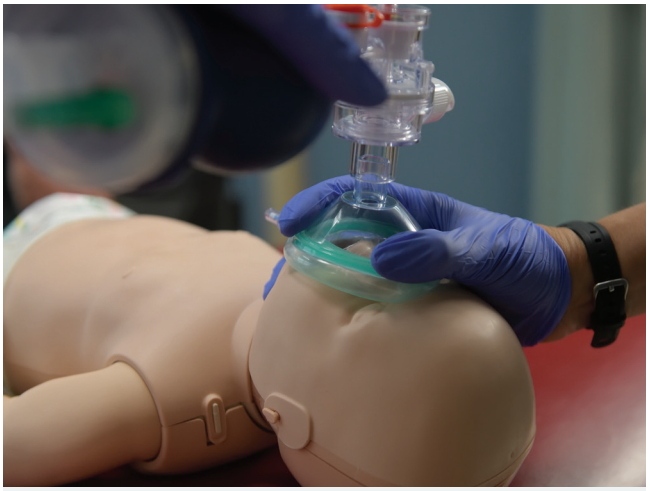


Figure 4-8 | To ensure an effective seal, choose an appropriately sized BVM.

When delivering ventilations with a BVM, maintain the mask seal and open airway in a slightly past-neutral position for children or a neutral position for infants. Avoid any hyperextension or flexion in the neck. Do not place your fingers on the soft tissues under the chin or neck to open the airway.

Practice Note

In children and infants, additional factors must be considered when opening the airway and using the device. The back, lower portion of the head is larger in children than it is in adults, which means there is more flexion of the neck. Other considerations include larger tongues and possible lack of teeth, which may impede ventilation.

Compression-to-Ventilation Ratio for Children

When you are the only provider, the ratio of compressions to ventilations for a child is the same as for an adult—that is, 30 compressions to 2 ventilations (30:2). However, in multiple-provider CPR, this ratio changes to 15 compressions to 2 ventilations (15:2).

Compression-to-Ventilation Ratio for Infants

When you are the only provider, the ratio of compressions to ventilations for an infant is the same as for an adult and child—that is, 30:2. In multiple-provider CPR, however, this ratio changes to 15:2, which is the same as for a child.

Advanced Airways

When an advanced airway is in place, one provider gives 1 ventilation every 6 to 8 seconds. If the child is in cardiac arrest, another provider performs compressions at a rate of 100 to 120 compressions per minute. In this case, the compression-to-ventilation ratio does not apply because compressions and ventilations are delivered continuously with no interruptions.

AED Use for Children and Infants

Although defibrillation is needed less often for a child or an infant than for an adult, the use of an AED remains a critical component of child and infant cardiac arrest care. AEDs work the same way regardless of the patient's age, but the pads or setting used for children and infants differ, as does pad placement, based on the size of the child and infant (Figure 4-9).

Figure 4-9 | While AEDs work the same regardless of the patient's age, the pads or setting used for children and infants differ.

- **Children 8 years of age or younger (including infants) or weighing 55 pounds (25 kg) or less:** Use pediatric AED pads or electrical settings, if available. Pediatric AED pads are smaller and designed specifically to deliver a lower level of energy. If pediatric AED pads are not available or the AED does not have a pediatric setting, it is safe to use adult AED pads or adult levels of energy on a child or infant.
- **Children over the age of 8 years or weighing more than 55 pounds (25 kg):** Use adult AED pads. You should not use pediatric AED pads or the pediatric setting on an adult or child over the age of 8 years or weighing more than 55 pounds (25 kg) because the shock delivered will not be sufficient. In these cases, always use adult AED pads and energy level.

ALERT

Never use pediatric AED pads or a pediatric electrical setting on a child older than 8 or weighing more than 55 pounds (25 kilograms).

For children, position the pads in the same way you would for an adult. (i.e., Use the anterior/lateral or anterior/posterior position according to the manufacturer's instructions.) The AED pads should never touch each other when applied (Figure 4-10, A). If it appears that the AED pads would touch each other based on the size of the child's chest, use an anterior/posterior pad placement as an alternative. Apply one pad to the center of the child's chest on the sternum and one pad to the child's back between the scapulae. When using an AED on an infant, always use the anterior/posterior pad placement (Figure 4-10, B).

Figure 4-10 | (A) When using the anterior/lateral pad placement on a child, make sure the AED pads do not touch. (B) For an infant, always use the anterior/posterior AED pad placement.

Practice Note:

Various models of AEDs and manual defibrillators function differently. Be sure to follow the manufacturer's recommendations and your facility's protocols.

Single and Multiple Providers

When responding to a pediatric respiratory or cardiac event, you must complete a rapid assessment, recognize the problem and provide quality care as described in *Appendix C: Basic Life Support Sequences.*

Respiratory Arrest

Follow these steps for or a child or infant who is unresponsive, not breathing normally (or only gasping) but has a pulse > 60 bpm:

- If you have not already done so, call for help to activate EMS, the rapid response team or the resuscitation team, as appropriate, and call for an AED.
- If you are alone and do not have a mobile phone or other form of communication, you must decide to call first or care first.
- Deliver 1 ventilation every 3 to 5 seconds; each ventilation should last about 1 second and make the chest begin to rise (Figure 4-11).
- Continue ventilations. Check the pulse and breathing about every 2 minutes. If the pulse decreases to 60 bpm or less with signs of poor perfusion, begin CPR and reassess about every 2 minutes.

Follow these steps for or a child or infant who is unresponsive, showing signs of poor perfusion and not breathing normally (or only gasping) but has a pulse ≤ 60 bpm:

- If you have not already done so, call for help to activate EMS, the rapid response team or the resuscitation team, as appropriate, and call for an AED.
- If you are alone and do not have a mobile phone or other form of communication, you must decide to call first or care first.

Figure 4-11 | For both children and infants in respiratory arrest, deliver 1 ventilation every 3 to 5 seconds.

- Begin CPR.
- Continue ventilations and chest compressions.
- Check the pulse and breathing about every 2 minutes.
  - If the child is not breathing normally and the pulse increases to greater than 60 bpm, stop chest compressions but continue providing 1 ventilation every 3 to 5 seconds.
  - If the child is not breathing normally but has a pulse less than 60 bpm, continue CPR.

Practice Note

Signs of poor perfusion in a child or infant include cool, moist skin; pallor, mottling or cyanosis; a weak or thready pulse; decreased capillary refill; and hypotension.

Cardiac Arrest

When you are the only provider present, you must complete the rapid assessment, perform CPR and use an AED. Performing CPR can be exhausting, so you should seek additional resources as early as possible during the visual survey. When you are the only provider present, the ratio of compressions to ventilations for a child or infant is the same as for an adult, that is, 30 compressions to 2 ventilations (30:2). Remember for single-provider infant CPR, use the two-finger technique to provide compressions.

When multiple providers are available, the first provider performs the rapid assessment and begins providing CPR, starting with chest compressions. Meanwhile, another provider calls for additional resources and gets and prepares the AED, if available. The first provider continues to provide high-quality CPR with 30 compressions to 2 ventilations until another provider is ready to assist or the AED is ready to analyze. When two providers are performing CPR for children and infants, the ratio changes to 15 compressions to 2 ventilations (15:2). If an advanced airway is in place, the compression-to-ventilation ratio of 15:2 does not apply because compressions and ventilations are delivered continuously with no interruptions. Remember for multiple-provider infant CPR, use the encircling thumbs technique to provide compressions.

> For single providers, the compression-to-ventilation ratio is 30:2. For multiple providers, the ratio changes to 15:2.

As with adults, it is the responsibility of the team leader to orchestrate movements between providers to ensure no one provider becomes fatigued and that all critical areas are addressed when caring for children and infants. For example, additional providers may assimilate into roles of compressor or airway manager/ventilator to ensure that high-quality CPR is maintained. (Figure 4-12)

Figure 4-12 | High-performance resuscitation teams work together in a well-organized effort to provide high-quality CPR for children and infants.

SKILL SHEET

Rapid Assessment for Children and Infants

Step 1 Perform a visual survey

- Make sure the environment is safe—for you, your team and any individuals present during the emergency.
- Gather an initial impression of the child or infant, which includes looking for severe, life-threatening bleeding.
- Quickly determine the need for additional resources.

⚠ Alert

If you see severe life-threatening bleeding, immediately use any available resources to control the hemorrhage, including a tourniquet or hemostatic dressing if one is available.

Step 2 Check for responsiveness

- Shout, "Are you OK?" Use the child's or infant's name if you know it.
- Tap the *child's shoulder* or the *bottom of the infant's foot* and shout again (shout-tap-shout).
- If the child or infant is unresponsive and you are alone, call for help to activate EMS, the rapid response team or the resuscitation team, as appropriate, and call for an AED.
- If the child or infant is unresponsive and you are with another provider, the first provider stays with the child or infant. Other providers activate EMS, the rapid response team or the resuscitation team, as appropriate, and retrieve the AED, BVM and other emergency equipment.

SKILL SHEET

Rapid Assessment for Children and Infants *(continued)*

Step 3 Simultaneously check for breathing and pulse

- Make sure the child or infant is in a supine (face-up) position. If they are face-down, you must roll them onto their back, taking care not to create or worsen a suspected injury.
- Open the airway to a *slightly past-neutral* position for a child or to a *neutral* position for an infant using the head-tilt/chin-lift technique; or, use the modified jaw-thrust maneuver if you suspect a head, neck or spinal injury.
- Simultaneously check for breathing and a *carotid* pulse for a child or a *brachial* pulse for an infant for at least 5 seconds but no more than 10.

Step 4 Provide care based on the conditions found

- Obtain consent from a parent or legal guardian, if present.

SKILL SHEET

CPR for Children

Step 1 Conduct a rapid assessment

- Perform a quick visual survey, check for responsiveness, open the airway, and simultaneously check for breathing and a carotid pulse for at least 5 seconds but no more than 10.
- If the child is unresponsive, isn't breathing normally and doesn't have a pulse, begin CPR.

Step 2 Place the child on a firm, flat surface

- In a healthcare setting, use a bed with a CPR feature, or place a CPR board under the child.
- Adjust the bed to an appropriate working height or use a step stool. Lower the bed side rail closest to you.
- In other settings, move the child to the floor or ground and kneel beside them.

Practice Note

If drowning or another hypoxic event is the suspected cause of cardiac arrest, deliver 2 initial ventilations before starting CPR.

Step 3 Position your hands correctly

- Expose the child's chest to ensure proper hand placement and visualize chest recoil.
- Place the heel of one hand in the center of the child's chest on the lower half of the sternum.
- Place your other hand on top of the first and interlace your fingers or hold them up so that they are not resting on the child's chest.
- Alternatively, for a small child, you may only need to use one hand, instead of two. Place the heel of one hand in the center of the child's chest.

SKILL SHEET

CPR for Children *(continued)*

Step 4 Position your body effectively

- Position yourself so your shoulders are directly over your hands. This position lets you compress the chest using a straight up-and-down motion.
- To help keep your arms straight, lock your elbows.

Step 5 Perform chest compressions

- For a child, compress the chest to a depth of about 2 inches (5 cm).
- Provide smooth compressions at a rate of at least 100 to 120 per minute.
- Allow the chest to fully recoil after each compression. Avoid leaning on the patient's chest at the top of the compression.
- If you are a single provider, perform 30 chest compressions.
- If you are working with a team of providers, perform 15 chest compressions for a child.

Step 6 Seal the mask and open the airway

- Use an appropriately sized pocket mask for single-provider CPR or a BVM for multiple-provider CPR.
- Seal the mask and simultaneously open the airway to a slightly past-neutral position using the head-tilt/chin-lift technique. Avoid any hyperextension of flexion of the neck.
- Or, use the modified jaw-thrust technique if you suspect head, neck or spinal injury.

SKILL SHEET

CPR for Children *(continued)*

Step 7 Provide 2 ventilations

- While maintaining the mask seal and open airway, provide smooth, effortless ventilations. Each ventilation should last about 1 second and make the chest begin to rise. Avoid excessive ventilation.
- If you do not have a pocket mask or BVM, provide mouth-to-mouth or mouth-to-nose ventilations.

Practice Note

If an advanced airway is in place, one provider delivers 1 ventilation every 6 to 8 seconds. At the same time, a second provider performs compressions at a rate of 100 to 120 per minute. In this case, the compression-to-ventilation ratio of 15:2 for multiple-provider CPR does not apply because compressions and ventilations are delivered continuously with no interruptions.

Step 8 Switch positions every 2 minutes

- When providing CPR with multiple providers, smoothly switch positions about every 2 minutes. This should take less than 10 seconds.
- The compressor calls for a position change by saying "switch" in place of the number 1 in the compression cycle.

SKILL SHEET

CPR for Children *(continued)*

Step 9 Continue CPR

Continue providing CPR until:

- You see signs of ROSC, such as patient movement or normal breathing.
- Other trained providers take over and relieve you from compression or ventilation responsibilities.
- You are presented with a valid do not resuscitate (DNR) order.
- You are alone and too exhausted to continue.
- The situation becomes unsafe.

Practice Note

Upon achieving ROSC, supplemental oxygen should be used based on your facility's protocols to maintain a normal oxygen saturation level while avoiding hyperoxygenation. Providers should use a pulse oximeter to monitor oxygen saturation.

SKILL SHEET

CPR for Infants

Step 1 Conduct a rapid assessment

- Perform a quick visual survey, check for responsiveness, open the airway, and simultaneously check for breathing and a brachial pulse for at least 5 seconds but no more than 10.
- If the infant is unresponsive, isn't breathing normally and doesn't have a pulse, begin CPR.

Step 2 Place the infant on a firm, flat surface

- In a healthcare setting, use a crib with a CPR feature, or place a CPR board under the infant.
- Adjust the crib to an appropriate working height or use a step stool. Lower the crib side rail closest to you.
- In other settings, move the infant to a stable surface above the ground, such as a table or countertop.

Practice Note

If drowning or another hypoxic event is the suspected cause of cardiac arrest, deliver 2 initial ventilations before starting CPR.

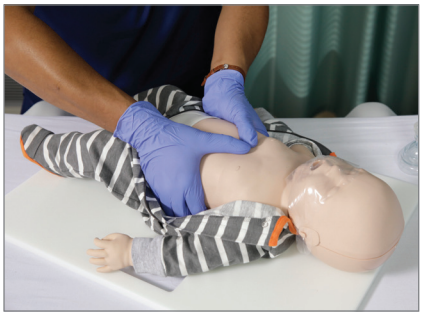
Step 3 Position your hands correctly

- Expose the infant's chest to ensure proper hand placement and visualize chest recoil.
- **If you are a single provider, use the two-finger technique:**
  - Stand to the side of the infant.
  - Place the two fingers of your hand closest to the infant's feet in the center of the exposed chest just below the nipple line on the sternum.
  - Use your index and middle fingers or your middle and fourth fingers to provide compressions. Fingers that are more similar in length tend to make compressions easier to deliver.

SKILL SHEET

CPR for Infants *(continued)*

- **If you are working with a team of multiple providers, use the encircling thumbs technique:**
  - Stand at the infant's feet.
  - Place both thumbs (side-by-side) on the center of the infant's chest just below the nipple line.
  - Then use the other fingers to encircle the infant's chest toward the back, providing support.



Step 4 Perform chest compressions

- For an infant, compress the chest to a depth of about 1½ inches (3.8 cm) or one-third the anterior-posterior diameter of the chest.
- Provide smooth compressions at a rate of at least 100 per minute but not more than 120 per minute.
- Allow the chest to fully recoil after each compression. Avoid leaning on the infant's chest at the top of the compression.
- If you are a single provider, perform 30 chest compressions. If you are working with a team of providers, perform 15 chest compressions for an infant.

Step 5 Seal the mask and open the airway

- Use an infant pocket mask for single-provider CPR or a BVM for multiple-provider CPR.
- Seal the mask and simultaneously open the airway to a neutral position using the head-tilt/chin-lift technique. Avoid any hyperextension of flexion of the neck.
- Or, use the modified jaw-thrust technique if you suspect head, neck or spinal injury.

Step 6 Provide 2 ventilations

- While maintaining the mask seal and open airway, provide smooth, effortless ventilations. Each ventilation should last about 1 second and make the chest begin to rise. Avoid excessive ventilation.
- If you do not have a pocket mask or BVM, provide mouth-to-mouth or mouth-to-nose ventilations.

SKILL SHEET

CPR for Infants *(continued)*

Practice Note

If an advanced airway is in place, one provider delivers 1 ventilation every 6 to 8 seconds. At the same time, a second provider performs compressions at a rate of 100 to 120 per minute. In this case, the compression-to-ventilation ratio of 15:2 for multiple-provider CPR does not apply because compressions and ventilations are delivered continuously with no interruptions.

Step 7 Switch positions every 2 minutes

- When providing CPR with multiple providers, smoothly switch positions about every 2 minutes. This should take less than 10 seconds.
- The compressor calls for a position change by saying "switch" in place of the number 1 in the compression cycle.
- Remember, during multiple-provider CPR, the compressor will stand at the infant's feet, the ventilator will stand at the infant's side, and the provider maintaining the airway will stand at the infant's head.

Step 8 Continue CPR

Continue providing CPR until:

- You see signs of ROSC, such as patient movement or normal breathing.
- Other trained providers take over and relieve you from compression or ventilation responsibilities.
- You are presented with a valid do not resuscitate (DNR) order.
- You are alone and too exhausted to continue.
- The situation becomes unsafe.

Practice Note

Upon achieving ROSC, supplemental oxygen should be used based on your facility's protocols to maintain a normal oxygen saturation level while avoiding hyperoxygenation. Providers should use a pulse oximeter to monitor oxygen saturation.

SKILL SHEET

AED Use for Children and Infants

Step 1 Turn on the AED and follow the prompts

- Because AED models function differently, follow your facility's protocols and the manufacturer's instructions for the AED you have.

Step 2 Expose the chest

- Expose the chest and wipe it dry, if necessary.

Step 3 Attach the pads

- **For infants up to 1 year old:**
  - Use pediatric pads if available. If pediatric pads *aren't* available—or the AED doesn't have a pediatric setting—it's safe to use adult AED pads or adult levels of energy.
  - Always use an anterior/posterior pad placement. To do this, apply one pad to the center of the infant's chest—on the sternum—and one pad to the infant's back between the scapulae.

- **For children 8 or younger or weighing 55 pounds (25 kg) or less:**
  - Use pediatric pads if available. If pediatric pads *aren't* available—or the AED doesn't have a pediatric setting—it's safe to use adult AED pads or adult levels of energy.
  - Use an anterior/lateral placement, according to the manufacturer instructions: Place one pad to the right of the sternum and below the right clavicle. Place the other on the left side of the chest on the mid-axillary line, a few inches below the left armpit.
  - Or, use an anterior/posterior pad placement, if the AED pads risk touching each other on the child's chest or the manufacturer recommends.

SKILL SHEET

AED Use for Children and Infants *(continued)*

- **For children older than 8 years or weighing more than 55 pounds (25 kg):**
  - Use adult AED pads.
  - Use an anterior/lateral or anterior/posterior placement, according to manufacturer instructions.

Alert

Never use pediatric AED pads or a pediatric electrical setting on a child older than 8 years or weighing more than 55 pounds (25 kg). That's because the shock delivered will not be sufficient. In these cases, always use adult AED pads and energy levels.

Practice Note

Some AEDs come with pediatric AED pads. These are smaller and designed specifically to deliver a lower level of energy. Also, some AEDs use a switch or key on the device itself instead of changing pads.

Step 4 Prepare to let the AED analyze the heart's rhythm

- If necessary, plug in the connector and push the analyze button.
- Instruct everyone to stand clear while the AED analyzes. No one, including you, should be touching the patient.
- As the AED analyzes, switch positions if you are working with a team. The provider giving compressions should hover their hands above the patient's chest.

SKILL SHEET

AED Use for Children and Infants *(continued)*

Step 5 Deliver a shock, if the AED determines one is needed

- If the AED advises a shock, again instruct everyone to stand clear. The compressor continues to hover their hands over the patient's chest in preparation for CPR.
- Press the shock button to deliver the shock.

Step 6 After the AED delivers the shock, or if no shock is needed

- Immediately begin CPR. You do not need to wait for the AED prompt.
- Continue for about 2 minutes until:
  - The AED prompts that it is reanalyzing.
  - The patient shows signs of return of spontaneous circulation.
  - The team leader or other trained providers instruct you to stop.
- If you are working with a team, rotate roles during the analysis to prevent fatigue as needed.

CHAPTER 5

Obstructed Airway

Introduction

Airway obstructions are a common emergency. You need to assess the situation and recognize that a patient who cannot cough, speak, cry or breathe requires immediate care. If the patient does not receive quick and effective care, an **airway obstruction** can lead to respiratory arrest, which in turn can lead to cardiac arrest.

Obstructed Airway Care for Adults and Children

Caring for a Responsive Adult or Child

A patient who is choking typically has a panicked, confused or surprised facial expression. They may run about, flail their arms or try to get another's attention. The patient may place one or both hands on their throat. This act of clutching the throat is commonly referred to as the universal sign of choking (Figure 5-1).

You may hear stridor as the patient tries to breathe, or nothing at all. **Stridor** is a high-pitched squeaking noise during inspiration. It is caused by narrowing or obstruction of the upper airway. Stridor is not exclusive to choking and may be a sign of another respiratory disorder (e.g., anaphylaxis, croup).

The patient's skin may initially appear flushed, but it will become pale or cyanotic as the body is deprived of oxygen.

> If the patient cannot breathe or has a weak or ineffective cough, perform abdominal thrusts or alternate techniques to clear an airway obstruction.

Figure 5-1 | Clutching the throat with one or both hands is commonly referred to as the universal sign of choking.

Encourage the adult or child who is coughing forcefully to continue coughing until they are able to breathe normally. If the patient cannot breathe or has a weak or ineffective cough, summon additional resources and obtain consent. For a child, obtain consent from the parent or guardian. If the parent or guardian is not available, consent is implied. Then, perform abdominal thrusts or alternate techniques to clear the obstruction.

Abdominal Thrusts

To perform **abdominal thrusts**:

- First, stand behind the patient with one foot in front of the other for balance and stability. If possible, place your front foot between the patient's feet (Figure 5-2, A). If the patient is in a wheelchair or is a young child, you may need to kneel behind them.

Figure 5-2 | (A) Stand behind the patient, with one foot in front of the other and if possible, between the patient's feet. (B) Place the thumb side of your fist against the middle of the abdomen, just above the navel, and grab the fist with your other hand.

- Wrap your arms around the patient's waist. Use one or two fingers to find the navel.
- Make a fist with one hand and place the thumb side of your fist against the middle of the abdomen, just above the navel.
- Grab your fist with your other hand and give quick inward and upward thrusts (Figure 5-2, B).
- Make sure each thrust is a distinct attempt to dislodge the object.
- Continue delivering abdominal thrusts until the object is forced out and the patient can cough, speak or breathe, or until the patient becomes unresponsive.

Alternate Techniques

Evidence suggests that it may take more than one technique to relieve an airway obstruction. For example, you might not be able to reach far enough around the patient or they might be pregnant, in bed or in a wheelchair with features that make abdominal thrusts difficult to do. Or, abdominal thrusts just might not be effective.

If this is the case, use back blows, chest thrusts or airway management techniques to dislodge the object from the airway. Remember, follow your facility's protocols when implementing alternate techniques.

Back Blows

In some instances, **back blows** may be needed to relieve the obstruction.

To use this option:

- Position yourself to the side and slightly behind the patient. For a patient in a wheelchair or a young child, you may need to kneel.
- Provide support by placing one arm diagonally across the patient's chest.
- Then bend the patient forward at the waist so that the patient's upper body is parallel to the ground or as close as it can be.

> Alternate techniques include back blows, chest thrusts or airway management techniques. Evidence suggests that it may take more than one technique to relieve an airway obstruction.

Figure 5-3 | For effective back blows, bend the patient forward at the waist so that the patient's upper body is parallel to the ground. Give 5 firm back blows between the patient's scapulae.

- Using the heel of your other hand, give firm back blows between the patient's scapulae (Figure 5-3).
- Make each blow a separate and distinct attempt to dislodge the object.

Practice Note

If back blows alone do not dislodge the object, use a series of 5 back blows and 5 abdominal (or chest) thrusts. Always follow your facility's protocols.

Chest Thrusts

To perform **chest thrusts**:

- Position yourself behind the patient as you would for abdominal thrusts. If the patient is a young child or is in a wheelchair, you may need to kneel.
- Place the thumb side of your fist against the center of the patient's chest on the lower half of the sternum.
- Then cover your fist with your other hand and pull straight back, providing a quick inward thrust into the patient's chest (Figure 5-4).
- Make sure each thrust is a distinct attempt to dislodge the object.

Airway Management Techniques

If you are in a healthcare facility and abdominal thrusts are not effective or possible, use a combination of basic or advanced airway management techniques based on your level of training and experience.

Figure 5-4 | For effective chest thrusts, pull straight back, providing a quick inward thrust into the patient's chest.

Caring for an Unresponsive Adult or Child

If a choking patient becomes unresponsive:

- Carefully lower them to a firm, flat surface, while protecting their head.
- Then, send someone to get an AED and additional resources (if appropriate and you have not already done so).
- Immediately begin CPR, starting with chest compressions. Compressions may help clear the airway by moving the blockage into the upper airway and the **oropharynx**, where it can be seen and removed.
- After each set of chest compressions, open the patient's mouth and look for the object before attempting ventilations.
- If you see the object in the patient's mouth, remove it using a **finger sweep** (Figure 5-5). If you do not see the object, do not perform a blind finger sweep.
- Next, attempt 2 ventilations. Never try more than 2 ventilations during one cycle of CPR, even if the chest does not rise.
- Continue CPR, checking for an object before each set of ventilations.

Figure 5-5 | After each set of compressions and before ventilations look for the object. Use a finger sweep to remove it, if seen.

Obstructed Airway Care for Infants

Caring for a Responsive Infant

If the infant is crying or coughing forcefully, allow the infant to keep coughing but be prepared to clear the infant's airway if the infant's condition changes.

If the infant is unable to cry or is coughing weakly, call for additional resources and to obtain an AED. Obtain consent from the parent or guardian. If the parent or guardian is not available, consent is implied.

Then, perform a series of 5 back blows and 5 chest thrusts.

Back Blows

To deliver back blows:

- Place your forearm along the infant's back, cradling the back of the infant's head with your hand.
- Place your other forearm along the infant's front, supporting the infant's jaw with your thumb and fingers.
- Hold the infant in a face-down position along your forearm using your thigh for support and keeping the infant's head lower than their body (Figure 5-6).

> If back blows do not dislodge the object in a responsive infant with an obstructed airway, try chest thrusts.

Figure 5-6 | For obstructive airway care, hold the infant in a face-down position along your forearm, using your thigh for support. Keep the infant's head lower than their body.

Figure 5-7 | Give 5 quick chest thrusts, about 1½ inches deep. Each should be separate from the others.

- Use the heel of your hand to deliver a back blow between the infant's scapulae. Keep your fingers up to avoid hitting the infant's head or neck.
- Provide 5 firm back blows, with each one separate from the others.

Chest Thrusts

If back blows do not dislodge the object, try chest thrusts:

- Position the infant between your forearms, support the head and neck, and turn the infant face-up. Then lower the infant onto your thigh with their head lower than their chest.
- Place two fingers in the center of the infant's chest, just below the nipple line.
- Then give 5 quick chest thrusts about 1½ inches deep. Let the chest return to its normal position, keeping your fingers in contact with the breastbone. Each chest thrust should be separate from the others (Figure 5-7).
- Continue to provide sets of 5 back blows and 5 chest thrusts until the object is forced out and the infant can cough, cry or breathe, or, until the infant becomes unresponsive.

Caring for an Unresponsive Infant

If an infant becomes unresponsive while choking, provide care as you would for an unresponsive adult or child who is choking. However, use your pinky to remove an object, if you can see it (Figure 5-8).

Figure 5-8 | For an infant, use your pinky to remove an object, if seen.

SKILL SHEET

Obstructed Airway Care for Adults and Children

Step 1 Verify the patient is choking

- If the patient is able to speak to you or is coughing forcefully: Encourage the patient to keep coughing but be prepared to clear the airway if the patient's condition changes.
- If the patient is unable to speak to you or is coughing weakly: Call for additional resources. Continue to Step 2.

Step 2 Obtain consent

- **For the adult**: Obtain consent from the patient.
- **For the child**: Obtain consent from the parent or legal guardian if present. If they're not available, consent is implied.

Step 3A Perform abdominal thrusts

- First, stand behind the patient, with one foot in front of the other for balance and stability. If possible, place your front foot in between the patient's feet.
- If the patient is a young child or is in a wheelchair, you may need to kneel.
- Then, get your hands in place. Using one or two fingers to find the patient's navel, make a fist with your other hand and place the thumb side of your fist against the middle of the abdomen, just above the navel.
- Grab your fist with your other hand.
- Give quick inward and upward thrusts.
- Be sure to make each thrust a distinct attempt to dislodge the object.
- If abdominal thrusts do not dislodge the object, continue to Step 4.

SKILL SHEET

Obstructed Airway Care for Adults and Children *(continued)*

Step 3B Perform alternate techniques

Perform alternate techniques—back blows, chest thrusts or airway management techniques if:

- You cannot reach far enough around the patient.
- They might be pregnant.
- They are in a bed or in a wheelchair with features that make abdominal thrusts difficult to do.
- Abdominal thrusts are not effective in dislodging the object.

Note: Remember to always follow your facility's protocol when implementing alternate techniques.

Back Blows

- Position yourself to the side and slightly behind the patient.
- Provide support by placing one arm diagonally across the patient's chest.
- Then bend the patient forward at the waist so the upper body is parallel to the ground or as close as it can be.
- Using the heel of your other hand, give firm back blows between the patient's scapulae. Make each blow a separate and distinct attempt to dislodge the object.
- If back blows do not dislodge the object, use a series of 5 back blows and 5 abdominal or chest thrusts.

Chest Thrusts

- Position yourself behind the patient as you would for abdominal thrusts. If the patient is a young child or is in a wheelchair, you may need to kneel.
- Place the thumb side of your fist against the center of the patient's chest on the lower half of the sternum.
- Then cover your fist with your other hand and pull straight back, providing a quick inward thrust into the patient's chest.
- If chest thrusts do not dislodge the object, use a series of 5 back blows and 5 chest thrusts.

SKILL SHEET

Obstructed Airway Care for Adults and Children *(continued)*

Airway Management Techniques

- If you are in a healthcare facility and abdominal thrusts, back blows or chest thrusts are not effective or practical, use a combination of basic or advanced airway management techniques based on your level of training and experience.

Step 4 Continue to clear the airway

Continue to clear the airway until:

- The object is forced out.
- The patient can cough forcefully, speak, cry or breathe.
- The patient becomes unresponsive.

Practice Note

If the patient becomes unresponsive, carefully lower them to a firm, flat surface, while protecting their head. Then, call for additional resources and to get an AED (if appropriate and you have not already done so). Immediately begin CPR, starting with chest compressions. After each set of compressions and before ventilations, open the patient's mouth and look for the object—if seen, remove it using a finger sweep. Do not perform a blind finger sweep. Next attempt 2 ventilations. Never try more than 2 ventilations during one cycle of CPR, even if the chest does not rise. Continue performing cycles of 30 compressions and 2 ventilations, checking for an object before each set of ventilations.

SKILL SHEET

Obstructed Airway Care for Infants

Step 1 Verify that the infant is choking

- If the infant is crying or coughing forcefully: Allow the infant to keep coughing but be prepared to clear the infant's airway if the infant's condition changes.
- If the infant is unable to cry or is coughing weakly: Call for additional resources. Continue to Step 2.

Step 2 Obtain consent

- Obtain consent from the parent or legal guardian if present. If they're not available, consent is implied.

Step 3 Position the infant for back blows

- Place your forearm along the infant's back, cradling the back of the infant's head with your hand.
- Place your other forearm along the infant's front, supporting the infant's jaw with your thumb and fingers.
- Hold the infant in a face-down position along your forearm using your thigh for support and keeping the infant's head lower than their body.

Step 4 Deliver 5 back blows

- Use the heel of your hand to deliver back blows between the infant's scapulae. Keep your fingers up to avoid hitting the infant's head or neck.
- Provide 5 firm back blows, with each one separate from the others.

SKILL SHEET

Obstructed Airway Care for Infants
(continued)

Step 5 Deliver 5 chest thrusts

If back blows don't dislodge the object, perform chest thrusts:

- Position the infant between your forearms, support the head and neck, and turn the infant face-up.
- Then lower the infant onto your thigh with their head lower than their chest.
- Now, place two fingers in the center of the infant's chest, just below the nipple line.
- Next deliver 5 quick chest thrusts about 1½ inches deep. Let the chest return to its normal position, keeping your fingers in contact with the breastbone. Each chest thrust should be separate from the others.

Step 6 Continue to clear the airway

Continue to provide sets of 5 back blows and 5 chest thrusts until:

- The object is forced out.
- The infant can cough, cry or breathe.
- The infant becomes unresponsive.

Practice Note

If the infant becomes unresponsive, carefully position them on a firm, flat surface while protecting their head. Then, call for additional resources and to get an AED (if appropriate and you have not already done so). Immediately begin CPR, starting with chest compressions. After each set of compressions and before ventilations, open the infant's mouth and look for the object—if seen, remove it using a finger sweep. Do not perform a blind finger sweep. Next attempt 2 ventilations. Never try more than 2 ventilations during one cycle of CPR, even if the chest does not rise. Continue performing cycles of compressions and ventilations (using a ratio of 30:2 if a single provider and 15:2 if working with a team), checking for an object before each set of ventilations.

CHAPTER 6

Opioid Overdose

Introduction

As the number of opioid overdose-associated deaths continues to rise in the United States, it is more important than ever that healthcare providers quickly assess and recognize a potential opioid overdose and provide immediate care. Opioid overdose-associated fatalities can be prevented if you provide basic life support care and immediately administer naloxone when opioid overdose is suspected.

The Opioid Crisis

As a healthcare provider, you must be prepared to respond to opioid-associated life-threatening emergencies. The opioid crisis in the United States was officially declared a public health emergency in 2017. In 2016, more than 42,000 people in the United States died from opioid overdose, and more than three in five drug overdose-related deaths involved an opioid. Figure 6-1 depicts opioid overdose rates by type between 2000 and 2016.

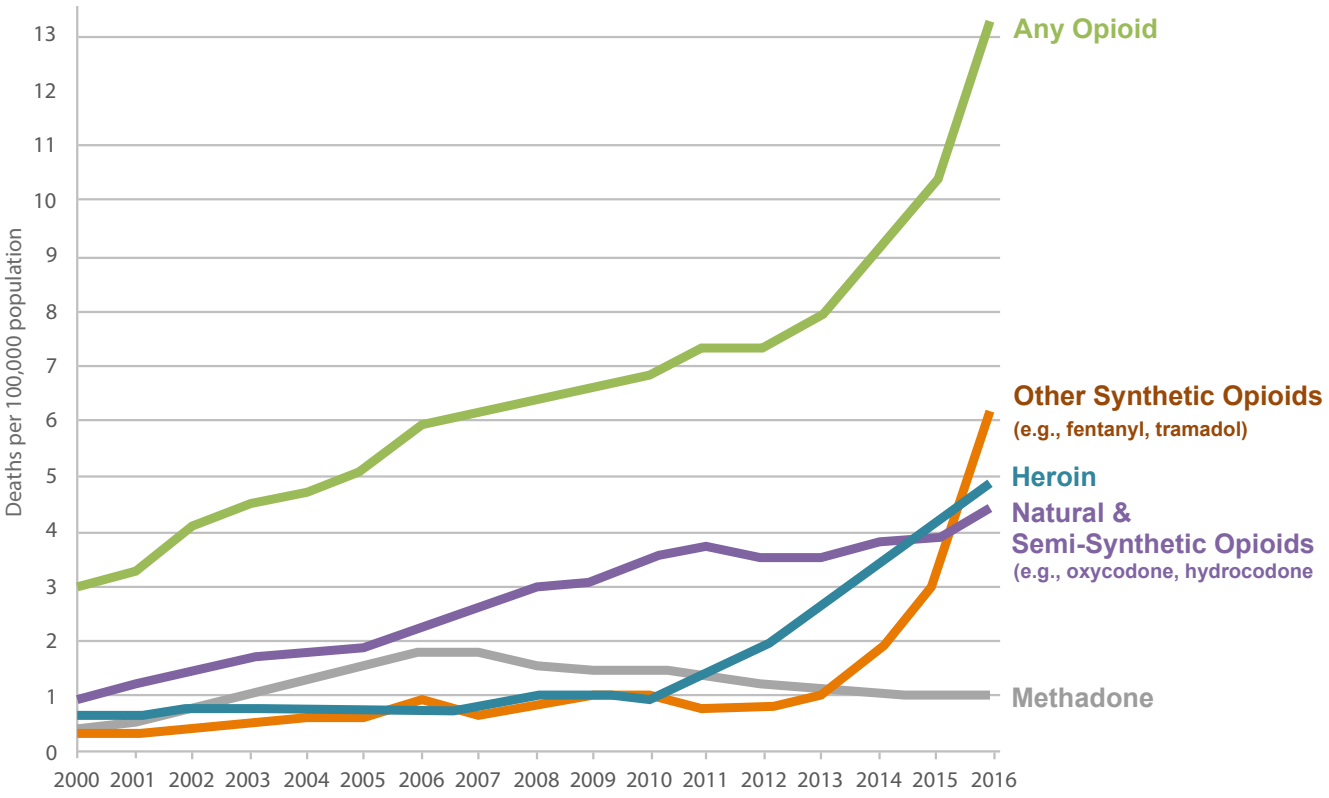
The rate of opioid-related emergency department visits almost doubled between 2005 and 2014.

> The opioid crisis in the United States was officially declared a public health emergency in 2017.

Assess for Opioid Overdose

- To quickly assess for an opioid overdose, use the **opioid overdose triad**:
  - Pinpoint pupils (Figure 6-2, A)
  - Respiratory depression
  - Unconsciousness or severe sleepiness
- Other indicators of opioid overdose include:
  - Cyanosis.
  - Track marks from intravenous drug use (Figure 6-2, B).
  - Prescription pill bottles, pipes, needles, syringes, pill powder or other drug-related items.
  - History of opioid drug abuse.

When assessing a patient with suspected or known opioid overdose, consider the use of more objective assessments to assess breathing, such as capnography. A normal $ETCO_2$ value rules out respiratory depression.



SOURCE: CDC/NCHS, National Vital Statistics System, Mortality. CDC WONDER, Atlanta, GA: US Department of Health and Human Services, CDC; 2017. https://wonder.cdc.gov/.

Figure 6-1 | The United States has seen a dramatic increase in opioid-related deaths in recent years.

Figure 6-2 | (A) Signs of opioid overdose may include pinpoint pupils. (B) Track marks also may be an indicator of opioid use.

Recognize the Problem and Provide Care

If the patient is unresponsive and experiencing a suspected or known opioid overdose, activate EMS, the rapid response team or the resuscitation team, as appropriate, and call for an AED and naloxone. Then, provide care for the condition found and administer naloxone as soon as it is available based on your facility's protocols and available resources.

ALERT

Ensure personal safety during assessment and care. Avoid white powder or other potential hazards (e.g., needles) near or on the patient and use **personal protective equipment (PPE)** according to your facility's protocols.

Respiratory Arrest

If the patient is in respiratory arrest, deliver 1 ventilation every 5 to 6 seconds for an adult and every 3 to 5 seconds for children and infants. Each ventilation should last about 1 second and make the chest begin to rise. Then, if your facility protocol allows, administer naloxone as soon as it is available.

Check the pulse and breathing about every 2 minutes. If you find no pulse, begin CPR or use an AED if one is available and ready to use. Remember, providing ventilations is the priority over administering naloxone during respiratory arrest.

> Use the opioid overdose triad to quickly assess the patient for signs and symptoms of opioid overdose.

Cardiac Arrest

Begin CPR within 10 seconds of recognizing the patient is in cardiac arrest. As soon as available, use the AED and, if your facility protocol allows, administer naloxone.

If you are alone and do not have a mobile device or other form of communication, perform CPR for about 2 minutes before leaving to call for additional resources.

Remember, providing high-quality CPR is the priority over administering naloxone during cardiac arrest.

Administering Naloxone

Trained providers should administer naloxone (also referred to by its trade name, Narcan™) when the patient is in respiratory or cardiac arrest and an opioid overdose is suspected. Administer naloxone as soon as it is available; however, remember, chest compressions, ventilations and/or defibrillation are the priority over naloxone administration.

Although naloxone is typically administered intravenously in the hospital setting, it can be administered intranasally (Figure 6-3) or intramuscularly. The adult dose is 2 mg

intranasal or 0.4 mg intramuscular. You may repeat after 4 minutes. Follow facility protocols to determine dosing and timing of naloxone administration.

Naloxone is usually safe to administer if the person is not breathing and you cannot identify the drug overdosed. It has few adverse effects, and it can temporarily reverse the effects of opioid overdose. Although no evidence supports any benefit to naloxone administration during cardiac arrest, administration of naloxone is recommended during both respiratory and cardiac arrest.

> Provide care as you would with any respiratory or cardiac arrest emergency, but call for and administer naloxone based on your facility's protocols and available resources.

When the Patient Responds

If the patient begins to breathe normally, check responsiveness and assess for breathing and a pulse (Figure 6-4). Then place the patient in a recovery position, providing you do not suspect a head, neck, spinal, hip or pelvic injury. Monitor the patient until EMS, the rapid response team or the resuscitation team arrives. If the patient stops responding, begin ventilations or CPR as appropriate and repeat naloxone.

Figure 6-3 | Intranasal administration of naloxone

Figure 6-4 | When the patient responds, assess for breathing and a pulse.

ALERT

Patients who respond after receiving naloxone frequently vomit and may even become violent. Be prepared to suction the airway or call for help to provide suction, but always keep your safety in mind.

Appendices

APPENDIX A

Common Legal Considerations

Duty to Act	The duty to respond to an emergency and provide care. Failure to fulfill these duties could result in legal action.
Scope of Practice	The range of duties and skills you have acquired in training that you are authorized to perform by your certification to practice.
Standard of Care	The public's expectation that personnel summoned to an emergency will provide care with a certain level of knowledge and skill.
Negligence	Failure to follow a reasonable standard of care, thereby causing or contributing to injury or damage.
Refusal of Care	A competent patient's refusal of care from a healthcare provider. Refusal of care must be honored, even if the patient is seriously injured or ill or desperately needs assistance. A patient can refuse some or all care. If a witness is available, have the witness listen to any refusal of care, and document it in writing.
Advance Directives	Written instructions that describe a patient's wishes (or the wishes of the parent or legal guardian) regarding medical treatment or healthcare decisions. Guidance for advance directives, including any required identification and verification process, is documented in state, regional or local laws, statutes and/or protocols, and must be followed. Advance directives include: ■ Do Not Resuscitate (DNR) orders, also called Do Not Attempt Resuscitation (DNAR) orders. ■ Physician Orders for Life-Sustaining Treatment (POLST).
Battery	The unlawful, harmful or offensive touching of a patient without the patient's consent.
Abandonment	Discontinuing care once it has begun. You must continue care until someone with equal or more advanced training takes over.
Confidentiality	While providing care to a patient, you may learn details about the patient that are private and confidential. Do not share this information with anyone except personnel directly associated with the patient's medical care.

Consent	To obtain consent from a patient or legal guardian, follow these steps: ■ Identify yourself to the patient or legal guardian. ■ State your level of training. ■ Explain what you observe. ■ Explain what you plan to do. ■ Ask for permission from the patient or legal guardian to provide care. If an adult patient is unresponsive, has an altered mental status, is mentally impaired or is unable to give consent verbally or through a gesture, then consent is implied. For most infants and children up to the age of 17 years, you must obtain consent to provide care from the child's parent or legal guardian if they are present regardless of the child's level of consciousness. If a parent or legal guardian is not present, consent is implied in life-threatening emergencies. Always follow your local laws and regulations as they relate to the care of minors.

APPENDIX B

Standard Precautions

Always follow standard precautions when performing a rapid assessment. Standard precautions are safety measures to prevent disease transmission based on the assumption that all body fluids may be infectious.

Applying Standard Precautions

You must wear appropriate personal protective equipment (PPE) and follow standard precautions for the particular situation.

Always make sure to review your facility's protocols for standard precautions.

Additionally, maintain good health habits (such as maintaining currency with all required and suggested immunizations, getting adequate sleep and exercise, and following a healthy diet) to lower your susceptibility to infection and prevent the spread of infection to others.

Standard precautions include the use of:

- **Personal protective equipment (PPE):** Specialized clothing, equipment and supplies that prevent direct contact with potentially infectious materials. PPE includes gloves, CPR breathing barriers, gowns, face shields, protective eyewear and biohazard bags.
- **Hand hygiene:** Hand washing is the most effective measure to prevent the spread of infection. Alcohol-based hand sanitizers allow you to clean your hands when soap and water are not readily available and your hands are not visibly soiled.
- **Engineering controls:** Objects used in the workplace that isolate or remove a hazard, reducing the risk of exposure.
- **Work practice controls:** Methods of working that reduce the likelihood of an exposure incident by changing the way a task is carried out.
- **Proper equipment cleaning:** After providing care, the equipment and surfaces used should always be cleaned and disinfected or properly disposed.
- **Proper spill cleanup procedures:** If a spill occurs, appropriate measures should be taken to limit and reduce exposure to possible contaminants.

Your Role During an Exposure Incident

Even with the best use of standard precautions, exposures do occur. When an exposure incident occurs, follow these steps as well as any steps outlined by your healthcare facility:

- Wash needlestick injuries, cuts and exposed skin.
- If blood or other body fluids are splashed around the mouth or nose, flush the area with water.
- If eyes are involved, irrigate with clean water, saline or sterile irrigant solution for 20 minutes.
- Clean the contaminated area thoroughly with soap and water.

Your Role After an Exposure Incident

After the exposure incident has occurred, it is important to:

- Report the incident immediately to the appropriate person identified in your facility's infection/exposure control plan.
- Write down what happened, including the time, date and circumstances, actions taken and any other information required by your employer.
- Seek immediate follow-up care according to your facility's infection/exposure control plan.

APPENDIX C

Basic Life Support Sequences

BLS for Adults

BLS for Children and Infants

BASIC LIFE SUPPORT SEQUENCE

BLS for Adults

When responding to a cardiac emergency, you must complete a rapid assessment, recognize the problem and provide quality care.

Assess

Conduct a Rapid Assessment

Perform visual survey

- Check your surroundings for safety.
- Gather an initial impression, including whether there is severe, life-threatening bleeding.
- Determine the need for additional resources.

> **Practice Note**
>
> The sequence of these steps is not critical if all goals are accomplished. Depending on the setting, additional resources may include emergency medical services (EMS), the rapid response team or the resuscitation team. Follow standard precautions, including using personal protective equipment (PPE), and obtain consent before proceeding if appropriate.

Check for responsiveness

- Shout, "Are you OK?" Use the patient's name if you know it.
- Tap the patient's shoulder and shout again (shout-tap-shout).
- If the patient is unresponsive and you are alone, call for help to activate EMS, the rapid response team or the resuscitation team, as appropriate, and call for an AED.
- If the patient is unresponsive and you are with another provider, the first provider stays with the patient. Other providers activate EMS, the rapid response team or the resuscitation team, as appropriate, and retrieve the AED, bag-valve-mask (BVM) resuscitator and other emergency equipment.

Simultaneously check for breathing and pulse

- Open the patient's airway to a past-neutral position, using the head-tilt/chin-lift technique; or, use the modified jaw-thrust maneuver if you a suspect head, neck or spinal injury.
- Simultaneously check for breathing and a carotid pulse for at least 5 seconds but no more than 10.

BASIC LIFE SUPPORT SEQUENCE

BLS for Adults *(continued)*

Recognize

Recognize the emergency condition and determine your immediate course of action

Respiratory arrest

If the patient is unresponsive, not breathing normally (or only gasping) but has a pulse, they are in respiratory arrest. Follow these steps:

- If you have not already done so, call for help to activate EMS, the rapid response team or the resuscitation team, as appropriate.
- Call for an AED.
- Deliver 1 ventilation every 5 to 6 seconds; each ventilation should last about 1 second and make the chest begin to rise.
- Continue ventilations. Check the pulse and breathing about every 2 minutes. If you find no pulse, start CPR within 10 seconds following the steps outlined in the Care section.

Practice Note

For a suspected or known opioid overdose, administer naloxone per your facility's protocol (if available).

Cardiac arrest

If the patient is unresponsive, not breathing normally (or only gasping) and has no pulse, they are in cardiac arrest. Follow these steps:

- If you have not already done so, call for help to activate EMS, the rapid response team or the resuscitation team, as appropriate.
- Call for an AED.
- Start CPR within 10 seconds following the steps outlined in the Care section.

Practice Note

For a suspected or known opioid overdose, administer naloxone per your facility's protocol (if available).

Practice Note

If drowning or another hypoxic event is the suspected cause of cardiac arrest, deliver 2 initial ventilations before starting CPR.

BLS for Adults *(continued)*

Care

Provide CPR/AED Care

Single-Provider CPR

Provide chest compressions

- The compressor exposes the chest.
- The compressor performs 30 chest compressions. The compressor centers their hands on the lower half of the sternum and compresses the chest to a depth of at least 2 inches (5 cm) at a rate of 100 to 120 compressions per minute, allowing for full chest recoil. It should take 15 to 18 seconds to perform 30 chest compressions.

Deliver ventilations

- Seal the pocket mask and simultaneously open the airway to a past-neutral position using the head-tilt/chin-lift technique. Or, use the modified jaw-thrust maneuver if a head, neck or spinal injury is suspected.
- Deliver 2 ventilations. Each ventilation should last about 1 second and make the chest begin to rise.

Practice Note

Interruptions of chest compressions should be less than 10 seconds. Therefore, a bag-valve-mask (BVM) is not a practical way to deliver ventilations during CPR when responding alone.

Continue CPR

- Provide 30 chest compressions at the proper rate and depth, using correct hand placement and allowing for full chest recoil.
- Seal the mask and open the airway.
- Deliver 2 ventilations.

Multiple-Provider CPR

Provide chest compressions

- The compressor exposes the chest.
- The compressor performs 30 chest compressions. The compressor centers their hands on the lower half of the sternum and compresses the chest to a depth of at least 2 inches (5 cm) at a rate of 100 to 120 compressions per minute, allowing for full chest recoil. It should take 15 to 18 seconds to perform 30 chest compressions.

BASIC LIFE SUPPORT SEQUENCE

BLS for Adults *(continued)*

Deliver ventilations

- The airway manager seals the BVM mask and simultaneously opens the airway to a past-neutral position using the head-tilt/chin-lift technique. Or, they use the modified jaw-thrust maneuver if a head, neck or spinal injury is suspected.
- The ventilator delivers 2 ventilations. Each ventilation should last about 1 second and make the chest begin to rise.

> **Practice Note**
>
> If only one provider is available to operate the BVM, they take on the role of airway manager and ventilator.

> **Practice Note**
>
> If an advanced airway is in place, one provider delivers 1 ventilation every 6 seconds. At the same time, a second provider performs compressions at a rate of 100 to 120 per minute. In this case, the compression-to-ventilation ratio of 30:2 does not apply because compressions and ventilations are delivered continuously with no interruptions.

Switch positions

- The providers smoothly switch positions about every 2 minutes. This should take less than 10 seconds.
- The compressor calls for a position change by saying “switch” in place of the number 1 in the compression cycle.

Continue CPR

- The compressor provides 30 chest compressions at the proper rate and depth, using correct hand placement and allowing for full chest recoil.
- The airway manager maintains an open airway and seals the mask.
- The ventilator delivers 2 ventilations with the BVM resuscitator.

AED Use

Set up the AED and continue CPR until the AED is ready to analyze

- CPR continues until the AED is ready to analyze the rhythm.
- While CPR continues, the AED operator:
  - Turns on the AED.
  - Attaches the AED pads.

BLS for Adults *(continued)*

- Plugs in the connectors, if necessary.
- Ensures that everyone is clear of the patient while the AED analyzes, loudly saying, "Clear."

Rotate providers during analysis to prevent fatigue, as needed

- The new compressor hovers their hands a few inches over the patient's chest, preparing to take over compressions immediately after analysis is complete. This helps minimize interruptions in chest compressions to less than 10 seconds. The other provider(s) get into position ready to operate the AED, maintain the mask seal and open airway and deliver ventilations.

If shock is advised/not advised:

Shock advised

- The AED operator ensures that everyone is clear of the patient while the AED delivers the shock.
- The AED operator says, "Clear."
- The AED operator presses the shock button as soon as the AED prompts.
- The providers immediately resume CPR after the shock is delivered. They do not need to wait for the AED prompt.

No shock advised

- The providers immediately resume CPR, without shocking the patient.

Continue CPR

- The providers continue performing cycles of CPR (30 compressions/2 ventilations) switching roles about every 2 minutes. The switch should take less than 10 seconds.

Stopping CPR/AED Use

Continue CPR/AED use until:

- Other trained providers arrive and relieve you.
- You see signs of return of spontaneous circulation (ROSC), such as spontaneous movement or breathing.
- You are presented with a valid do not resuscitate (DNR) order.
- You are too exhausted to continue.
- The situation becomes unsafe.

If ROSC is achieved:

- Stop CPR/AED use.
- Check for breathing and pulse. It is appropriate to check the carotid or femoral pulse when the patient shows signs of ROSC and multiple providers are present.

BASIC LIFE SUPPORT SEQUENCE

BLS for Adults *(continued)*

- Monitor the patient until the advanced cardiac life support team takes over.

Practice Note

Upon achieving ROSC, supplemental oxygen should be used based on your facility's protocols to maintain a normal oxygen saturation level while avoiding hyperoxygenation. Providers should use a pulse oximeter to monitor oxygen saturation.

BASIC LIFE SUPPORT SEQUENCE

BLS for Children and Infants

When responding to a cardiac event, you must complete a rapid assessment, recognize the problem and provide quality care.

Assess

Conduct a Rapid Assessment

Perform visual survey

- Check your surroundings for safety.
- Gather an initial impression, including whether there is severe, life-threatening bleeding.
- Determine the need for additional resources.

> **Practice Note**
>
> The sequence of these steps is not critical if all goals are accomplished. Depending on the setting, additional resources may include emergency medical services (EMS), the rapid response team or the resuscitation team. Follow standard precautions, including using personal protective equipment (PPE), and obtain consent before proceeding if appropriate.

Check for responsiveness

- Shout, "Are you OK?" Use the child or infant's name if you know it.
- Tap the child's shoulder or the infant's foot and shout again (shout-tap-shout).
- If the child or infant is unresponsive and you are alone, call for help to activate EMS, the rapid response team or the resuscitation team, as appropriate, and call for an AED. If you are alone and do not have a mobile phone or other form of communication, you must decide to call first or care first.
- If the child or infant is unresponsive and you are with another provider, the first provider stays with the child or infant. Other providers activate EMS, the rapid response team or the resuscitation team, as appropriate, and retrieve the AED, bag-valve-mask (BVM) resuscitator and other emergency equipment.

Simultaneously check for breathing and pulse

- Open the airway to a slightly past-neutral position for a child or to a neutral position for an infant, using the head-tilt/chin-lift technique; or use the modified jaw-thrust maneuver if you a suspect head, neck or spinal injury.
- Simultaneously check for breathing and a pulse for at least 5 seconds but no more than 10 to quickly determine whether the pulse is > 60 bpm. Check the carotid pulse in children and the brachial pulse in infants.

BASIC LIFE SUPPORT SEQUENCE

BLS for Children and Infants *(continued)*

Recognize

Recognize the emergency condition and determine your immediate course of action

Respiratory arrest with a pulse > 60 bpm

If the patient is unresponsive, not breathing normally (or only gasping) but has a pulse > 60 bpm, they are in respiratory arrest. Follow these steps:

- If you have not already done so, call for help to activate EMS, the rapid response team or the resuscitation team, as appropriate, and call for an AED.
- If you are alone and do not have a mobile phone or other form of communication, you must decide to call first or care first.
- Deliver 1 ventilation every 3 to 5 seconds; each ventilation should last about 1 second and make the chest begin to rise.
- Continue ventilations. Check the pulse and breathing about every 2 minutes.
    - If the pulse decreases to 60 bpm or less with signs of poor perfusion, begin CPR as outlined in the Care section and reassess about every 2 minutes.

Practice Note

Signs of poor perfusion in a child or infant include cool, moist skin; pallor, mottling or cyanosis; a weak or thready pulse; decreased capillary refill; and hypotension.

Practice Note

For a suspected or known opioid overdose, administer naloxone per your facility's protocol (if available).

Respiratory arrest with a pulse ≤ 60 bpm and signs of poor perfusion

If the patient is unresponsive, showing signs of poor perfusion and not breathing normally (or only gasping) but has a pulse ≤ 60 bpm, they are in respiratory arrest. Follow these steps:

- If you have not already done so, call for help to activate EMS, the rapid response team or the resuscitation team, as appropriate, and call for an AED.
- If you are alone and do not have a mobile phone, you must decide to call first or care first.
- Begin CPR as outlined in the Care section.
- Continue ventilations and chest compressions.
- Check the pulse and breathing about every 2 minutes.

BLS for Children and Infants *(continued)*

- If the child is not breathing normally and the pulse increases to greater than 60 bpm, stop chest compressions but continue providing 1 ventilation every 3 to 5 seconds.
- If the child is not breathing normally but has a pulse less than 60 bpm, continue CPR.

Practice Note

For a suspected or known opioid overdose, administer naloxone per your facility's protocol (if available).

Cardiac arrest

If the patient is unresponsive, not breathing normally (or only gasping) and has no pulse, they are in cardiac arrest. Follow these steps:

- If you have not already done so, call for help to activate EMS, the rapid response team or the resuscitation team, as appropriate, and call for an AED.
- If you are alone and do not have a mobile phone or other form of communication, you must decide to call first or care first.
- Start CPR within 10 seconds of recognizing cardiac arrest following the steps outlined in the Care section.

Practice Note

If drowning or another hypoxic event is the suspected cause of cardiac arrest, deliver 2 initial ventilations before starting CPR.

Practice Note

For a suspected or known opioid overdose, administer naloxone per your facility's protocol (if available).

BASIC LIFE SUPPORT SEQUENCE

BLS for Children and Infants *(continued)*

Care

Provide CPR/AED Care

Single-Provider CPR

Provide chest compressions

- Expose the chest and perform 30 chest compressions.
- **For Children:** Center your hands on the lower half of the sternum and compress the chest to a depth of about 2 inches (5 cm) at a rate of 100 to 120 compressions per minute, allowing for full chest recoil.
- **For Infants:** Center your fingers on the lower half of the sternum, just below the nipple line. Using the two-finger technique, compress the chest at a depth of about 1½ inches (3.8 cm), or one-third the anterior-posterior diameter of the chest, and at a rate of 100 to 120 compressions per minute, allowing for full chest recoil.

Deliver ventilations

- Seal the pocket mask and simultaneously open the airway to a slightly past-neutral position for children or a neutral position for infants using the head-tilt/chin-lift technique. Or, use the modified jaw-thrust maneuver if a head, neck or spinal injury is suspected.
- Deliver 2 ventilations. Each ventilation should last about 1 second and make the chest begin to rise.

Practice Note

Interruptions of chest compressions should be less than 10 seconds. Therefore, a bag-valve-mask (BVM) is not a practical way to deliver ventilations during CPR when responding alone.

Continue CPR

- Provide 30 chest compressions at the proper rate and depth, using correct hand placement and allowing for full chest recoil.
- Seal the mask and open the airway.
- Deliver 2 ventilations.

BLS for Children and Infants *(continued)*

Multiple-Provider CPR

Provide chest compressions

- The compressor exposes the chest and performs 15 chest compressions.
- **For Children:** The compressor centers their hands on the lower half of the sternum and compresses the chest to a depth of about 2 inches (5 cm) at a rate of 100 to 120 compressions per minute, allowing for full chest recoil.
- **For Infants:** The compressor centers their thumbs on the lower half of the sternum. Using the encircling thumbs technique, the compressor compresses the chest to a depth of about 1½ inches (3.8 cm), or one-third the anterior-posterior diameter of the chest, at a rate of 100 to 120 compressions per minute, allowing for full chest recoil.

Deliver ventilations

- The airway manager seals the BVM mask and simultaneously opens the airway to a slightly past-neutral position for children or a neutral position for infants using the head-tilt/chin-lift technique. Or, they use the modified jaw-thrust maneuver if a head, neck or spinal injury is suspected.
- The ventilator delivers 2 ventilations. Each ventilation should last about 1 second and make the chest begin to rise.

Practice Note

If only one provider is available to operate the BVM, they take on the role of airway manager and ventilator.

Practice Note

If an advanced airway is in place, one provider delivers 1 ventilation every 6-8 seconds. At the same time, a second provider performs compressions at a rate of 100 to 120 per minute. In this case, the compression-to-ventilation ratio of 15:2 does not apply because compressions and ventilations are delivered continuously with no interruptions.

Switch positions

- The providers smoothly switch positions about every 2 minutes. This should take less than 10 seconds.
- The compressor calls for a position change by saying “switch” in place of the number 1 in the compression cycle.

Continue CPR

- The compressor provides 15 chest compressions at the proper rate and depth, using correct hand placement and allowing for full chest recoil.
- The airway manager maintains an open airway and seals the mask.
- The ventilator delivers 2 ventilations with the child or infant-sized BVM resuscitator or pocket mask.

BASIC LIFE SUPPORT SEQUENCE

BLS for Children and Infants *(continued)*

AED Use

Set up the AED and continue CPR until the AED is ready to analyze

- CPR continues until the AED is ready to analyze the rhythm.
- While CPR continues, the AED operator:
  - Turns on the AED.
  - Attaches the AED pads.
  - Plugs in the connectors, if necessary.
  - Ensures that everyone is clear of the patient while the AED analyzes, loudly saying, "Clear."

Rotate providers during analysis to prevent fatigue, as needed

- The new compressor hovers their hands a few inches over the child or infant's chest, preparing to take over compressions immediately after analysis is complete. This helps minimize interruptions in chest compressions to less than 10 seconds. The other provider(s) get into position ready to operate the AED, maintain the mask seal and open airway and deliver ventilations.

If shock is advised/not advised:

Shock advised

- The AED operator ensures that everyone is clear of the child or infant while the AED delivers the shock.
- The AED operator says, "Clear."
- The AED operator presses the shock button as soon as the AED prompts.
- The providers immediately resume CPR after the shock is delivered. They do not need to wait for the AED prompt.

No shock advised

- The providers immediately resume CPR, without shocking the patient.

Continue CPR

- The providers continue performing cycles of CPR (15:2) switching roles about every 2 minutes.

Stopping CPR/AED Use

Continue CPR/AED use until:

BLS for Children and Infants *(continued)*

- Other trained providers arrive and relieve you.
- You see signs of return of spontaneous circulation (ROSC), such as spontaneous movement or breathing.
- You are presented with a valid do not resuscitate (DNR) order.
- You are too exhausted to continue.
- The situation becomes unsafe.

If ROSC is achieved:

- Stop CPR/AED use.
- Check for breathing and pulse. When the patient shows signs of ROSC and multiple providers are present, it is appropriate to check the following sites:
  - Carotid or femoral pulse for a child
  - Brachial or femoral pulse for an infant
- Monitor the child or infant until the pediatric advanced life support team takes over.

Practice Note

Upon achieving ROSC, supplemental oxygen should be used based on your facility's protocols to maintain a normal oxygen saturation level while avoiding hyperoxygenation. Providers should use a pulse oximeter to monitor oxygen saturation.

APPENDIX D

Basic Life Support Differences Among Adults, Children and Infants

	Adult	Child (age 1 through onset of puberty)	Infant (birth to age 1)
Shout-tap-shout sequence	Shout "Are you OK?" **Tap the shoulder.** Then shout again.	Shout "Are you OK?" **Tap the shoulder.** Then shout again.	Shout "Are you OK?" **Tap the bottom of the foot.** Then shout again.
Calling for additional resources: If alone and no form of communication	**Leave to call for additional resources.** Then begin CPR.	Witnessed sudden collapse or known cardiac condition: **Leave to call for additional resources.** Then begin CPR. Unwitnessed sudden collapse: **Perform 2 minutes of CPR.** Then leave to call for additional resources.	Witnessed sudden collapse or known cardiac condition: **Leave to call for additional resources.** Then begin CPR. Unwitnessed sudden collapse: **Perform 2 minutes of CPR.** Then leave to call for additional resources.
Airway: Head-tilt/chin-lift	**Past-neutral** position	**Slightly past-neutral** position	**Neutral** position
Ventilations: Respiratory arrest	**1** ventilation every **5** to **6** seconds	**1** ventilation every **3** to **5** seconds	**1** ventilation every **3** to **5** seconds
Compression technique	**Two hands interlaced** on the chest centered on lower half of the sternum	**Two hands interlaced** on the chest centered on lower half of the sternum For smaller children, use the **one-hand technique**	Single-Provider CPR: **Two-finger technique**—two fingers centered on the sternum just below the nipple line Multiple-Provider CPR: **Encircling thumbs technique**—two thumbs centered on the sternum just below the nipple line with fingers encircling chest
Compression rate	100 to 120 per minute	100 to 120 per minute	100 to 120 per minute
Compression depth	**At least 2 inches** (5 cm) but no more than 2.4 inches (6 cm)	**About 2 inches** (5 cm) or one-third the anterior-posterior diameter of the chest	**About 1½ inches** (3.8 cm) or one-third the anterior-posterior diameter of the chest

	Adult	Child (age 1 through onset of puberty)	Infant (birth to age 1)
Compression-to-ventilation ratio	Single-provider CPR: **30:2** Multiple-provider CPR: **30:2**	Single-provider CPR: **30:2** Multiple-provider CPR: **15:2**	Single-provider CPR: **30:2** Multiple-provider CPR: **15:2**
CPR with an advanced airway in place	**1** ventilation every **6** seconds; compressions and ventilations are delivered continuously with no interruptions	**1** ventilation every **6** to **8** seconds; compressions and ventilations are delivered continuously with no interruptions	**1** ventilation every **6** to **8** seconds; compressions and ventilations are delivered continuously with no interruptions
AED pads	Use **adult pads. Do not use pediatric pads or setting**; the shock delivered will not be sufficient.	Age > 8 years, weight > 55 pounds (25 kg): Use **adult pads. Do not use pediatric pads or setting**; the shock delivered will not be sufficient. Age ≤ 8 years, weight ≤ 55 pounds (25 kg): Use **pediatric pads or setting**. Use **adult pads** if pediatric pads or setting are not available.	Use **pediatric pads or setting**. Use **adult pads** if pediatric pads or setting are not available.
AED pad placement	**Anterior/lateral** placement ■ Upper right chest below right clavicle to right of sternum ■ Left side of chest several inches below left armpit on midaxillary line **Anterior/posterior** placement, if recommended by manufacturer	**Anterior/lateral** placement ■ Upper right chest below right clavicle to right of sternum ■ Left side of chest several inches below left armpit on midaxillary line **Anterior/posterior** placement, if pads risk touching each other or recommended by manufacturer	**Anterior/posterior** placement ■ Middle of chest ■ Back between scapulae

APPENDIX E

Glossary

Abandonment
Discontinuing care once it has begun.

Abdominal thrusts
Inward and upward thrusts just above the navel to force an object out of the airway when a person is choking.

Adolescent
In the context of CPR, someone from the onset of puberty (as evidenced by breast development in girls and underarm hair development in boys—usually around the age of 12) through adulthood.

Advance directive
Written instructions that describe a patient's wishes (or the wishes of the parent and/or legal guardian) regarding medical treatment or healthcare decisions.

Agonal breaths
Isolated or infrequent gasps that occur in the absence of normal breathing in an unconscious patient; can occur after the heart has stopped beating and are considered a sign of cardiac arrest.

Airway obstruction
Blockage within the airway that can prevent inhalation or ventilation.

Assess, Recognize and Care Concept
A systematic, continuous approach for quick and accurate assessment, rapid recognition and immediate care in emergency situations.

Automated external defibrillator (AED)
A portable electronic device that automatically analyzes a patient's heart rhythm and provides defibrillation, an electrical shock that may help the heart re-establish a perfusing rhythm; delivers defibrillation to patients with ventricular fibrillation and ventricular tachycardia.

Back blows
Blows between the scapulae to force an object out of the airway when a person is choking.

Bag-valve-mask (BVM) resuscitator
A handheld device used to ventilate a patient through the delivery of ambient air, thereby providing a 20% to 21% concentration of oxygen.

Battery
The unlawful, harmful or offensive touching of a patient without the patient's consent.

Capnography
A noninvasive way of measuring end-tidal carbon dioxide (CO_2) level.

Cardiac arrest
Cessation of heart function. A patient who is not breathing normally (or only gasping) and has no pulse is in cardiac arrest.

Chest compression
During chest compressions, you press down on the person's chest. This squeezes (compresses) the heart between the breastbone (sternum) and spine, moving blood out of the heart and to the brain and other vital organs.

Chest compression fraction (CCF)
The percentage of time spent performing chest compressions during the resuscitation effort; an indicator of CPR quality.

Chest recoil
Return of the chest to the expanded position after a compression, which allows blood to flow back into the heart.

Chest thrusts
Inward thrusts into the chest (while pulling straight back with the thumb-side of the fist against the center of the person's breastbone) to force an object out of the airway when a person is choking.

Child
A child is defined as someone from the age of 1 to the onset of puberty as evidenced by breast development in girls and underarm hair development in boys (usually around the age of 12).

Closed-loop communication
A communication technique used to prevent misunderstandings; the receiver confirms that the message has been received and understood.

Compression-to-ventilation ratio
The number of compressions and ventilations delivered during CPR; this varies for adults, children and infants.

Confidentiality
Details obtained throughout the course of providing care to a patient must not be shared with anyone except personnel directly associated with the patient's medical care.

Consent
Asking a responsive person (or the parent or guardian of a minor) for permission to help before giving care.

Coronary perfusion pressure (CPP)
The difference between the pressure in the aorta and the pressure in the right atrium during diastole; a reflection of myocardial blood flow.

CPR
Cardiopulmonary resuscitation; ventilations and compressions that circulate oxygenated blood to the patient's vital organs.

Crew resource management
A concept that helps to promote effective and efficient teamwork and reduce the likelihood of errors by encouraging problem solving and communication among team members.

Critical thinking
The process of thinking clearly and rationally to identify the connection between information and actions.

Defibrillation
Delivery of an electrical shock using an AED.

DNR order
Do Not Resuscitate order; a legal order that instructs healthcare providers to avoid CPR or advanced cardiac life support if a patient experiences cardiac or respiratory arrest.

Duty to act
The duty to respond to an emergency and provide care. Failure to fulfill this duty could result in legal action.

E-C hand position
A method to hold the mask in place; position one hand around the mask, forming an "E" with the last three fingers and a "C" with your thumb and index finger.

Feedback devices
Technology, ranging from apps to self-contained systems, that is used to gather data about CPR performance and provide real-time feedback; these devices collect objective data such as the rate at which compressions and ventilations are being delivered, the depth of compressions and the amount of chest recoil.

Finger sweep
Technique for clearing a mechanical obstruction from the upper airway of an unconscious patient in which the rescuer attempts to remove a mechanical obstruction from the patient's mouth using a finger; only used when the object is visible within the patient's mouth.

Hand hygiene
Washing hands with soap and water and keeping hands clean even when they are not visibly soiled; the most effective measure to prevent the spread of infection.

High-performance resuscitation team
A team of highly trained and skilled personnel who work together to provide resuscitative care when a patient experiences respiratory or cardiac arrest.

High-quality CPR
Method of performing CPR that helps you to provide appropriate, effective care until the advanced cardiac life support team arrives. If provided during the first few minutes of cardiac arrest, high-quality CPR can double or triple a patient's chance of survival.

Hovering
In the context of CPR, remaining in position with the hands a few inches above the patient's chest during AED analysis and shock delivery to minimize interruptions in chest compressions.

Infant
An infant is defined as someone under the age of 1.

Myocardial infarction (MI)
Necrosis (death) of heart tissue as a result of insufficient delivery of oxygenated blood to the heart; also called a heart attack.

Opioid overdose triad
A method for recognizing the signs and symptoms of opioid overdose; includes checking for pinpoint pupils, respiratory depression and unconsciousness or severe sleepiness.

Oropharynx
The region of the pharynx that extends from the hard palate to the level of the hyoid bone and is located posterior to the oral cavity.

Overventilation
Excessive pulmonary ventilation; increases thoracic pressure to the extent that atrial and ventricular filling is decreased and coronary perfusion pressure is reduced.

Personal protective equipment (PPE)
Specialized clothing, equipment and supplies, such as gloves, CPR breathing barriers, gowns, face shields, protective eyewear and biohazard bags, that prevent direct contact with potentially infectious materials.

Problem solving
The ability to use readily available resources to find solutions to challenging or complex situations or issues that arise.

Rapid assessment
The initial hands-on evaluation of a patient in an emergency situation; includes performing a quick visual survey, checking for responsiveness, opening the patient's airway and simultaneously checking for breathing and a pulse.

Rapid response team
A team of highly trained and skilled personnel who work together to care for a patient when signs of cardiopulmonary compromise or shock are noted.

Recovery position
A body position used to help maintain a clear airway in an unresponsive patient who is uninjured and breathing normally.

Refusal of care
A competent patient's refusal of some or all care provided by a healthcare provider. Refusal of care must be honored, even if the patient is seriously injured or ill or desperately needs assistance.

Respiratory arrest
Complete cessation of the breathing effort. A patient who is not breathing normally (or only gasping) but has a pulse is in respiratory arrest.

Return of spontaneous circulation (ROSC)
A return of pulse during resuscitative efforts; describes the successful resuscitation of a patient in cardiac arrest.

Scope of practice
The range of duties and skills you have acquired in training that you are authorized to perform by your certification to practice.

Shout-tap-shout sequence
Technique used to check for patient responsiveness: First, shout "Are you OK?" using the patient's name if you know it, then tap the patient's shoulder (or bottom of the foot if an infant) and shout again.

Standard of care
The public's expectation that personnel summoned to an emergency will provide care with a certain level of knowledge and skill.

Standard precautions
Safety measures to prevent disease transmission based on the assumption that all body fluids may be infectious.

Stridor
High-pitched squeaking noises during attempts to breathe.

Supine
Lying on the back with the face upward.

Teamwork
The actions of a group of people with well-defined roles and responsibilities making a coordinated effort to achieve a common goal.

Venous return
The rate of blood flow back into the heart.

Visual survey
Initial assessment of the scene of an emergency event; includes checking your surroundings for safety, gathering an initial impression (including whether there is severe, life-threatening bleeding) and determining the need for additional resources.

Work practice controls
Methods of working that reduce the likelihood of an exposure incident by changing the way a task is carried out.

APPENDIX F

Bibliography

Chapter 1

Fernandez Castelao, E., S. G. Russo, M. Riethmuller, M. Boos. 2013. Effects of team coordination during cardiopulmonary resuscitation: a systematic review of the literature. *Journal of Critical Care* 28 (4): 504–521.

Bhanji, F., A. J. Donoghue, M. S. Wolff, et al. 2015. Part 14: education: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 132 (18 suppl 2): S561–S573.

Hobgood, C., D. Mathew, D. J. Woodyard, F. S. Shofer, J. H. Brice. 2013. Death in the field: teaching paramedics to deliver effective death notifications using the educational intervention "GRIEV_ING". *Prehospital Emergency Care* 17 (4): 501–510.

Cole E., N. Crichton. 2006. The culture of a trauma team in relation to human factors. *Journal of Clinical Nursing* 15 (10): 1257–1266.

Chapter 2

Planas, J. H., W. Muhammad. 2017. Trauma, primary survey. Treasure Island, FL: StatPearls Publishing. Accessed December 30, 2017. https://www.ncbi.nlm.nih.gov/books/NBK430800/.

[No author]. 2000. Guidelines 2000 for cardiopulmonary resuscitation and emergency cardiovascular care. Part 3: adult basic life support. The American Heart Association in collaboration with the International Liaison Committee on Resuscitation. *Circulation* 102 (8 suppl): I22–I59.

Kronick, S. L., M. C. Kurz, S. Lin, et al. 2015. Part 4: systems of care and continuous quality improvement: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 132 (18 suppl 2): S397–S413.

Institute of Medicine. 2015. Strategies to improve cardiac arrest survival: a time to act. Washington, DC: National Academies Press.

Eckerline, C. A., J. D. Shopp. 2017. Legal aspects of emergency care. In: *CURRENT Diagnosis & Treatment: Emergency Medicin*e, eds. C. Stone and R. L. Humphries, 44–55. 8th ed. New York: McGraw-Hill Education.

Standard of care. In *Taber's* medical dictionary. Accessed April 6, 2018. http://www.tabers.com.

Refusal of therapy. In *Taber's* medical dictionary. Accessed April 6, 2018. http://www.tabers.com.

Kapp, M. B. 2015. Legal issues in critical care. In *Principles of critical care*, eds. J. B. Hall, G. A. Schmidt, and J. P. Kress, 125–130. 4th ed. New York: McGraw-Hill Education.

Advance directive. In *Taber's* medical dictionary. Accessed April 6, 2018. http://www.tabers.com.

Landzaat, L. H., C. T. Sinclair. 2017. Care of the dying patient. In *Principles and practice of hospital medicine*, eds. S. C. McKean, J. J. Ross, D. D. Dressler, and D. B. Scheurer, 1756–1766. 2nd ed. New York: McGraw-Hill Education.

Battery. In *Taber's* medical dictionary. Accessed April 6, 2018. http://www.tabers.com.

Lo, B., C. Grady. 2015. Ethical issues in clinical medicine. In *Harrison's principles of internal medicine*, vol. 1, eds. D. Kasper, A. Fauci, S. Hauser, D. Longo, J. L. Jameson, and J. Loscalzo. 19th ed. New York: McGraw-Hill Education.

Consent. In *Taber's* medical dictionary. Accessed April 6, 2018. http://www.tabers.com.

World Health Organization. 2004. Best practice protocols: clinical procedures safety. Accessed April 12, 2018. http://www.who.int/surgery/publications/BestPracticeProtocolsCPSafety07.pdf.

Universal precautions. In *Stedman's* medical dictionary. Accessed April 6, 2018. http://stedmansonline.com.

Occupational Safety and Health Administration. Occupational safety and health standards: toxic and hazardous substances: bloodborne pathogens. Standard no. 1910.1030. Accessed April 7, 2018. https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10051.

Gerberding, J. L., D. K. Henderson. 1992. Management of occupational exposures to bloodborne pathogens: hepatitis B virus, hepatitis C virus, and human immunodeficiency virus. *Clinical Infectious Diseases* 14 (6): 1179–1185.

Kleinman, M. E., E. E. Brennan, Z. D. Goldberger, et al. 2015. Part 5: adult basic life support and cardiopulmonary resuscitation quality: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 132 (18 suppl 2): S414–S435.

Singletary E. M., N. P. Charlton, J. L. Epstein, et al. 2015. Part 15: first aid: 2015 American Heart Association and American Red Cross guidelines update for first aid. *Circulation* 132 (18 suppl 2):S574–S589.

Atkins, D. L., S. Berger, J. P. Duff, et al. 2015. Part 11: pediatric basic life support and cardiopulmonary resuscitation quality: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 132 (18 suppl 2): S519–S525.

National Heart, Lung, and Blood Institute. Sudden cardiac arrest. Accessed April 5, 2018. https://www.nhlbi.nih.gov/health-topics/sudden-cardiac-arrest.

Harvard Health Publishing. 2005. Emergencies and first aid - recovery position: adult recovery position. Updated February 14, 2017. Accessed April 11, 2018. https://www.health.harvard.edu/staying-healthy/emergencies-and-first-aid-recovery-position.

Medline Plus. Heart attack. Accessed April 8, 2018. https://medlineplus.gov/ency/article/000195.htm.

Myocardial infraction. In *Stedman's* medical dictionary. Accessed April 7, 2018. http://stedmansonline.com.

McSweeney, J. C., M. Cody, P. O'Sullivan, K. Elberson, D. K. Moser, B. J. Garvin. 2003. Women's early warning symptoms of acute myocardial infarction. *Circulation* 108 (21): 2619–2623.

Chapter 3

[No author]. 2000. Guidelines 2000 for cardiopulmonary resuscitation and emergency cardiovascular care. Part 3: adult basic life support. The American Heart Association in collaboration with the International Liaison Committee on Resuscitation. *Circulation* 102 (8 suppl): I22–I59.

Kleinman, M. E., E. E. Brennan, Z. D. Goldberger, et al. 2015. Part 5: adult basic life support and cardiopulmonary resuscitation quality: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 132 (18 suppl 2): S414–S435.

Wissenberg M., F. K. Lippert, F. Folke, et al. 2013. Association of national initiatives to improve cardiac arrest management with rates of bystander intervention and patient survival after out-of-hospital cardiac arrest. *Journal of the American Medical Association* 310 (13): 1377–1384.

Vanden Hoek, T. L., L. J. Morrison, M. Shuster, et al. 2010. Part 12: cardiac arrest in special situations: 2010 American Heart Association Guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 122 (18 suppl 3): S829–S861.

Monsieurs, K. G., M. De Regge, K. Vansteelandt, et al. 2012. Excessive chest compression rate is associated with insufficient compression depth in prehospital cardiac arrest. *Resuscitation* 83 (11): 1319–1323.

Idris, A. H., D. Guffey, P. E. Pepe, et al.; Resuscitation Outcomes Consoritium Investigators. 2015. Chest compression rates and survival following out-of-hospital cardiac arrest. *Critical Care Medicine* 43 (4): 840–848.

Hellevuo, H., M. Sainio, R. Nevalainen, et al. 2013. Deeper chest compression - more complications for cardiac arrest patients? *Resuscitation* 84 (6): 760–765.

Finn J. C., F. Bhanji, A. Lockey, et al.; Education, Implementation, Teams Chapter Collaborators. 2015. Part 8: education, implementation, and teams: 2015 international consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations. *Circulation* 95: e203–e224.

Meaney, P. A., B. J. Bobrow, M. E. Mancini, et al.; CPR Quality Summit Investigators, the American Heart Association Emergency Cardiovascular Care Committee, and the Council on Cardiopulmonary Critical Care, Perioperative and Resuscitation. 2013. Cardiopulmonary resuscitation quality: [corrected] improving cardiac resuscitation outcomes both inside and outside the hospital: a consensus statement from the American Heart Association. *Circulation* 128 (4): 417–435.

Coronary perfusion pressure. In *Taber's* medical dictionary. Accessed April 11, 2018. http://www.tabers.com.

Berg, M. D., S. M. Schexnayder, L. Chameides, et al. 2010. Part 13: pediatric basic life support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 122 (18 suppl 3): S862–S875.

Monsieurs, K. G., J. P. Nolan, L. L. Bossaert, et al.; ERC Guidelines 2015 Writing Group. 2015. European Resuscitation Council guidelines for resuscitation 2015: section 1. Executive summary. *Resuscitation* 95: 1–80.

Soar, J., M. E. Mancini, F. Bhanji, et al.; Education, Implementation, Teams Chapter Collaborators. 2010. Part 12: education, implementation, and teams: 2010 international consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations. *Resuscitation* 81 suppl 1: e288–e330.

Graham-Field Health Products. 2007. Grafco CPR pocket mask resuscitator [user instructions]. Atlanta, GA: Graham-Field Health Products.

Wenzel, V., A. H. Idris, M. J. Banner, R. S. Fuerst, K. J. Tucker. 1994. The composition of gas given by mouth-to-mouth ventilation during CPR. *Chest* 106 (6): 1806–1810.

Berg, R. A., R. Hemphill, B. S. Abella, et al. 2010. Part 5: adult basic life support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 122 (18 suppl 3):S685–S705.

[No authors]. 2005. Part 7.1: adjuncts for airway control and ventilation. *Circulation* 112: IV-51–IV-57.

Rock, M. 2014. The dos and don'ts of bag-valve mask ventilation. *Journal of Emergency Medical Services* 39 (8). Accessed April 20, 2018. http://www.jems.com/articles/print/volume-39/issue-8/features/dos-and-don-ts-bag-valve-mask-ventilatio.year=2014.html.

Clark M. D., M. P. Davis, M. A. Petschauer, E. E. Swartz, J. P. Mihalik. 2018. Delivering chest compressions and ventilations with and without men's lacrosse equipment. *Journal of Athletic Training* 53 (4): 416-422.

Peberdy M. A., C. W. Callaway, R. W. Neumar, et al. 2010. Part 9: post-cardiac arrest care: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 122 (18 suppl 3): S768–S786.

Bucher, J. T., J. S. Cooper. 2017. Bag mask ventilation (bag valve mask, BVM). Treasure Island, FL: StatPearls Publishing. Accessed April 14, 2018. https://www.ncbi.nlm.nih.gov/books/NBK441924/.

Moss, J. E., J. Persoff. 2017. Inpatient cardiac arrest and cardiopulmonary resuscitation. In *Principles and practice of hospital medicine*, eds. S. C. McKean, J. J. Ross, D. D. Dressler, and D. B. Scheurer, 1037–1046. 2nd ed. New York: McGraw-Hill Education.

Htin K. J., D. S. Birenbaum, A. H. Idris, M. J. Banner, N. Gravenstein. 1998. Rescuer breathing pattern significantly affects O2 and CO2 received by the patient during mouth-to-mouth ventilation. *Critical Care Medicine* 26 (suppl 1): A56–A60.

Neumar, R. W., C. W. Otto, M. S. Link, et al. 2010. Part 8: adult advanced cardiovascular life support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 122 (18 suppl 3): S729–S767.

Olasveengen, T. M., A. R. de Caen, M. E. Mancini, et al.; ILCOR Collaborators. 2017. 2017 International consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations summary. Circulation 136 (23): e424–e440.

Starr, L. M. 2012. Automated external defibrillation in the occupational setting. *Journal of Occupational and Environmental Medicine* 54 (9): 1170–1176.

Institute of Medicine. 2015. Strategies to improve cardiac arrest survival: a time to act. Washington, DC: National Academies Press.

Perkins, G. D., A. J. Handley, R. W. Koster, et al.; Adult Basic Life Support and Automated External Defibrillation Section Collaborators. 2015. European Resuscitation Council guidelines for resuscitation 2015: section 2. Adult basic life support and automated external defibrillation. *Resuscitation* 95: 81–99.

Hauda, W. E. 2016. *Resuscitation of children.* In *Tintinalli's emergency medicine: a comprehensive study guide*, eds. J. E. Tintinalli, J. S. Stapczynski, O. J. Ma, D. M. Yealy, G. D. Meckler, and D. M. Cline, 695–705. 8th ed. New York: McGraw-Hill Education.

National CPR Association. CPR / AED study guide: part 2. Accessed April 20, 2018. https://www.nationalcprassociation.com/cpr-aed-study-guide-part-2/.

State of Connecticut. CPR for the professional rescuer with AED and standard first aid. Review sheet to ECC guidelines 2010. Accessed April 20, 2018. http://www.ct.gov/dmhas/lib/dmhas/publications/FPRFAAAEDreviewsheet.pdf.

Link, M. S., D. L. Atkins, R. S. Passman, et al. 2010. Part 6: electrical therapies: automated external defibrillators, defibrillation, cardioversion, and pacing: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 122 (18 suppl 3): S706–S719.

Craig, K. 2006. Take charge with an automated external defibrillator. *Nursing* 36 suppl cardiac: 24–26.

Oliver, T. 2014. Should you ever not use an AED? AEDs Today. Accessed August 23, 2018. http://www.aedstoday.com/Should-You-Ever-Not-Use-An-AED_b_96.html#.Wt6KYKZ4eqF.

Baldi, E., E. Contri. 2016. Using an AED in particular environments: is it safe or not? Suggestions for lay people and their instructors. *Resuscitation* 106: e25.

Physio-Control, Inc. 2014. LifePak CR Plus [operating instructions]. Redmond, WA: Physio-Control, Inc.

Mancini, M. E., D. S. Diekema, T. A. Hoadley, et al. 2015. Part 3: ethical issues: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 132 (18 suppl 2): S383–S396.

Kronick, S. L., M. C. Kurz, S. Lin, et al. 2015. Part 4: systems of care and continuous quality improvement: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 132 (18 suppl 2): S397–S413.

Long, B., A. Koyfman, M. A. Vivirito. 2017. Capnography in the emergency department: a review of uses, waveforms, and limitations. *Journal of Emergency Medicine* 53 (6): 829–842.

Chapter 4

Berg, M. D., S. M. Schexnayder, L. Chameides, et al. 2010. Part 13: pediatric basic life support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 122 (18 suppl 3): S862–S875.

Dieckmann, R. A., D. Brownstein, M. Gausche-Hill. 2010. The pediatric assessment triangle: a novel approach for the rapid evaluation of children. *Pediatric Emergency Care* 26 (4): 312–315.

de Caen, A. R., I. K. Maconochie, R. Aickin, et al.; Pediatric Basic Life Support and Pediatric Advanced Life Support Chapter Collaborators. 2015. Part 6: pediatric basic life support and pediatric advanced life support: 2015 international consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations. *Circulation* 132 (16 suppl 1): S177–S203.

National CPR Association. Infant / pediatric CPR study guide. Accessed May 1, 2018. https://www.nationalcprassociation.com/infant-pediatric-cpr-study-guide/.

Alexis, O. 2010. Providing best practice in manual pulse measurement. *British Journal of Nursing* 19 (4): 228–234.

American Heart Association. 2006. 2005 American Heart Association (AHA) guidelines for cardiopulmonary resuscitation (CPR) and emergency cardiovascular care (ECC) of pediatric and neonatal patients: pediatric basic life support. *Pediatrics* 117 (5): e989–e1004.

Biarent, D., R. Bingham, S. Richmond, et al.; European Resuscitation Council. 2005. European Resuscitation Council guidelines for resuscitation 2005. Section 6. Paediatric life support. *Resuscitation* 67 suppl 1: S97–S133.

[No authors]. 2000. Guidelines 2000 for cardiopulmonary resuscitation and emergency cardiovascular care. Part 9: pediatric basic life support. The American Heart Association in collaboration with the International Liaison Committee on Resuscitation. *Circulation* 102 (8 suppl): I253–I290.

American Heart Association. 2006. 2005 American Heart Association (AHA) guidelines for cardiopulmonary resuscitation (CPR) and emergency cardiovascular care (ECC) of pediatric and neonatal patients: pediatric advanced life support. *Pediatrics* 117 (5): e1005–e1028.

Samuels, M., S. Wieteska. 2011. Basic life support. In *Advanced paediatric life support: the practical approach*, ed. Advanced Life Support Group, 20–34. 5th ed. Manchester, England: Blackwell Publishing.

Atkins, D. L., S. Berger, J. P. Duff, et al. 2015. Part 11: Pediatric basic life support and cardiopulmonary resuscitation quality: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 132 (18 suppl 2): S519–S525.

Bosson, N., Z. Mosenifar. Bag-valve-mask ventilation. Updated March 28, 2018. Accessed May 2, 2018. https://emedicine.medscape.com/article/80184-overview#showall.

American Heart Association. Summary of highquality CPR components for BLS providers. Accessed April 24, 2018. https://eccguidelines.heart.org/index.php/tables/summary-of-high-quality-cpr-components-for-bls-providers/.

Bhanji, F., J. C. Finn, A. Lockey, et al.; Education, Implementation, and Teams Chapter Collaborators. 2015. Part 8: education, implementation, and teams: 2015 international consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations. *Circulation* 132 (16 suppl 1): S242–S268.

Kleinman, M. E., L. Chameides, S. M. Schexnayder, et al. 2010. Part 14: pediatric advanced life support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 122 (18 suppl 3): S876–S908.

[No authors]. 2005. Part 5: electrical therapies: automated external defibrillators, defibrillation, cardioversion, and pacing. *Circulation* 112 (24 suppl):IV-35–IV-46.

Ong, M. E. H., S. H. Lim, A. Venkataraman. 2016. Defibrillation and cardioversion. In *Tintinalli's emergency medicine: a comprehensive study guide*, eds. J. E. Tintinalli, J. S. Stapczynski, O. J. Ma, D. M. Yealy, G. D. Meckler, and D. M. Cline, 157–159. 8th ed. New York: McGraw-Hill Education.

[No authors]. 2000. Guidelines 2000 for cardiopulmonary resuscitation and emergency cardiovascular care. Part 3: adult basic life support. The American Heart Association in collaboration with the International Liaison Committee on Resuscitation. *Circulation* 102 (8 suppl): I22–I59.

Kleinman, M. E., E. E. Brennan, Z. D. Goldberger, et al. 2015. Part 5: adult basic life support and cardiopulmonary resuscitation quality: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 132 (18 suppl 2): S414–S435.

Mancini, M. E., D. S. Diekema, T. A. Hoadley, et al. 2015. Part 3: Ethical Issues: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 132 (18 suppl 2): S383–S396.

Monsieurs, K. G., J. P. Nolan, L. L. Bossaert, et al.; ERC Guidelines 2015 Writing Group. 2015. European Resuscitation Council guidelines for resuscitation 2015: section 1. Executive summary. *Resuscitation* 95: 1–80.

Nolan, J. P., C. D. Deakin, J. Soar, B. W. Bottiger, G. Smith; European Resuscitation Council. 2005. European Resuscitation Council guidelines for resuscitation 2005. Section 4. Adult advanced life support. *Resuscitation* 67 suppl 1: S39–S86.

Maconochie, I. K., R. Bingham, C. Eich, et al.; Paediatric Life Support Section Collaborators. 2015. European Resuscitation Council guidelines for resuscitation 2015: section 6. Paediatric life support. *Resuscitation* 95: 223–248.

Link, M. S., D. L. Atkins, R. S. Passman, et al. 2010. Part 6: electrical therapies: automated external defibrillators, defibrillation, cardioversion, and pacing: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 122 (18 suppl 3): S706–S719.

Neumar, R. W., C. W. Otto, M. S. Link, et al. 2010. Part 8: adult advanced cardiovascular life support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 122 (18 suppl 3): S729–S767.

Berg, R. A., R. Hemphill, B. S. Abella, et al. 2010. Part 5: adult basic life support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 122 (18 suppl 3): S685–S705.

Center for Professional Practice of Nursing, UC Davis Health System. CPR guidelines for health-care providers. Accessed May 9, 2018. http://www.ucdmc.ucdavis.edu/cppn/documents/classes/cpr/cpr_handout.pdf.

Chapter 5

[No author]. 2000. Guidelines 2000 for cardiopulmonary resuscitation and emergency cardiovascular care. Part 3: adult basic life support. The American Heart Association in collaboration with the International Liaison Committee on Resuscitation. *Circulation* 102 (8 suppl): I22–I59.

Moss, J. E., J. Persoff. 2017. Inpatient cardiac arrest and cardiopulmonary resuscitation. In *Principles and practice of hospital medicine*, eds. S. C. McKean, J. J. Ross, D. D. Dressler, and D. B. Scheurer, 1037–1046. 2nd ed. New York: McGraw-Hill Education.

Berg, M. D., S. M. Schexnayder, L. Chameides, et al. 2010. Part 13: pediatric basic life support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 122 (18 suppl 3): S862–S875.

Mayo Clinic Staff. 2017. Choking: first aid. Accessed April 23, 2018. https://www.mayoclinic.org/first-aid/first-aid-choking/basics/art-20056637.

Sayre, M. R., R. W. Koster, M. Botha, et al. 2010. Part 5: Adult basic life support: 2010 international consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations. *Circulation* 122 (16 suppl 2): S298–S324.

Perkins, G. D., A. J. Handley, R. W. Koster, et al.; Adult Basic Life Support and Automated External Defibrillation Collaborators. 2015. European Resuscitation Council guidelines for resuscitation 2015: section 2. Adult basic life support and automated external defibrillation. *Resuscitation* 95: 81–99.

Nolan, J. P., C. D. Deakin, J. Soar, B. W. Bottiger, G. Smith; European Resuscitation Council. 2005. European Resuscitation Council guidelines for resuscitation 2005. Section 4. Adult advanced life support. *Resuscitation* 67 suppl 1: S39–S86.

Berg, R. A., R. Hemphill, B. S. Abella, et al. 2010. Part 5: adult basic life support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 122 (18 suppl 3): S685–S705.

Biarent, D., R. Bingham, S. Richmond, et al.; European Resuscitation Council. 2005. European Resuscitation Council guidelines for resuscitation 2005. Section 6. Paediatric life support. *Resuscitation* 67 suppl 1: S97–S133.

Part 3: overview of CPR. *Circulation* 2005; 112 (24 suppl): IV-12–IV-18.

Chapter 6

Kleinman, M. E., E. E. Brennan, Z. D. Goldberger, et al. 2015. Part 5: Adult basic life support and cardiopulmonary resuscitation quality: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 132 (18 suppl 2): S414–S435.

U.S. Department of Health and Human Services. 2017. HHS acting secretary declares public health emergency to address national opioid crisis. Accessed April 20, 2018. https://www.hhs.gov/about/news/2017/10/26/hhs-acting-secretary-declares-public-health-emergency-address-national-opioid-crisis.html.

Seth, P., R. A. Rudd, R. K. Noonan, T. M. Haegerich. 2018. Quantifying the epidemic of prescription opioid overdose deaths. *American Journal of Public Health* 108 (4): 500–502.

Centers for Disease Control and Prevention. Opoid data analysis. Updated February 9, 2017. Accessed April 22, 2018. https://www.cdc.gov/drugoverdose/data/analysis.html.

Hedegaard, H., M. Warner, A. M. Miniño. 2017. Drug overdose deaths in the United States, 1999-2016. NCHS Data Brief (294): 1–8.

Weiss, A. J., M. K. Bailey, L. O'Malley, M. L. Barrett, A. Elixhauser, C. A. Steiner. 2017. Patient characteristics of opioid-related inpatient stays and emergency department visits nationally and by state, 2014: statistical brief no. 224. In *Healthcare Cost and Utilization Project (HCUP) Statistical Briefs*. Rockville, MD: Agency for Healthcare Research and Quality.

Stevens, J. P., M. J. Wall, L. Novack, J. Marshall, D. J. Hsu, M. D. Howell. 2017. The critical care crisis of opioid overdoses in the United States. *Annals of the American Thoracic Society* 14 (12): 1803–1809.

Boyer, E. W. 2012. Management of opioid analgesic overdose. *New England Journal of Medicine* 367 (2): 146–155.

Dinis-Oliveira, R. J., F. Carvalho, R. Moreira, et al. 2012. Clinical and forensic signs related to opioids abuse. *Current Drug Abuse Reviews* 5 (4): 273–290.

World Health Organization. 2014. Information sheet on opioid overdose. Accessed April 22, 2018. http://www.who.int/substance_abuse/information-sheet/en/.

Jolley, C. J., J. Bell, G. F. Rafferty, J. Moxham, J. Strang. 2015. Understanding heroin overdose: a study of the acute respiratory depressant effects of injected pharmaceutical heroin. *PLoS One* 10 (10): e0140995.

Lavonas, E. J., I. R. Drennan, A. Gabrielli, et al. 2015. Part 10: special circumstances of resuscitation: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 132 (18 suppl 2): S501–S518.

Berg, R. A., R. Hemphill, B. S. Abella, et al. 2010. Part 5: adult basic life support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 122 (18 suppl 3): S685–S705.

Mancini, M. E., D. S. Diekema, T. A. Hoadley, et al. 2015. Part 3: ethical issues: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 132 (18 suppl 2): S383–S396.

Monsieurs, K. G., J. P. Nolan, L. L. Bossaert, et al.; ERC Guidelines 2015 Writing Group. 2015. European Resuscitation Council guidelines for resuscitation 2015: section 1. Executive summary. *Resuscitation* 95: 1–80.

Adapt Pharma, Inc. 2017. Narcan [package insert]. Radnor, PA: Adapt Pharma, Inc.

Naloxoneinfo.org. Naloxone: frequently asked questions. New York: Open Society Foundations. Accessed April 23, 2018. http://naloxoneinfo.org/sites/default/files/Frequently%20Asked%20Questions-Naloxone_EN.pdf.

Vanden Hoek, T. L., L. J. Morrison, M. Shuster, et al. 2010. Part 12: cardiac arrest in special situations: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 122 (18 suppl 3): S829–S861.

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American Red Cross
Training Services

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American Red Cross Training Services and the Scientific Advisory Council

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- The 2015-2018 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care.

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The American Red Cross prevents and alleviates human suffering in the face of emergencies by mobilizing the power of volunteers and the generosity of donors.