FLEX CEUs

Basic Life Support for Healthcare Providers

Introduction

EdCompass's Basic Life Support (BLS) for Healthcare Providers course provides foundational training for physical therapists and physical therapy assistants who are faced with life-threatening situations related to cardiac arrest. This course enables prompt recognition of potential emergencies and encourages high quality cardiopulmonary resuscitation (CPR) skills in situations that require emergent cardiac, breathing, and first aid care. You will learn ways in which to respond as a single rescuer or as a member of a high performance rescue team. The skills gained will allow you to recognize signs of cardiac arrest, activate the emergency response system, and react appropriately with confidence. Recommendations contained within this course are consistent with the International Liaison Committee on Resuscitation (ILCOR) 2015-2020 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations (CoSTR) and the 2015-2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care.[1,2]

Foundational skills for BLS include:

1. **Acknowledge** and recognize cardiac arrest in order to activate the Chain of Survival
2. **Deliver** high quality compressions in order to circulate oxygenated blood to the heart, brain, and vital organs
3. **Familiarize** oneself with the Automatic External Defibrillator (AED)
4. **Provide** rescue breaths
5. **Understand** ways in which high performance rescue teams can optimize outcomes
6. **Recognize** how to act during situations when victims are choking
7. **Deliver** appropriate lifesaving care measures in times of suspected opioid-associated emergencies or overdoses

CPR is a fundamental life saving skill that is administered for victims with signs of cardiac arrest. The two key components of CPR are high quality compressions and rescue breaths. When CPR is administered within 10 seconds of recognizing that cardiac arrest has occurred, the victim's chances for survival are significantly increased.[11]

Course requirements

Please note that this course comprehensively covers concepts and skills pertaining to CPR but does not address protocols that are specific to each state. For more information on state-regulated protocols, refer to your local health authority or regulatory body in your state.

As such, this course fulfills the academic requirements of a blended learning module for BLS certification. In addition to successful completion of this course, participants will need to complete a hands-on skills demonstration with a certified instructor in order to achieve full BLS certification. Please confirm that this course meets the necessary requirements of your state prior to enrolling.

Course updates for 2020[1,2,8,9,10,1312]

These key points summarize the latest changes in the Cardiopulmonary Resuscitation (CPR) guidelines for 2020. They also include revisions for adult, pediatric, and special populations with respect to resuscitation life saving measures.

350,000 adults in the United States suffered a nontraumatic out-of-hospital cardiac arrest requiring emergency medical services in 2012.[12] Unfortunately, studies show that less than 40% of adults receive CPR training, and fewer than 12% have utilized an automated external defibrillator (AED) before advanced medical professionals arrived on scene.[12] Despite these statistics, survival rates following an out-of-hospital cardiac arrest have plateaued since 2012.[12] With respect to in-hospital cardiac arrest, outcomes are significantly improved when compared to out-of-hospital outcomes.

In an attempt to improve education and training surrounding treatment for in and out-of hospital cardiac arrests, the following changes have been proposed:

- Heightened emphasis on early initiation of CPR by rescuers
- Encouragement of early administration of epinephrine by appropriate medical personnel
- Use of real-time audiovisual feedback as a technique to maintain high quality CPR in hospital settings
- Limited use of double sequential defibrillation

- Recognition of the importance of a formal evaluation and assessment of victims' needs following cardiac arrest which may include support for physical, cognitive, and psychosocial wellness
- Acknowledging the stress response for rescuers and providers who provide resuscitation
- Support for maternal resuscitation in the event of cardiac arrest during pregnancy
- Adding "Recovery" to the Chain of Survival
- Acknowledging differences between causes of cardiac arrest in adult and pediatric populations

Significant updates and modifications[1,2,8,9,10,12,13]

1. Rescuers **should** initiate CPR in the presence of assumed cardiac arrest because the benefit outweighs the risk of harm if the victim is not in cardiac arrest.
2. Rescuers **should not** check for a pulse and, instead, **should** assume that cardiac arrest is present if a victim suddenly collapses OR if a victim is unresponsive and not breathing normally. The rescuer should check for a pulse for no more than 10 seconds.
3. Rescuers **should not** administer sequential defibrillation attempts as the research is unclear on the benefit of such a practice.
4. Survivors of cardiac arrest **should** undergo a multidisciplinary assessment with corresponding treatment for physical, neurologic, cardiopulmonary, and cognitive impairments. They may also require extensive discharge services including medical and rehabilitative recommendations and guidance on return-to-work and return-to-activities. It is strongly recommended that survivors and their caregivers also receive formal assessments for anxiety, depression, post traumatic stress, and fatigue.
5. Rescuers who are experiencing anxiety or posttraumatic stress **should** follow up with mental health professionals after providing resuscitation attempts.
6. Rescuers **should** prioritize oxygenation and airway management when providing resuscitation for cardiac arrest for women who are pregnant. This is because women are more prone to hypoxia during pregnancy.

7. Rescuers **should not** prioritize fetal monitoring when administering maternal resuscitation due to potential interference with high quality CPR.
8. Rescuers **should** administer 1 breath every 2-3 seconds (20-30 breaths per minute) in infants and children with a pulse but absent or poor respirations.
9. Rescuers **should** achieve a rate of 1 breath every 2-3 seconds (20-30 breaths per minute) when performing CPR in infants and children with an advanced airway. New data demonstrates that higher ventilation rates in children and infants are associated with higher rates of survival.
10. Rescuers **should** administer rescue breaths or bag-mask ventilation until spontaneous breathing resumes in victims of opioid-associated emergencies or opioid overdoses.
11. Rescuers **should** administer intramuscular or intranasal naloxone in a victim with a suspected opioid overdose who has a pulse but is not breathing normally.
12. Rescuers **should** prioritize CPR in the presence of victims who are in cardiac arrest secondary to an opioid-associated emergency or overdose.

Summary of updates for 2020:

You SHOULD:	***You SHOULD NOT:***
• Begin CPR quickly if you suspect cardiac arrest • Allow survivors of cardiac arrest to receive multidisciplinary assessments to check for physical, neurological, cardiopulmonary, and cognitive impairments • Follow up with a mental health professional after giving a resuscitation attempt • Prioritize airway management in women who are pregnant • Administer 1 rescue breath every 2-3 seconds in infants and children with a pulse but no respirations • Perform 20-30 breaths per minute in infants and children with an advanced airway • Perform rescue breaths until the victim begins to breathe on his/her own after an opioid-associated emergency • Administer naloxone in an opioid-associated emergency if the victim has a pulse but is not breathing normally • Prioritize CPR over giving naloxone if a victim becomes unresponsive during an opioid-associated emergency	• Stop and check the victim's pulse for more than 10 seconds • Give back-to-back defibrillation attempts • Prioritize fetal monitoring when performing CPR in women who are pregnant

Section 1: Before Emergency Care Is Provided[4,5,6,7,11]

An emergency occurs when an unexpected situation requires immediate action. As a licensed physical therapist or physical therapy assistant, your participation can increase the likelihood of a positive outcome should an emergent situation occur. This section provides basic first aid skills to enable you to recognize and respond appropriately to any emergency until advanced medical care can be obtained.

Emergencies can be further categorized as life-threatening and non-life-threatening. A life-threatening emergency occurs when an injury impairs a person's ability to circulate oxygenated blood to the rest of the body and will likely result in death if not attended to immediately. A non-life-threatening emergency is a situation that does not have an immediate impact on body circulation but still requires medical attention.[7]

Examples of life-threatening emergencies[7,11]

- Unresponsiveness
- Altered loss of consciousness
- Breathing difficulty
- Severe bleeding
- Heart attack or stroke
- Severe burns
- Injury to the head, neck, or spine
- Broken bones
- Suspected poisoning
- Seizures

In the first few minutes of an emergency, a trained healthcare responder can provide life-saving measures that can make a difference between life or death.[7,11] While you are not considered to be part of the emergency medical services (EMS) system, trained responders can initiate the sequence of events within the EMS system in order to provide the best care for individuals in various types of emergencies.

Your primary responsibilities during an emergency are listed below. Please refer to **Table 1.1** for a complete description of each responsibility.

1. Recognize that an emergency exists.
2. Decide to take action.
3. Activate the EMS system by calling 9-1-1.
4. Provide care until EMS arrives on scene.

Table 1.1 Responsibilities when responding to an emergency

Responsibility	***Considerations***
Recognize that an emergency exists.	Unusual noises, sights, odors, appearances, or behaviors may be the first sign of an emergency. Alert bystanders of a possible emergency and instruct them to find a First Aid kit, call emergency services, clear a path, or find an AED.
Take action.	Hesitation to respond can be attributed to panic, uncertainty, or fear of catching a disease. Overcome these fears by becoming certified, wearing personal protection equipment, and being confident in your skillset.
Activate the EMS system by calling 9-1-1	The rapid arrival of EMS services can greatly increase an individual's risk of surviving a medical emergency.[11] When possible, ask a bystander to call 9-1-1 while you initiate life-saving actions or care for the victim. The caller should always remain on the phone with the dispatcher until instructed to hang up or until advanced medical professionals arrive on the scene. Experts recommend enabling the speakerphone as you begin to assess the victim and provide life saving measures in order to minimize interruptions in care.[2]
Provide care until EMS arrives on scene.	Obtain consent when possible. Consent is implied if the person is unresponsive, confused, mentally impaired, or a minor with a life-threatening emergency without a parent/guardian present.

Emergency action steps

CHECK-CALL-CARE Principle

The three most important action steps after an emergency has been identified is to **CHECK** the scene, **CALL** for help, and **CARE** for the individual.

Some considerations when **checking** the scene are:

- Is the scene safe for you to enter?
- What other external factors may have caused the emergency? Are they still present?
- How many people were involved?
- What type of condition is the person in? Is he/she moving or motionless?
- Are any bystanders available to help?

Depending upon your observations, you may need to retrieve equipment, like a First Aid kit or automated external defibrillator (AED), or call for emergency services prior to administering life-saving care.

When **calling** for help, be prepared to offer this information to the dispatcher:

- *Your location and that of the emergency.* Provide an address, nearby intersections, landmarks, or building location if the information is available.
- The *nature of the emergency* and if other professionals, like the police, fire department, or other medical assistance is required.
- *Your telephone number* or the number of the phone that is being used
- A thorough *description of what happened* and what you witnessed
- The *number of injured* or ill people
- *Any life saving measures that were provided*

Experts recommend that you remain on the phone with the dispatcher until you are instructed to hang up or once advanced medical professionals arrive on the scene and can take over care.

What to do if you are alone:

1. ***CALL FIRST*** during cardiac emergencies
2. ***CARE FIRST*** during breathing emergencies and life-threatening bleeding emergencies

Protection from infection[4,5,6,7]

As a trained healthcare responder, ensuring your safety during any emergency situation is a top priority. Fortunately, the risk of catching a disease when providing first aid care or resuscitation efforts is extremely low.[7] Using personal protection equipment (PPE) and taking standard precautions can also reduce this risk even further.

Standard precautions are safety measures to prevent unnecessary exposure to blood and other potentially infectious pathogens when providing care. Utilizing standard precautions to infection control includes assuming that all bodily fluids and substances are potentially infectious.

These practices include personal hygiene, using PPE, and using proper equipment for cleaning or disinfecting contaminated surfaces. Following these precautions can prevent transmission of bloodborne pathogens that may be spread from person to person through direct or indirect contact transmission.

Use of PPE is encouraged for all healthcare providers in order to protect them from injury, exposure, or infection while administering life-saving care. PPE protocols can vary based upon situations and availability and can include a combination of items including gloves, eye protection, gowns, high-visibility clothing, footwear, and safety helmets. According to the Red Cross, “responders [should] use appropriate PPE when giving first aid care, if PPE is available and circumstances allow.”[11]

Latex gloves are commonly used articles of PPE, however, many individuals develop allergic reactions to protein found in latex. As a result, use of latex-free gloves should be prioritized when providing care or if there is an open wound on your hand. Gloves should be removed using this technique to avoid contamination with your own skin or external environment:

1. Pinch the palm of one glove on the outside near your wrist
2. Pull the glove towards your fingertips as you turn it inside out. Pull it off your hand.

3. Hold the discarded glove in the palm of your still-gloved hand.
4. Carefully place two fingers inside the glove, near the wrist. Avoid touching the outside of the glove.
5. Pull the inside of the glove towards the fingertips as you turn it inside out. The other glove should be inside.

Wearing gloves does not eliminate the importance of handwashing techniques to prevent the spread of disease. If soap and water are not available, then use an alcohol-based hand sanitizer. Proper hand hygiene can prevent disease transmission and should be prioritized over hand sanitizers if your hands are visibly soiled.

Breathing barriers can be used to provide rescue breaths and protect you against inhaling the air that the individual exhales. The most commonly used breathing barrier is a face shield, which is a thin piece of plastic that is placed over the person's face with the opening over the mouth. The opening contains a valve that prevents contact between body parts. It is important to use a breathing barrier that is appropriately sized for the individual.

First Aid Kit[7]

Prepare for the unexpected by keeping a fully-stocked first aid kit in your home and vehicle. Always know the location of the first aid kit and automated external defibrillator (AED) in your workplace.

The Red Cross recommends the following items in a First Aid Kit7 as described in Table 1.2:

Table 1.2 First Aid Kit items

Item	***Quantity***
Disposable Latex-free gloves	2 pairs
Latex-free bandages: 1x3 in, ¾x3 in, large fingertip, knuckle	3 each
Sterile gauze pads (2x2 and 4x4)	8
Adhesive cloth tape	1 roll
Roller bandages (2-3 in by 4 yards and 4 in by 4 yards)	4
Elastic bandage (3-4 in x 5 yards)	1
Triangular bandages	3-4
36-in malleable radiolucent splint	1
Antibiotic ointment, cream, or wound gel	1
Plastic bags	4
Antiseptic wipes	5
Hydrocortisone ointment packs	2
Chewable aspirin 81 mg each	2
Space blanket	1
CPR breathing barrier with 1 way valve	1
Scissors	1
Oral thermometer	1
Tweezers	1
First aid manual	1

Taking action in an emergency

Upon recognizing that an emergency may be occurring, you will need to decide upon some type of action, which may be easier said than done.

Understanding the best course of action in the face of an emergent situation can be stressful and frightening. For some, taking action may induce panic, uncertainty, or fear for various reasons. However, as a healthcare provider, it is important to realize that your decisive actions can make the difference between life and death for the person in danger. Regardless of whether or not you decide to take action, you should contact emergency medical services immediately.

Hesitation to act in an emergency can stem from different sources. Common reasons for not acting may include:

- Panic
- Lack of confidence in lifesaving skills
- Uncertainty that a medical emergency exists
- Fear of providing inappropriate care or causing the person more harm
- Assuming that the situation is under control
- Squeamishness to adverse sights, smells, or sounds
- Fear of catching a disease
- Fear of litigation

Legal Considerations[7]

Bystanders cite a fear of being sued as a strong deterrent to taking action in an emergency.[7] For this reason, a majority of the states have implemented Good Samaritan laws (Refer to Table 1.3) to protect individuals against claims of negligence when providing emergency care in good faith. Also, it is reassuring to know that lawsuits against responders are unusual and rarely successful in court.

Table 1.3 More Information on Good Samaritan Laws

Note that these laws will vary from state to state.

What it does	Protects responders from financial liability when acting to help others in emergency situations. It usually only protects respondents who act in a reasonable manner.
What it requires	Volunteers must use common sense and a reasonable skill level and only provide emergency care for which the responder is trained.
Who it protects	Any individual who volunteers to aid a person who is injured, ill, or in danger. Action must be voluntary (without expectation, reimbursement, or compensation) for legal protection
Who it does NOT protect	Responders who act in a negligent or reckless manner Responders who abandon care for an invalid reason

There are some crucial steps that you must take prior to administering emergency care. By following these steps, you can decrease the risk of a lawsuit even further.

1. **Obtain consent from the injured individual or parent/guardian if the person is a minor.**

   Consent is implied for someone who is unresponsive, confused, mentally impaired, or if a minor's parent/guardian is not present. If, at any point, the individual withdrawals consent, then emergency care must be immediately stopped in order to respect the person's wishes.

   To obtain consent:

   a. State your name

   b. State the type of training that you have

   c. Explain what you think may be wrong

   d. Explain how you may help and what you plan to do

   e. Ask for permission to help

2. **Follow through with emergency care.**

   Once you have begun emergency care, you are legally obligated to continue until (1) someone with equal or higher training can relieve you, (2) you are physically unable to continue, or (3) the individual refuses care. If, at any point, you

discontinue care without a valid reason, then you may be at risk for legally abandonment of a person in need.

Responder Stress[7]

It is not uncommon to experience acute stress after responding to an emergency involving a serious illness, injury, or fatality. Signs and symptoms of responder stress reactions may appear immediately whereas others may develop later. If left untreated or ignored, acute stress may lead to post-traumatic stress disorder.

Common effects of responder stress may include:

- Anxiousness
- Difficulty sleeping or nightmares
- Restlessness
- Confusion
- Decreased attention span
- Poor concentration
- Denial
- Guilt
- Depression
- Anger
- Nausea
- Loss or change in appetite
- Uncharacteristic behavior
- Difficulty performing job responsibilities

Learning how to cope with responder stress might require professional help. Other strategies to address responder stress include eating a well-balanced diet, reducing stress, avoiding alcohol and drugs, and engaging in physical activity.

Chain of Survival[4,7,10,11,12]

The term, Chain of Survival, was designed by the American Heart Association to describe the elements of emergency cardiovascular care. It depicts the actions that must be taken in order to provide victims of cardiac arrest the best chance for survival. Each concept is an individual action that is connected to the step that precedes and follows it. Failure to follow the Chain of Survival will diminish a person's chance for surviving cardiac arrest.

Cardiac arrest occurs when the heart (1) stops beating or (2) has ineffective beats that do not adequately circulate blood to the brain and other organs. It can happen suddenly, without warning, and may occur as a result of cardiovascular disease, respiratory distress, drowning, choking, severe trauma, electric shock, or overdose. A person who is in cardiac arrest will not be responsive, breathing, or have a heartbeat.

The terms heart attack and cardiac arrest are commonly intertwined, but each has its own origin and treatment trajectories. A heart attack is caused by an interruption in blood flow in which a blockage or spasm in an artery restricts the flow of oxygenated blood to the cardiac muscle. Cardiac arrest, as described above, occurs as a result of an abnormal rhythm.

Risk factors for cardiac arrest include heart disease, which is the leading cause of the death in the United States.[12] Basic life support can take action against someone who suffers from cardiac arrest by recirculating oxygenated blood flow and minimizing damage to the heart, brain, and other vital organs due to a lack of oxygen. The techniques utilized in basic life support are founded in the Chain of Survival and based upon current empirical data to maximize positive outcomes and mortality.[1,2]

The key difference between adult and pediatric Chains of Survival (refer to Figures 1.1 and 1.2, respectively) is attributed to the precipitating event that requires the chain of events to be initiated.

- In adults, the most common cause for activating the Chain of Survival is a c*ardiac event* that causes cardiac arrest.
- In children, the most common cause of activating the Chain of Survival is *respiratory shock or failure* that causes cardiac arrest.

Prevention of cardiac arrest is the first link in the Pediatric Chain of Survival since most cases are secondary to respiratory failure or shock. Thus, the first link in the Pediatric Chain of Survival indicates "prevention" as opposed to the Adult Chain of Survival that

emphasizes preparation in addition to preventing cardiac events. Although there are minimal differences in the Chains of Survival depending on the victim's age, both processes include similar components with the main objective of increasing the person's chances of surviving cardiac arrest.

Figure 1.1 Chain of Survival for Adults

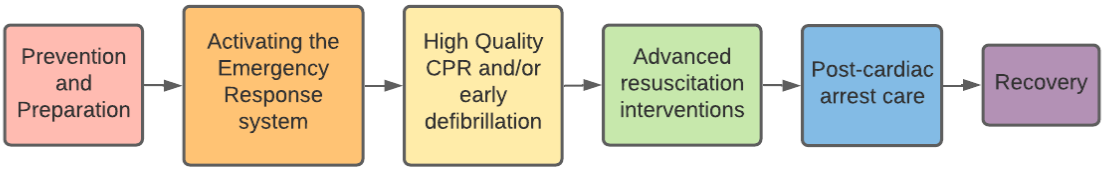
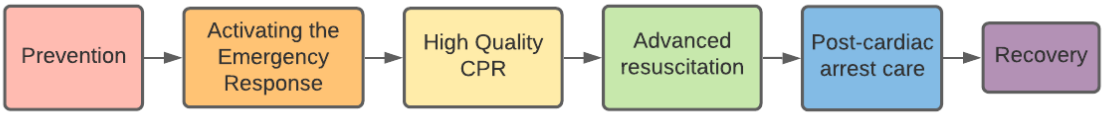


Figure 1.2 Pediatric Chain of Survival for Pediatrics



Finally, actions in the Chains of Survival can differ according to setting, but the main objective and elements remain the same. Table 1.4 illustrates such differences; refer below for an in-depth comparison of the Chains of Survival for hospital and out-of-hospital situations.

Table 1.4 A Comparison of the Chains of Survival for hospital and out-of-hospital situations

	Hospital	Out-of-hospital

Prevention and preparation	Preparation is the foundation of early recognition of cardiac arrest and rapid response in acute settings. Early recognition and response to patients who may need resuscitation, especially following serious respiratory or circulatory conditions, is essential. Vigilant healthcare providers can predict, and possibly prevent, many cardiac arrests through observation, preventative care, and early treatment.	Successful outcomes are dependent upon immediate recognition in the first few minutes after cardiac arrest. Because many cardiac arrests in adults occur unexpectedly and within a home environment, it is imperative that rescuers are prepared to administer high quality CPR and rapid defibrillation. Organized community programs can prepare the general public to know how to respond quickly to emergency situations that may involve cardiac arrest. Preparation also includes measures to improve public awareness and training so that members of the general public are confident in their abilities to recognize the signs of a heart attack or cardiac arrest and take effective action immediately.
Activating the emergency response system	Activating the hospital emergency response system is specific to each institution. A provider should be aware of methods to activate a code, summon the rapid response team, or call for help.	Usually involves shouting or calling for help and emergency medical services.

High-quality CPR, including early defibrillation	High quality CPR without interruptions and early defibrillation are associated with positive outcomes. High quality CPR should be initiated immediately after recognizing the onset of cardiac arrest and, when combined with early defibrillation, can increase chances of survival. These time-sensitive interventions can be provided by healthcare providers and members of the public. Bystanders who are not trained in BLS should perform hands-only chest compressions with guidance from the dispatch when the emergency medical service is activated.	
Advanced resuscitation interventions	Advanced interventions may include obtaining vascular access, medications, or placing an advanced airway. Such measures should only be performed by those with advanced medical training in those procedures.	
Post–cardiac arrest care	Will be provided by a multidisciplinary team at an advanced level of care. Providers focus on preventing any recurrence of cardiac arrest.	May include routine critical care support and blood pressure management.
Recovery	Recovery is specific to each individual and may require lifestyle changes to prevent reoccurrence of cardiac complications. Interventions may be required to address the underlying cause of cardiac arrest. Victims and family members may require psychological support, rehabilitation for physical, neurological, cardiopulmonary, and cognitive impairments, or comprehensive discharge planning to enhance community re-integration and return to activity/work expectations.	

Section 1: Key Words

Emergency - occurs when an unexpected situation requires immediate action

Life-threatening emergency - an injury that impairs a person's ability to circulate oxygenated blood to the body and will likely result in death if not attended to immediately

Non-life-threatening emergency - a situation that does not have an immediate impact on body circulation but still requires medical attention

Emergency medical services (EMS) system - a system that provides emergency medical care to individuals following an incident that causes serious illness or injury

CHECK-CALL-CARE Principle - outlines the three most important steps that should be taken after an emergency has been identified

Automated external defibrillator (AED) - a life saving medical device that is used to help those who experience sudden cardiac arrest

Personal protection equipment (PPE) - equipment worn to minimize exposure to hazards that cause serious injuries, illness, or disease that result from contact with chemicals, radiological, physical, electrical, mechanical, or other hazards.

Standard precautions - safety measures to prevent unnecessary exposure to blood and other potentially infectious pathogens when providing care.

Breathing barriers - flat, plastic barrier that lays across the mouth and nose to allow the rescuer to provide rescue breaths without coming into contact with the victim's skin

Good Samaritan laws - state laws that protect individuals against claims of negligence when providing emergency care in good faith

Cardiac arrest - occurs when the heart stops beating or has ineffective beats that do not adequately circulate blood to the brain and other organs

Section 1: Clinical Scenario

You are in the parking lot of the mall when you hear someone shouting, "There's something wrong with my baby!" You look around and see a woman kneeling next to a small child who is lying face-up on the pavement.

1. What is the first step that you should take as a healthcare provider who is certified in Basic Life Support and cardiopulmonary resuscitation?
2. Provide 3-4 questions that you may have prior to determining the best course of action for the child in need.
3. How would you gain consent in this clinical scenario?
4. Which link in the Pediatric Chain of Survival would be activated by your decision to help?

Section 1: Summary

- This course is designed to inform physical therapists and physical therapist assistants of their responsibilities as a healthcare provider when administering basic life support and CPR skills to individuals in emergency situations.
- Many factors can affect one's decision to administer life-saving care, however, at the very least, the clinician should alert emergency medical services.
- When alone in a medical emergency, the rescuer should recall the CHECK-CALL-CARE Principle to **CHECK** the scene, **CALL** for help, and **CARE** for the individual.
- If possible, the rescuer should don personal protection equipment and identify the closest AED and First Aid Kit prior to administering care.
- Rescuers may be hesitant to provide care but should not fear legal retaliation due to Good Samaritan Laws that protect the respondents in each state.
- Healthcare providers can play a critical role in activating the Chain of Survival when responding as a bystander in a life-threatening emergency.

Section 2: CPR and AED for adults, children, and infants

In Section 2, you will learn high-quality CPR skills for adults, both as a single rescuer and as a member of a team. Adult CPR skills should be administered for victims who are of adolescent age and older.

Later in the section, you will review and master skills and concepts to prepare you to provide high-quality CPR to an unresponsive child or infant.

You will also gain critical knowledge in the utility and operation of an AED for adults and children.

Important concepts to be reviewed in this section are: high performance rescue teams, the components of CPR, and learning the steps to perform CPR and administer AED as a single or team rescue for an unresponsive individual.

- High performance rescue teams are coordinated efforts by several rescuers who perform various components of CPR during a resuscitation attempt. Performing CPR as part of a high-performance rescue team has been shown to increase the victim's chances for survival.[12]
- When alone, a single-rescuer who is present at the scene of a potential emergency should follow the steps outlined in Table 2.1.

In the event of an emergency when two (or more) rescuers are present, one rescuer should coordinate the actions of the team. Because every second counts during a resuscitation attempt, it is important that each team member is aware of his/her roles and responsibilities. To avoid miscommunication, utilize these strategies when performing as part of a high performance rescue team:

- Use closed-loop communication that involves verbalizing a message, repeating it back, and confirming the message. In doing so, this technique can prevent misunderstandings and errors.
- Make eye contact when instructing members of the team.
- Confirm an instruction after it has been assigned and acknowledge its completion to the team.
- Use clear and concise language.
- Speak loudly for everyone to hear.
- Use a calm and affirmative tone of voice that models respect for all members of the team.

Table 2.1 One rescuer decision tree for adult victims[12]

Step 1	**Verify scene safety.** Move the person out of immediate danger (traffic, water, etc.) while avoiding injury to yourself.
Step 2	**Check for responsiveness.** Tap the victim on the shoulders while shouting, “Are you OK?” If the victim is unresponsive, then activate the emergency response system and instruct a bystander to find an AED. If no one is in sight, grab the AED yourself.
Step 3	If the victim is breathing normally and a pulse is felt, then monitor the victim. If the victim is not breathing normally but a pulse is felt, then provide rescue breathing at a rate of 1 breath every 6 seconds, or 10 breaths per minute. Check for a pulse about every 2 minutes. Perform high-quality CPR if you do not feel a pulse. If the victim is not breathing normally or is only gasping and has no pulse, begin high-quality CPR (Step 4).
Step 4	**Start high-quality CPR**, with 30 chest compressions followed by 2 breaths.
Step 5	**Use the AED as soon as it is available**. Follow the AED directions to check the rhythm.

Step 6	If the AED detects a shockable rhythm, give 1 shock. Resume CPR immediately until prompted by the AED to allow a rhythm check, about every 2 minutes. **Continue CPR and use the AED until advanced life support providers take over** or the victim begins to breathe, move, or otherwise react. If the AED detects a non-shockable rhythm, resume high-quality CPR until prompted by the AED to allow a rhythm check, about every 2 minutes. Continue CPR and use the AED until advanced life support providers take over or the victim begins to breathe, move, or otherwise react.

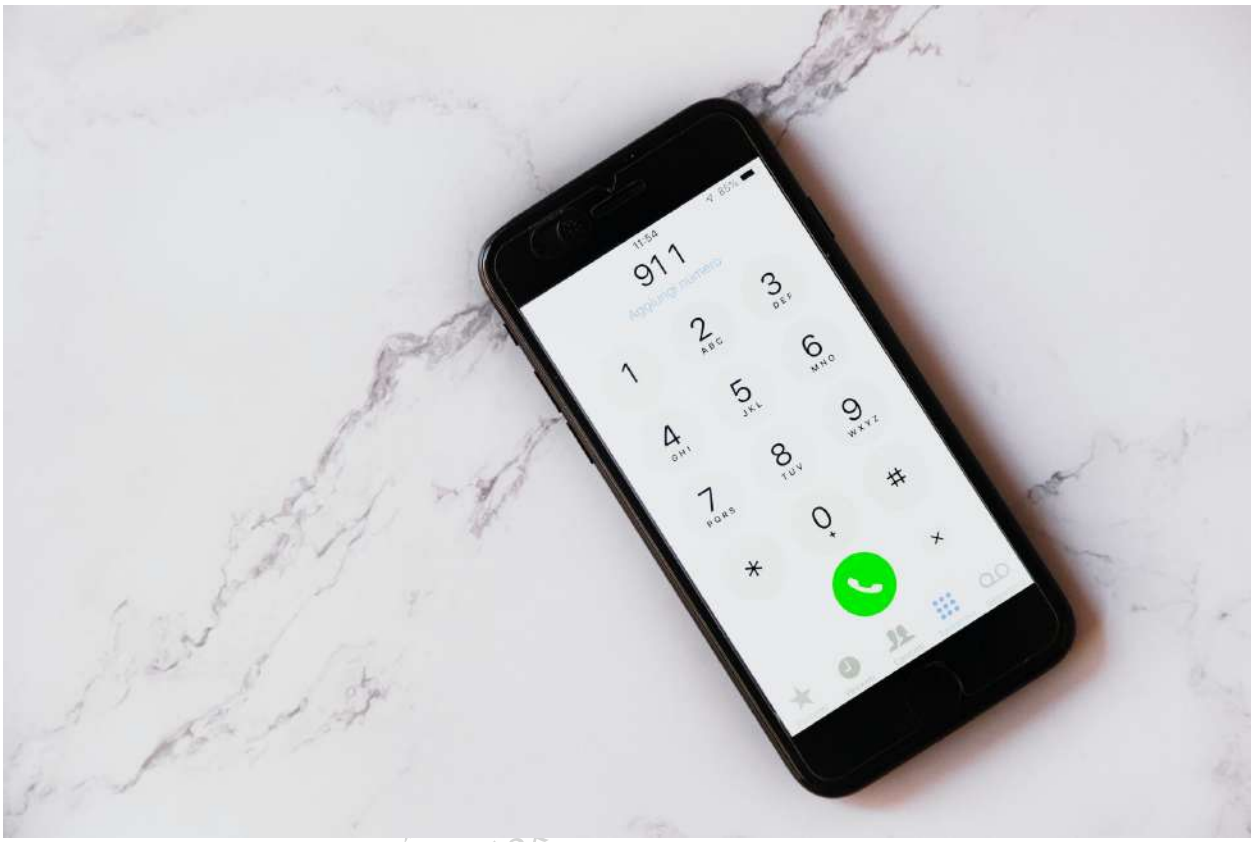
CPR for adults

Assess Breathing and Pulse in Adults[10,12]

After checking the victim for responsiveness, the next step is to assess the victim for normal breathing patterns and a pulse. Minimize the delay in providing emergency care by assessing the victim's breathing pattern and pulse concurrently. This should take 5-10 seconds, but no more than 10 seconds.[12]

1. **Checking breathing pattern**
    a. Scan the victim's chest for the rise and fall of a breathing pattern for no more than 10 seconds.[12]
    b. If the victim is not breathing, then prepare to administer high-quality CPR. Gasping is not considered to be normal breathing.
2. **Checking pulse**
    a. Feel for the carotid pulse on the side closest to you using two fingers.
    b. If you do not feel a pulse within 10 seconds, then begin high-quality CPR by starting with chest compressions.[12]

While you do this, instruct a bystander to activate the emergency response system and retrieve the AED. If alone, experts strongly recommend that you should dial 9-1-1 by using the hands-free option on the mobile phone and immediately begin CPR with dispatcher assistance.[2,9]



High Quality Chest Compressions for Adults[7,10,11,12]

High quality chest compressions are the foundation of CPR and serve to recirculate blood from the heart to the brain to the rest of the body. It is vital to limit interruptions in chest compressions as this can severely restrict blood flow from the heart to the brain and other vital organs.

Table 2.2 Quick Compression Reference for Adults

Compression to ventilation ratio	Compression rate	Compression depth
30 compressions to 2 breaths	100-120 per minute	At least 2 inches (5 cm)

When to initiate high quality chest compressions: (1) when a victim is not breathing normally or (2) a victim is gasping for breath and does not have a pulse

How to position the victim: supine on a firm, flat surface

Note: When you are providing high quality chest compressions within an inpatient hospital setting, activate the hospital bed's CPR mode. Experts caution against moving the patient from the bed to the floor as this will delay lifesaving care.[2,9,12]

Chest recoil: You must allow the chest to recoil completely after each compression is administered in order to allow adequate blood refill back into the heart's ventricles. To avoid the temptation to engage in compressions before the chest recoils, do not lean on the chest between compressions. Also, it is critical to minimize interruptions between chest compressions or as rescuers switch roles as this is associated with poor health outcomes.

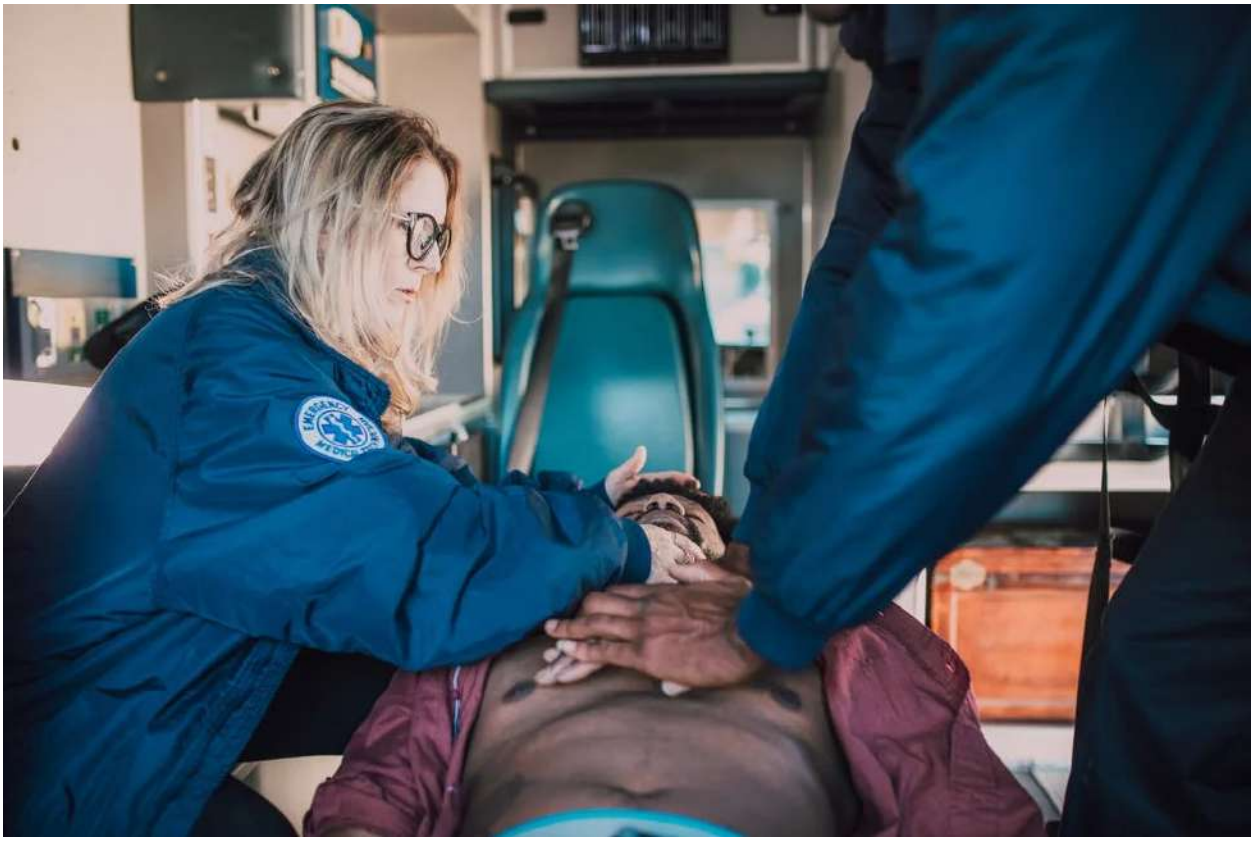
1-person technique to performing high quality CPR for adults[7,10,11,12]

1. Place the heel of one hand on the lower half of the sternum in the middle of the chest. Place your other hand directly on top of the other hand.
2. Stand (or kneel) at the victim's side as you press directly down into the victim's chest with straight arms to administer compressions. Compressions should be at least 2" deep at a minimum rate of 100 compressions per minute.
3. Allow the chest to recoil completely between each compression. Leaning on the chest between compressions can prevent the heart from refilling between compressions thus making them ineffective.
4. After 30 compressions, stop and administer 2 rescue breaths. Be sure to open the airway by tilting the head and lifting the chain. Use the jaw thrust maneuver if you suspect a cervical injury.
5. Give one breath while watching the chest rise and fall. Repeat again.
6. Immediately resume chest compressions within 10 seconds of providing the second rescue breath.

Note: once you begin to administer high-quality CPR and chest compressions, you are expected to continue until advanced medical personnel arrive on the scene to relieve you, another bystander can take over, or you are alone and physically unable to continue. One option to consider is to provide chest compressions with the heel of your foot while standing above the victim. This may also be an alternative position for those who are unable to kneel or have wrist/elbow conditions that prevent them from successfully performing effective and high-quality chest compressions.

2-person technique to performing high quality CPR for adults[10,12]

Oftentimes, there will be another individual at the scene of an emergency who can act as a second rescuer. Expert guidelines recommend delegating the task of calling emergency response services to the second rescuer and finding the AED as you (Rescuer 1) immediately begins high-quality chest compressions.



Follow these steps to administer high quality CPR for adults when 2 rescuers are available:

1. Rescuer 2 prepares the AED while Rescuer 1 (you) stands or kneels at the victim's side and begins chest compressions. Count each compression aloud.

2. Rescuer 2 attaches AED pads and provides 2 rescue breaths while standing at the victim's head.
3. Rescuer 2 takes over chest compressions after every five cycles of compressions and breaths or every 2 minutes. 1 cycle is 30 compressions and 2 breaths. Rescuer 1 takes over rescue breaths and moves to the head of the victim.
4. Quickly transition between rescuers when performing compressions to minimize interruptions. Avoid leaning on the chest between compressions to allow the heart to refill between each compression. Rescuers who become tired may tend to lean on the chest, and switching roles can minimize this behavior.
5. Once the rhythm is detected and analyzed, the rescuers should follow the prompts provided by the AED. If a shock is indicated, then all rescuers should stand aside until the AED has completed the process. Resume CPR as soon as possible, beginning with high quality compressions, and minimize interruptions in care.

Providing rescue breaths in adults[7,11,12]

Rescue breaths provide oxygen to a victim who is unable to breathe or has a poor breathing pattern. Inhaled air contains about 21% oxygen whereas exhaled air contains about 17% oxygen.[10]

Respiratory arrest occurs when normal rhythmic breathing ceases and prevents oxygen and carbon dioxide exchange. If one's breathing pattern is interrupted for too long and oxygen cannot reach the brain, the person will be rendered unresponsive. Signs indicative of respiratory arrest include:

- Unresponsive to stimuli
- Not breathing
- Gasping for air
- A palpable pulse

Respiratory arrest is considered to be a medical emergency requiring immediate treatment to avoid an anoxic brain injury, cardiac arrest, or death. Early interventions for respiratory arrest can prevent the development of cardiac arrest secondary to respiratory complications.

In adult victims who are not breathing but have a pulse, rescue breaths should be provided at a rate of 1 breath per every 6 seconds. The rescuer should watch the chest rise and fall before performing the next rescue breath. After 2 minutes, the rescuer should recheck the victim's pulse and administer CPR if necessary.

Table 2.3 Quick Reference for Rescue Breaths in Adults

	Ratio	Technique	Considerations
During CPR	1 breath per second for a total of 2 breaths	Rescue breath, watch chest rise and fall, rescue breath. Resume compressions	Resume chest compressions within 10 seconds of delivering the second rescue breath.
Rescue breaths only	1 breath every 6 seconds	Rescue breath, watch chest rise and fall, rescue breath.	Check pulse every 2 minutes.

Technique for administering rescue breaths[7,11,12]

1. Open the victim's airway by tilting the head back and lifting the jaw with your index and middle fingers. This is known as the head-tilt maneuver.
2. *Considerations*: Do not perform the head tilt maneuver if you suspect a cervical injury. Use the jaw-thrust maneuver in which you grasp the angles of the lower jaw and lift with both hands. This moves the jaw forward so that you may provide rescue breaths.
3. Position yourself at the side of the victim.
4. If available, place a barrier device correctly on the victim's face. Be sure to seal the device completely against the victim's skin.
5. Deliver one rescue breath per second and allow for the chest to completely rise and fall. Repeat by delivering a second rescue breath.
6. Quickly transition back to performing chest compressions if administering rescue breaths as part of high quality CPR measures.

What to do if the chest does not rise between rescue breaths[12]

Ask yourself the following questions if you do not observe the chest rise and fall between rescue breaths:

1. **Was the airway opened properly?** Retilt the chin to ensure that the airway is adequately open.
2. **Was the victim's nose and mouth properly sealed?** Check your hand placement around the victim's nose and mouth.
3. **Is an object blocking the airway?** If the second breath does not make the chest rise, then an object may be blocking the airway. Never attempt more than 2 rescue breaths between compression sets.11 Immediately initiate high-quality chest compressions as this may force the object out of the victim's airway. After a set of compressions, open the victim's mouth and observe for an object. Use a finger sweeping method to remove it. Never perform a blind finger sweep if you do not see the foreign body that is obstructing the airway.

Barrier devices for rescue breaths[11,12]

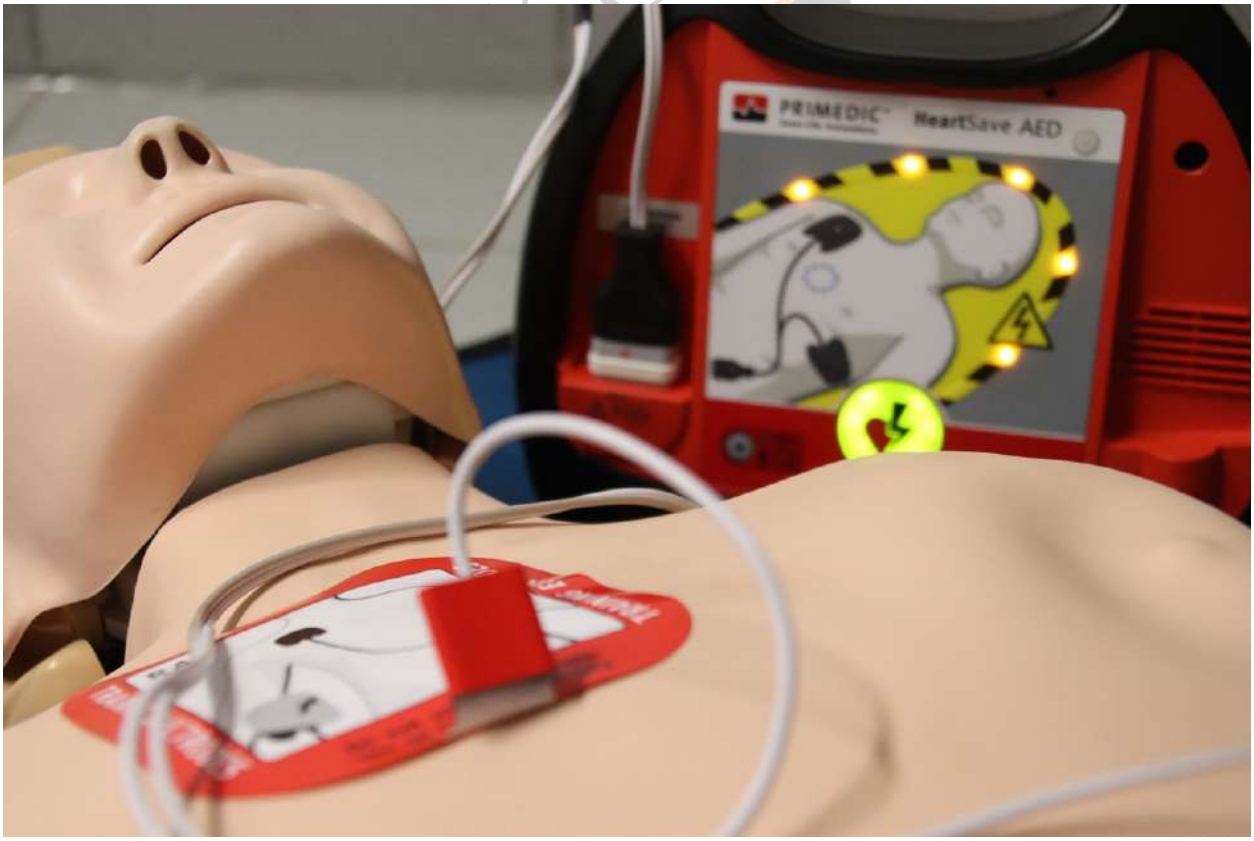
Barrier devices can be used as a standard precaution for rescuers who are administering rescue breaths. Although infection from life saving care is highly unlikely, the US Occupational Safety and Health Administration recommend their use whenever possible.10

1. **Pocket masks** allow the rescuer to administer rescue breaths to the victim through a one-way valve that diverts exhaled air, blood, or body fluids away from the rescuer.
    a. Pocket masks come in various sizes for adults, children, and infants and must properly fit the face of the victim in order to be effective.
    b. They are ideal for single rescuer scenarios because rescue breaths and compressions can be administered while remaining at the victim's side.
    c. To seal the mask against the victim's face: take the hand that is closest to the victim's hair and place your index finger and thumb along the top edge of the mask, forming the letter "C." Place your other thumb along the bottom edge of the mask and use the index and middle fingers to lift the jaw for the head tilt. This hand placement is known as the E-C technique.

(this photo shows the E-C hand placement for a rescuer while using the bag mask during a 2 person rescue.)

2. **Bag-mask devices** consist of a bag that is connected to a face mask.
    a. They come in various sizes for adults, children, and infants and must properly fit the face of the victim in order to be effective.
    b. Bag masks are ideal for 2-rescuers but can be performed by a 1-rescuer.
    c. To use a bag-mask device with 1-rescuer, position yourself directly above the victim's head. Place the mask on the victim's face and create a tight seal while you lift the jaw to hold the airway open. The narrow position of the mask should be positioned at the bridge of the nose. Then, squeeze the bag to provide one rescue breath while watching for chest rise.
    d. To use a bag-mask device with 2-rescuers, one rescuer should create a tight seal while the second rescuer provides the rescue breaths. Rescuer 1 should be positioned above the victim's head to hold the seal in place. Rescuer 2 should be stationed at the victim's side to squeeze the bag.

AED Application for adults and children ages 7 and over[7,11,12]



An Automated External Defibrillator (AED) is a lightweight portable medical device that identifies heart rhythms and can produce a shock to restore normal sinus rhythm. It can recognize abnormal heart rhythms, like ventricular fibrillation, that can lead to cardiac arrest. Treatment for heart dysrhythmias is defibrillation that produces an electric shock to the heart through the chest wall. In doing so, the shock attempts to stop the disorganized rhythm and allow the heart to resume sinus rhythm. In a witnessed cardiac arrest, the most common cause of cardiac arrest is likely to be ventricular fibrillation in which a defibrillator should immediately be located and utilized to ensure a positive outcome.

Importance of using an AED: when used properly, an AED can increase one's chance of survival from cardiac arrest that is caused by abnormal heart rhythms. Many large venues have accessible AED units for public use, and the AED has become a common sighting in most facilities.

How does it work: the device identifies the victim's heart rhythm as "shockable" or "nonshockable" and provides treatment recommendations accordingly. For "shockable" rhythms, the device administers defibrillation in an attempt to restore normal heart rhythm. Its foolproof process includes voice prompts, easy-to-read instructions, and necessities for use.

Set-up: Place the device next to the rescuer who will operate it. Clothing should be removed from the victim's chest, and chest hair should be shaved prior to placing the AED pads. AED pads will need to be placed directly against the victim's skin.

Pad placement:

Option 1: Pad 1 should be placed directly below the right collarbone, Pad 2 is placed to the side of the left nipple. When in doubt, follow the illustrations on the pads.

Option 2: Pad 1 between the left nipple and breastbone, Pad 2 on the left side of the back next to the spine. When in doubt, follow the illustrations on the pads.

Figure 2.1 Operating an AED[11,12]

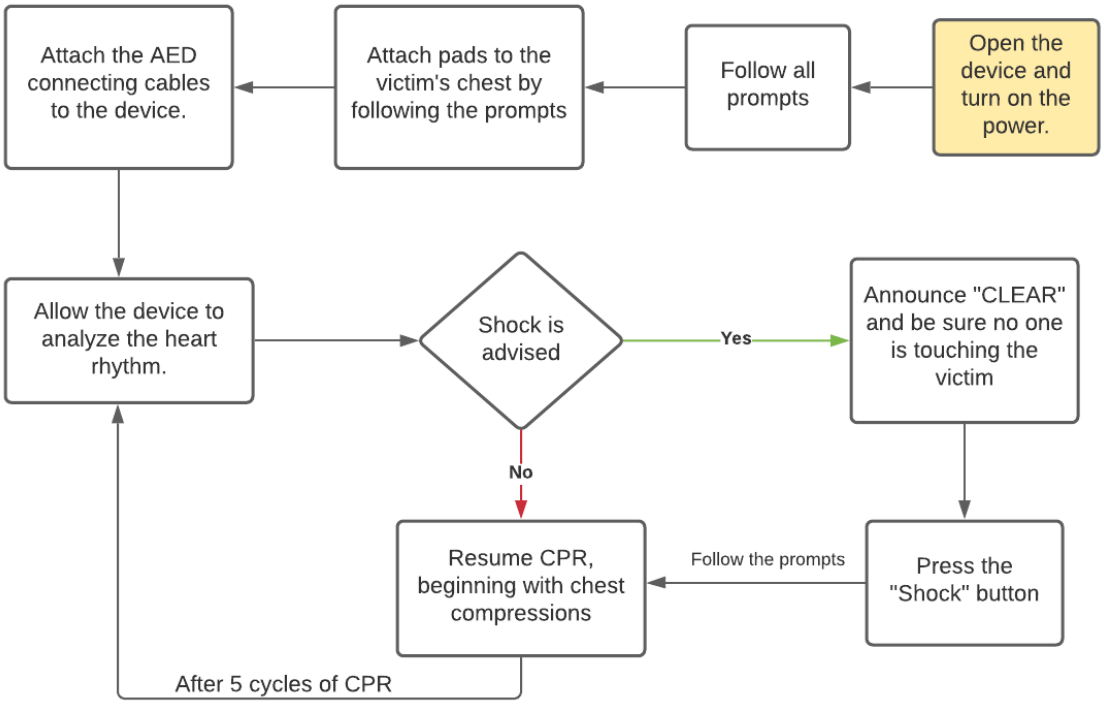
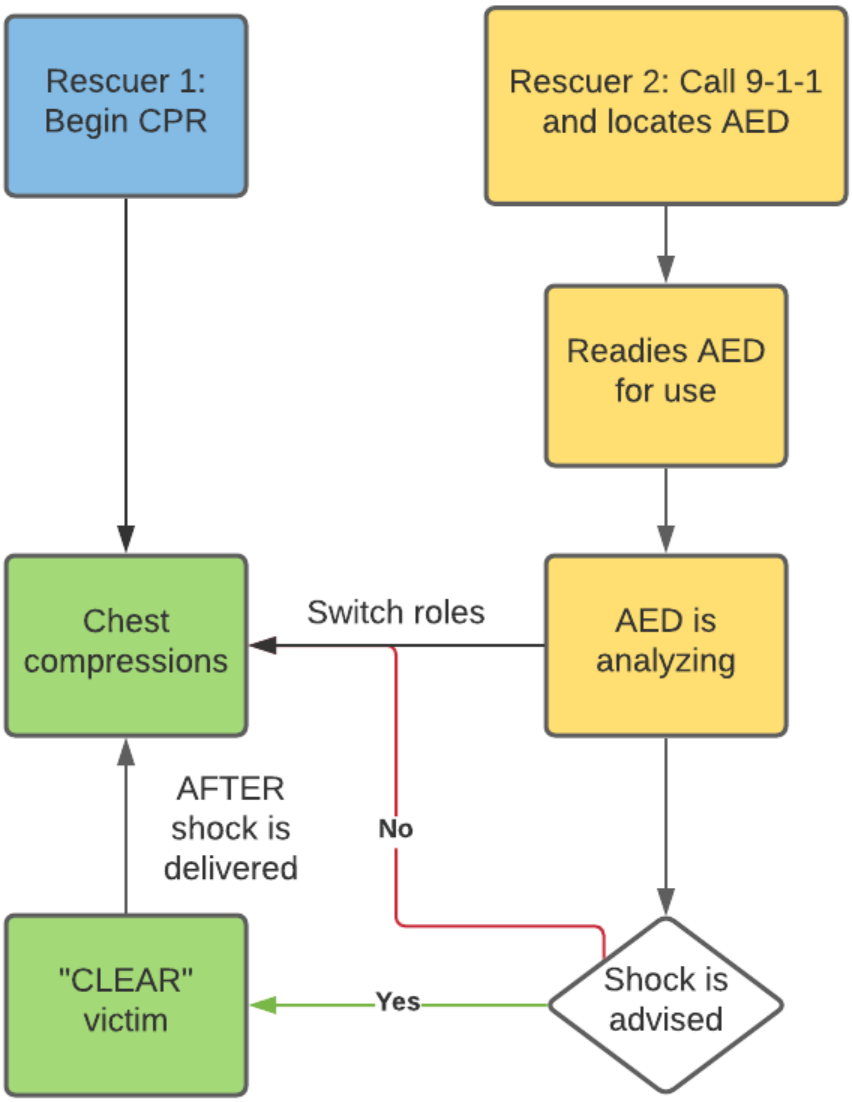


Figure 2.2 Two-rescuer CPR and AED decision tree[10,12]



AED Considerations

- AED pads should be placed directly against the victim's skin. Avoid contact with clothing, hair, medication patches, and implanted devices. When in doubt, place the pads as illustrated on the packaging.
- Use appropriately sized pads according to the victim's age and size. Do not apply child pads onto an adult as this will likely deliver a low shock dose that is ineffective for most adults. Child pads should be used on individuals up to eight

years of age or those who weigh less than 55 pounds. If you are unsure as to the victim's exact weight or age, observe for signs of puberty which would be an indication to use adult pads. Alternatively, do not use pediatric pads or equipment on an adult or child greater than eight years old. Child pads deliver a shock dose that is too low for adults and will most likely not be successful. It is better to provide high-quality CPR than to attempt to shock an adult with pediatric pads.

- If the victim is wet, then quickly dry the chest before placing the AED pads. Water and other liquids will conduct electricity and affect the effectiveness of the AED. If the victim is covered in water, quickly pull the victim out of the water and wipe the chest before placing the pads. It is okay to leave the victim in a small puddle or pile of snow, as long as the chest is dry.
- Chest hair should be shaved prior to placing the pads on the chest or upper back. AED pads will not adhere to chest hair and interfere with the device's ability to analyze the victim's heart rhythm. If a razor is not available, use a second (spare) set of pads to remove the hair (similar to a waxing technique).
- Do not place AED pads directly over an implanted medical device, like a pacemaker. The implanted devices may interfere with the shock delivery of the AED. You can easily identify if a victim has an implanted medical device by looking for a hard lump beneath the skin on the left side of the upper chest wall. It may also be found on the right upper chest wall or abdominal area. Place the AED pad at least one inch away from the implanted medical device.
- Do not place AED pads directly on top of a medication patch as this may interfere with the delivery of the shock or cause a small superficial burn to the skin. If possible, remove the patch, wipe the area, and attach the AED pad.
- It is safe and recommended to apply the AED pads onto women who are pregnant.

CPR for infants (less than one year of age) and children ages 1-8[4,10,11,12]

As discussed earlier in the section, a common cause of cardiac arrest in children and infants is respiratory distress or complications from a respiratory dysfunction. Infants and children who suddenly develop cardiac arrest may have underlying respiratory failure or shock that decreases the blood's oxygen content before the arrest occurs. In these situations, high quality chest compressions may not be enough to perfuse the heart and brain and should be accompanied by rescue breaths. Therefore, it is vitally

important that infants and children receive both high quality compressions and rescue breaths during life saving care.

Assess Breathing and Pulse[10,12]

After checking the child for responsiveness, the next step is to assess for normal breathing patterns and a pulse.

Minimize the delay in providing emergency care by assessing the child's breathing pattern and pulse concurrently. This should take 5-10 seconds, but no more than 10 seconds.[12]

1. Checking breathing pattern
    a. Scan the child's chest for the rise and fall of a breathing pattern for no more than 10 seconds.[12]
    b. If the child is not breathing, then prepare to administer high-quality CPR. Gasping is not considered to be normal breathing.
2. Checking pulse
    a. *Infants*: Feel for the brachial pulse by placing two fingers on the inside of the upper arm. The brachial pulse can be palpated on the inside of the upper arm, midway between the infant's elbow and shoulder.
    b. *Children*: Feel for a carotid or femoral pulse. The femoral pulse can be palpated by placing 2 fingers on the inner thigh, midway between the pubic symphysis and the crease where the leg meets the torso.
    c. If you do not feel a pulse within 10 seconds or observe a pulse less than 60 beats with signs of poor perfusion, then begin high quality CPR by starting with chest compressions.[12]

Signs of poor perfusion that may indicate the need for high quality CPR in children and infants

- Extremities that are cool to the touch
- Changes to the victim's mental state
- Altered consciousness
- Weak peripheral pulses

- Patchy appearance and/or cyanosis

Rescue Breaths in children and infants

- In order for rescue breaths to be effective, the child's airway must be open. When opening the airway in children and infants, rescuers should use the head tilt-chin lift and jaw-thrust maneuvers that are recommended for adults. In the absence of a neck injury, use the head tilt maneuver.
- Be mindful that, in infants, extending the infant's head beyond the neutral position during the head tilt-chin lift maneuver can block the airway. Avoid this by positioning the infant's external ear canal in line with his/her shoulder.
- Each rescue breath should last 1 second and cause the chest to rise. When administering rescue breaths only, provide 1 breath every 2-3 seconds while watching for the child's chest to fully rise and fall. When performing rescue breaths as part of high quality CPR, then deliver 2 rescue breaths after every 30 compressions.
- When using a barrier device, ensure that the mask is the correct size for the child. It should fully cover the child's mouth and nose without covering the eyes or chin.
- When using a device to provide rescue breaths, use the "E-C" clamp in which the letters "E" and "C" are formed by the fingers and thumb over the mask and chin.

Table 2.4 Quick Reference for Rescue Breaths in Infants/Children

	Ratio	Technique	Considerations
Rescue breaths + CPR	1 breath per second for a total of 2 breaths	Rescue breath, watch chest rise and fall, rescue breath. Resume compressions after 2 breaths.	Minimize interruptions in CPR by resuming chest compressions within 10 seconds of delivering the second rescue breath.
Rescue breaths only	1 breath every 2-3 seconds	Rescue breath, watch chest rise and fall, rescue breath.	Check pulse every 2 minutes. Begin CPR if heart rate falls below 60 beats with signs of poor perfusion. Begin CPR if pulse cannot be palpated.

Chest compressions for Children/Infants[10,12]

Table 2.5 Quick Reference for Compressions in Children/Infants

Compression to ventilation ratio	Compression rate	Compression depth
30 compressions to 2 breaths for one rescuer 15 compressions to 2 breaths for two rescuers	100-120 per minute	1.5 inches (4 cm) in infants 2 inches (5 cm) in children

1-person technique to performing high quality CPR for children/infants[10,11,12]

- For chest compressions in children, use 1 or 2 hands depending on the size of the child. For most children, use the same 2-hand technique as adults. For a child of small stature, 1-hand compressions may be adequate to achieve the desired compression depth of 2 inches. Refer to Table 2.6 for CPR for children ages 1-8 years.
- For infants, use the 2-finger or 2-thumb technique (refer to Table 2.7). The 2-thumb technique is preferable for situations in which two rescuers are present as

it produces increased blood supply to the cardiac muscle and may generate higher blood pressures.

Table 2.6 One rescuer decision tree for children ages 1-8[12]

Step 1	**Verify scene safety.** Move the child or infant out of immediate danger (traffic, water, etc.) while avoiding injury to yourself.
Step 2	**Check for responsiveness.** Gently shake the child while shouting, "Are you OK?" If the child is unresponsive, then activate the emergency response system and instruct a bystander to find an AED. If no one is in sight, grab the AED yourself.
Step 3	If the child is breathing normally and a pulse is felt, then monitor the child until emergency responders arrive. If the child is not breathing normally but a pulse is felt, then provide rescue breathing at a rate of 1 breath every 2-3 seconds, or 20-30 breaths per minute. If the heart rate is less than 60 BPM with poor signs of perfusion, then immediately, begin high-quality CPR (Step 4). If not, then continue with rescue breaths and check for a pulse every 2 minutes.

Step 4	**If the collapse was witnessed: Activate the emergency response system and find the AED.** **If the collapse was not witnessed: Start high-quality CPR**, with 30 chest compressions followed by 2 breaths. After 2 minutes, activate the emergency response system and find an AED if you are still alone. Minimize interruptions between compressions and allow for complete chest recoil in order to ensure adequate refilling of the heart's ventricles between compressions. For single rescuer scenarios, perform either the 2-finger or 2-thumb encircling hands technique for the most effective chest compressions in infants. For single rescuer scenarios, use 1 or 2 hands to administer high quality chest compressions in children.
Step 5	**Use the AED as soon as it is available**. Follow the AED directions to check the rhythm. Be sure to use the appropriate size pads for a child or infant.

Step 6	If the AED detects a shockable rhythm, give 1 shock. Resume CPR immediately until prompted by the AED to allow a rhythm check, about every 2 minutes. **Continue CPR and use the AED until advanced life support providers take over** or the victim begins to breathe, move, or otherwise react. If the AED detects a non-shockable rhythm, resume high-quality CPR until prompted by the AED to allow a rhythm check, about every 2 minutes. Continue CPR and use the AED until advanced life support providers take over or the victim begins to breathe, move, or otherwise react.

Table 2.7 Comparison of 2 CPR techniques for Infants (under one year of age)

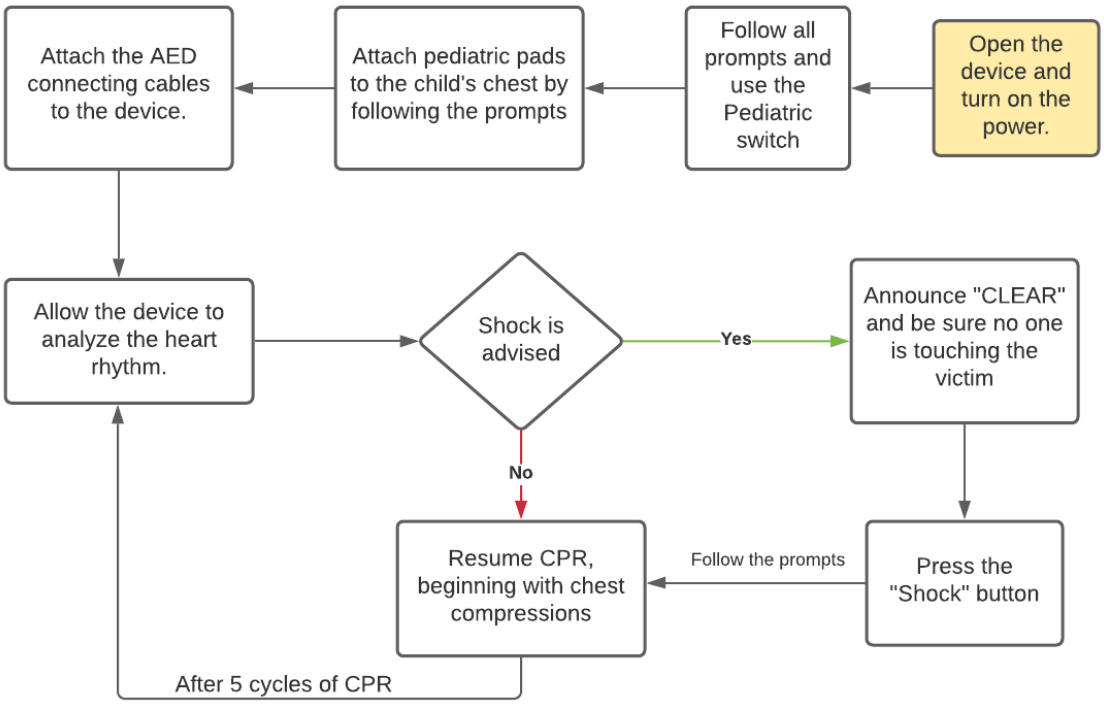
	2-finger technique	**2-thumb encircling hands technique**
Step 1	Place the infant on a flat surface. Place 2 fingers below the nipple line on the lower portion of the sternum.	Place the infant on a flat surface. Place both thumbs side by side in the center of the infant's chest near the lower portion of the sternum. Thumbs may overlap on small infants. Use the other fingers to encircle and support the infant's back.
Step 2	Use two fingers to provide 100-120 compressions per minute while compressing at least 1.5"(4 cm) into the infant's chest.	Use both thumbs to compress the sternum at a rate of 100-120 compressions per minute at a depth of at least 1.5" (4 cm) into the infant's chest.
Step 3	Avoid leaning against the infant's chest and allow for complete chest recoil between compressions.	

Step 4	In single rescuer scenarios, provide 2 rescue breaths after 30 compressions. Use the head tilt-chin lift maneuver and allow the chest to rise with each breath. The jaw-thrust maneuver should be utilized in the presence of a suspected cervical injury. In 2-person rescue teams, provide 2 rescue breaths after 15 compressions.	If a second rescuer is available, pause after 15 compressions for 2 rescue breaths using the head tilt-chin lift maneuver. The jaw thrust maneuver should be utilized in the presence of a potential cervical injury.
Step 5	After 5 cycles or 2 minutes of CPR, leave the infant (or carry with you) to activate the emergency response system and find the AED.	Continue with compressions at a ratio of 15:2 rescue breaths and switch roles every 2 minutes to avoid fatigue.
Step 6	Use the AED as soon as possible. Continue with compressions and rescue breaths until advanced medical professionals arrive to assist.	

AED Application for Infants and Children ages 8 and below[10,11,12]

AED models are capable of performing both adult and child resuscitation attempts. An AED should be used on children and infants as early as possible for optimal outcomes. Pediatric pads must be used for children less than 8 years of age as they deliver a reduced shock compared to adult pads. If pediatric pads are not available, then adult pads may be used as long as they are not touching one another when positioning on the victim. Some AED models have a switch that can be set to deliver a pediatric shock, therefore, it is important to familiarize yourself with the make and model of your AED.

Figure 2.3 AED steps for children and infants



CPR with an Advanced Airway[12]

When providing CPR to patients with an advanced airway, certain modifications must be made when delivering compressions and breaths. Fortunately, advanced airways prevent airway obstruction and offer a more direct route for oxygenation and ventilation.

Examples of advanced airways include:

- Laryngeal mask airway
- Supraglottic airway device
- Endotracheal tube

Table 2.8 Quick Reference for CPR Ratios with and without an Advanced Airway

Age	Airway status	Compression to ventilation ratio	Compression rate	Compression depth
Adults	No advanced airway	30 compressions to 2 breaths	100-120 per minute	At least 2 inches (5 cm) for adults
Infants and Children		Same as adults with 1 rescuer 15 to 2 breaths with 2 rescuers		1.5 inches (4 cm) in infants 2 inches (5 cm) in children
Adults	Advanced airway	Continuous compressions without pauses for breath		At least 2 inches (5 cm) for adults
Infants and Children				1.5 inches (4 cm) in infants 2 inches (5 cm) in children

CPR for Women who are Pregnant[1,2,12]

It is highly recommended to provide resuscitation care to women who are pregnant when the lives of the mother and baby are in danger.

Common causes of maternal cardiac arrest are:

1. Hemorrhage
2. Myocardial infarction
3. Aortic dissection
4. Myocarditis
5. Amniotic fluid embolism
6. Sepsis
7. Aspiration pneumonia
8. Pulmonary embolism
9. Eclampsia

Cardiac arrest in women who are pregnant is extremely rare in developed countries. While maternal cardiac arrest rates have increased over the past two decades, maternal mortality has decreased per delivery.[12] The best outcomes for both mother and child are most likely to be achieved through successful resuscitation efforts of the mother.

Table 2.8 CPR Decision making tree for women during pregnancy

Step 1	**Verify scene safety.** Move the victim out of immediate danger (traffic, water, etc.) while avoiding injury to yourself.
Step 2	**Check for responsiveness.** Gently shake the victim while shouting, "Are you OK?" If the woman is unresponsive, then activate the emergency response system and instruct a bystander to find an AED. If no one is in sight, grab the AED yourself. Be sure to notify emergency medical services that the victim may be in maternal arrest.

Step 3	If the victim is breathing normally and a pulse is felt, then monitor the victim until emergency responders arrive. Roll the woman onto her left side to relieve pressure on major blood vessels in the abdomen (this assists with lateral uterine displacement). If the victim is not breathing normally but a pulse is felt, then provide rescue breathing at a rate of 1 breath every 6 seconds, or 10 breaths per minute. Check for a pulse every 2 minutes. Begin high quality CPR if you do not feel a pulse. Administer naloxone if available and you suspect an opioid-associated emergency or potential overdose. Proceed with Step 4 in the event that the victim is not breathing normally or is gasping without a pulse.
Step 4	**Start high-quality CPR**, with 30 chest compressions followed by 2 breaths. Use an AED as soon as it is available and be sure to apply the pads against the victim's skin. Minimize interruptions between compressions and allow for complete chest recoil in order to ensure adequate refilling of the heart's ventricles between compressions. Perform manual lateral uterine displacement if appropriate.

Step 5	**Use the AED as soon as it is available**. Follow the AED directions to check the rhythm.
Step 6	If the AED detects a shockable rhythm, give 1 shock. Resume CPR immediately until prompted by the AED to allow a rhythm check, about every 2 minutes. **Continue CPR and use the AED until advanced life support providers take over** or the victim begins to breathe, move, or otherwise react. If the AED detects a non-shockable rhythm, resume high-quality CPR until prompted by the AED to allow a rhythm check, about every 2 minutes. Continue CPR and use the AED until advanced life support providers take over or the victim begins to breathe, move, or otherwise react.

Important considerations when administering compressions for women who are pregnant[12]

- Chest compressions should not be delayed for this patient population when maternal cardiac arrest is suspected.
- High quality chest compressions can increase the mother and child's chances of survival.
- The technique of administering high quality compressions for women who are pregnant are the same as adults/children over the age of 8.
- Manual lateral uterine displacement involves manually moving the uterus to the left in order to relieve pressure on mother's internal structures. In doing so, this may relieve pressure and improve blood circulation in the mother. Usually, if the woman appears to be visibly pregnant or the fetus is known to be 20 weeks or greater, then manually moving the uterus to the victim's left should be done when

performing high quality CPR and compressions. Also, the victim may be turned on her left side while rescue breaths are administered.

Section 2: Key Words

High performance rescue teams - a method of applying current CPR guidelines in an effective manner to improve outcomes and administer life-saving techniques as a team.

Closed-loop communication - a technique used to prevent miscommunication between team members. It includes verbalizing a message, repeating it back, and confirming the message.

Responsiveness - refers to the state of awareness in a victim

High quality chest compressions - refers to depth, rate, and ratio of compressions to breath when administering life-saving CPR

Chest recoil - refers to the ability of the chest cavity to return to its normal state after a compression is administered

Rescue breaths - refers to breathing techniques that provide life-saving oxygen to a victim during a emergency

Respiratory arrest - occurs when normal rhythmic breathing ceases and prevents oxygen and carbon dioxide exchange. If left untreated, it can lead to an anoxic brain injury, cardiac arrest, or death.

Barrier devices - a form of personal protection equipment that protects the rescuer who is delivering rescue breaths to a victim

Pocket masks - a type of barrier device that enables mouth to mask breaths through a one-way valve that diverts exhaled air, blood, or body fluids away from the rescuer

Bag-mask devices - a type of barrier device that consists of a bag connected to a face mask

E-C technique - a technique used to seal a barrier device against the victim's face. Take the hand that is closest to the victim's hair and place your index finger and thumb along the top edge of the mask, forming the letter "C." Place your other thumb along the bottom edge of the mask and use the index and middle fingers to lift the jaw for the head tilt.

Perfusion - measure of the flow of oxygenated blood from the heart, through the body's arteries, to the body's tissues and organs

Manual lateral uterine displacement - manually moving the uterus to the left in order to relieve pressure on mother's internal structures in order to relieve pressure and improve blood circulation in the mother.

Section 2: Clinical Scenarios

You and a friend are walking in a park when you notice a crowd gathering on the sidewalk. As you walk closer, you notice a middle-aged woman is slumped over on a park bench. There are no other signs of trauma or bleeding.

1. What are the first 3 steps that you should take as a healthcare professional who is certified in BLS?
2. Once you recognize that the woman does not appear to be breathing or have a pulse, what should you immediately do?
3. Your friend, who is also certified in BLS, has retrieved a nearby AED. What are the next steps to be taken as a high performance rescue team?

While waiting at a restaurant, a 5-year-old girl collapses in her chair, and her mother cries out for help. You are nearby at the time of the event and observe that the child is unresponsive without signs of trauma.

1. What is the first step that you should take as a healthcare professional after observing that the child is unresponsive?
2. After the mother grants consent for you to perform life-saving measures on her daughter, you measure the pulse, which is 50 beats per minute, and notice that the child is turning cyanotic. What are the next steps that you should take?
3. If you are the only BLS-certified healthcare provider, what is your main role in this life-threatening emergency?
4. While providing life-saving measures as a solo rescuer, what is the appropriate compression:breath ratio? If there are two rescuers present, how does the compression:breath ratio change?

Section 2: Summary

- High quality CPR can be administered by a solo rescuer or a team of rescuers. High performance rescue teams have been known to increase the victim's chances for survival. When working within a team, it is crucial to use closed-loop communication skills to avoid treatment errors. Also, each team member should have a thorough understanding of his/her role and responsibility.
- When acting alone to provide life-saving care, the rescuer should (1) check the scene for safety, (2) observe the victim's level of responsiveness, (3) activate emergency response services and find an AED, and (4) provide life-saving care, beginning with CPR and chest compressions. An AED should be used as soon as it is available.
- High-quality chest compressions are vital to the victim's outcome and should be administered at a rate of 100-120 compressions per minute at a depth of at least 2 inches in adults. The rescuer(s) should administer a ratio of 30 compressions to 2 breaths. The chest must be allowed to recoil between each compression in order to ensure adequate perfusion.
- In a two-person rescue team, one person administers life-saving care while the second rescuer finds and prepares the AED device in the event of cardiac arrest. Rescuers should switch roles after 5 cycles or 2 minutes.
- Rescue breaths may be provided for victims who are not breathing but have a pulse. Rescue breaths should be administered every 6 seconds in adults while allowing the chest to rise and fall between breaths. To perform a rescue breath, use the head-tilt maneuver or jaw-thrust maneuver if a cervical spine injury is suspected. Barrier devices, like pocket masks or bag-masks, may be used to protect the rescuer(s) while administering rescue breaths.
- When utilizing an AED in adults and children over the age of 8, open the device and follow the prompts. Be sure to attach the correct pads according to the age of the victim. Pads should be placed against bare skin without cloth or hair as barriers. If a shock is advised, the rescuer(s) should resume compressions after the shock is delivered until advanced life support providers arrive to provide additional care. If a shock is not advised, then the rescuer(s) should resume high quality CPR until prompted by the AED to recheck the rhythm or until advanced providers arrive on the scene.

- When providing high quality CPR to children ages 1-8 years, use 30 compressions to 2 breaths for a single rescuer and 15 compressions to 2 breaths if two rescuers are present. Compression rate is the same as adults (100-120 compressions per minute) whereas the depth of compressions should be 1.5 inches in infants and 2 inches in children. AED models are capable of delivering pediatric shocks and should be utilized as early as possible for optimal outcomes. Pediatric pads should be used for children less than 8 years of age. It is helpful to be aware of your specific AED model due to the fact that some AED models have a switch for pediatric resuscitation attempts.
- If an infant (under the age of 1) requires high quality CPR, rescuer(s) should utilize the 2-finger or 2-thumb encircling hands technique to deliver compressions.
- Barrier devices may be used on children as long as the device fully covers the victim's mouth and nose without occluding the eyes or chin.
- When administering rescue breaths only in children and infants, rescue breaths should be delivered every 2-3 seconds while observing for full chest inflation and deflation.
- In the event that high quality CPR is required for an individual with an advanced airway, compressions should be administered continuously without pausing for rescue breaths. Compressions should be performed at a rate of 100-120 beats per minute.
- Administering resuscitation attempts on women who are pregnant and in cardiac arrest are highly encouraged in order to preserve the life of the mother and baby. If a woman appears to be visibly pregnant, or the fetus is known to be at least 20 weeks in gestation, then manual lateral uterine displacement is encouraged in order to promote blood flow from internal abdominal structures.

Section 3: Choking in Adults, Children, and Infants[11,12]

In Section 3, you will learn how to (1) recognize the signs of choking in adults, children, and infants and (2) perform maneuvers to remove a foreign body that is obstructing the airway. Maneuvers are identical for adults and children but require a different skill set for infants. The appropriate response to choking in any individual is dependent upon the degree of airway obstruction, whether the victim is responsive, and the age.

Later in the section, you will review how to perform life saving measures for an individual who lost consciousness as a result of a foreign body airway obstruction.

Introduction to Choking

Choking occurs when the airway becomes either partially or completely blocked by a foreign object.

Risk factors for choking include:

- Eating while talking or eating too quickly
- Medical conditions that affect one's ability to chew and swallow
- Dental problems that affect one's ability to chew food properly

Unfortunately, choking is a common cause of injury and mortality in children under the age of 5.[11] This is due to the fact that children often explore their environment by placing objects in their mouths which increases the risk of choking. Also, young children typically lack the oral motor skills to thoroughly chew certain types of foods prior to swallowing.

Recognizing Choking[7,11,12,13]

It is imperative to recognize the signs of choking and distinguish it from other life-threatening emergencies as choking will dictate a different treatment pathway. Foreign airway obstruction can be categorized as mild or severe.

Important signs of a mild airway obstruction include:

- Able to breathe but may be wheezing
- Adequate airway exchange with a forceful cough
- May wheeze between coughs

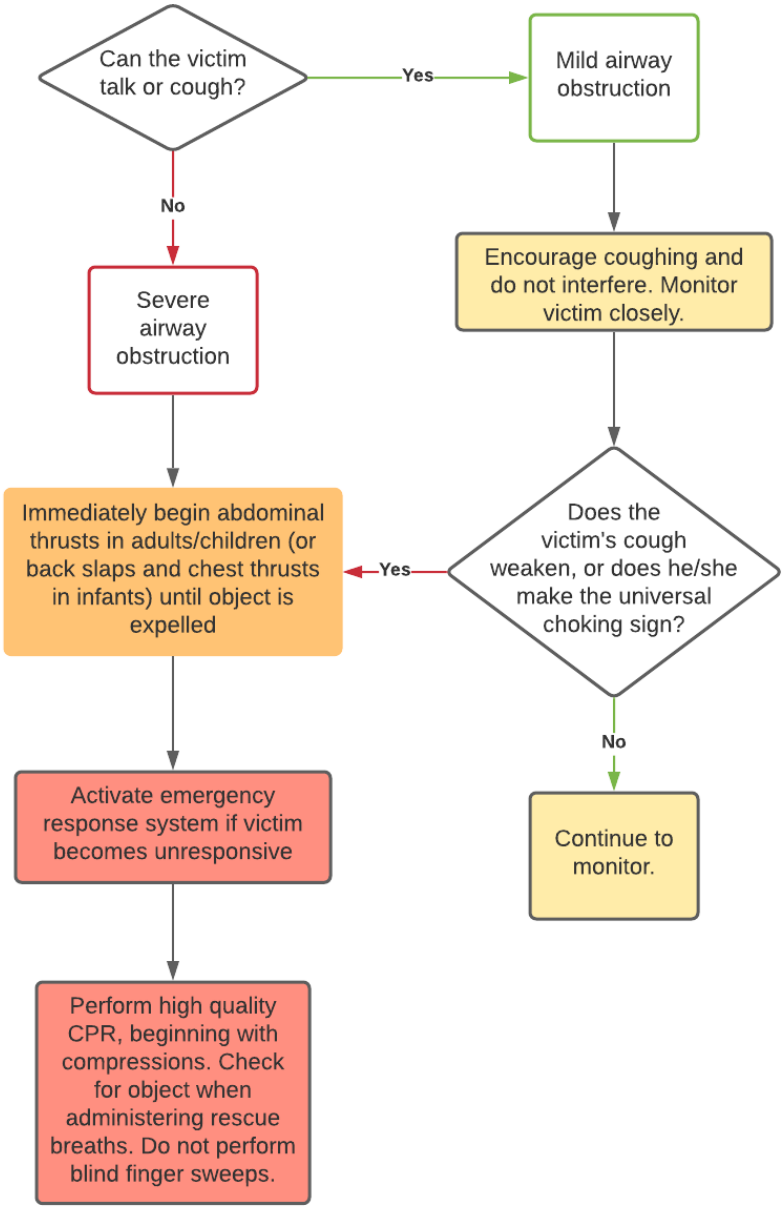
Signs of a severe airway obstruction include:

- Clutching at one's neck and making the universal choking sign
- Weak or no cough
- Unable to speak or cry
- Unable to make noise but may be able to make a high-pitched noise

- Little to no breathing
- May be cyanotic

Refer to Figure 3.1 to determine the appropriate action steps upon recognizing the signs of an airway obstruction.

Figure 3.1 Decision tree according to signs of a foreign-body airway obstruction



In children or adults with a mild airway obstruction, stay with the person and remain calm while monitoring their status. Encourage them to continue to cough in order to expel the foreign object and proceed with the appropriate steps if their status worsens. Calling emergency services may be warranted if the victim does not find relief on his/her own.

Choking relief in a responsive adult or child

Choking relief in a responsive adult or child can be performed with abdominal thrusts. Abdominal thrusts may be performed on children older than one year of age.

Do not attempt to perform abdominal thrusts on an infant. It is recommended that rescuers provide chest thrust maneuvers in victims who are pregnant or obese.

To perform abdominal thrusts/Heimlich Maneuver:

1. Stand or kneel directly behind the child or adult. Wrap your arms around their rib cage and make a fist with one hand. You may also position the victim against a solid wall as you provide abdominal thrusts from the front.
2. Place the thumb of your fist against the victim's abdomen, above the navel but below the xiphoid process. Avoid pressing on the lower part of the sternum.
3. Grasp your fist with the other hand as you provide quick forceful thrusts in an upward direction into the victim's abdomen.
4. Repeat until the foreign object is removed or the victim becomes unconscious.
5. If you can see the foreign object in the victim's mouth and can easily remove it, then perform a finger sweep. Observe for the victim's breathing pattern and initiate CPR with rescue breaths if necessary.

Choking relief in an unresponsive adult or child

If the victim becomes unresponsive at any time while you are performing abdominal thrusts, then you will need to perform life saving care. Follow these steps to provide choking relief to an unresponsive adult or child:

1. Shout for help and activate the emergency response system.
2. Gently lower the victim to the ground into a supine position.
3. Begin administering high quality CPR, starting with chest compressions.

4. As you open the mouth to provide rescue breaths, observe for the foreign object. Only attempt to remove the object if it is visible and perform a finger sweeping motion. Avoid performing a blind finger sweep as this can cause the object to become further dislodged.[2,12]

Considerations for providing rescue breaths with a known foreign object obstruction

Loss of consciousness relaxes the muscles around the throat, which could potentially lessen the airway obstruction. Additionally, the force of chest compressions may assist in dislodging the object. If you can see the chest rise and fall with each breath, then the airway is no longer obstructed.

After relieving choking in an unresponsive victim, you should monitor the victim's responsiveness, breathing patterns, and pulse. Also, confirm that emergency medical services have been contacted and continue to provide high quality CPR as warranted. You should always encourage responsive victims to seek immediate medical attention and a formal evaluation for potential complications related to the abdominal thrusts/ Heimlich Maneuver.

Choking relief in a responsive infant

Unlike choking relief in a responsive child, abdominal thrusts are not recommended for infants. Instead, use back slaps and chest thrusts for children/infants less than one year of age.

To perform back slaps and chest thrusts, follow these steps:

1. Sit the infant in your lap.
2. Turn the infant face down and hold his/her chest against your forearm with the head angled below the torso. Support the jaw and head with your hand, making sure not to constrict the infant's throat. Rest your arm and the infant on your thigh for support.
3. With the heel of your other hand, deliver 5 forceful slaps between the infant's shoulder blades.
4. Cradle the back of the infant's head with your hand and forearm and quickly turn the infant over, making sure the infant's head remains lower than the torso.
5. Administer 5 quick chest thrusts using your 2 fingers on the lower half of the infant's sternum. Deliver chest thrusts at a rate of 1 per second.
6. If the obstruction is not relieved, then repeat this sequence until the infant begins to breathe or becomes unresponsive.

Choking relief in an unresponsive infant

If the infant becomes unresponsive after performing back slaps and chest thrusts, then you will need to perform life saving care. Follow these steps to provide choking relief in an unresponsive infant:

1. Shout for help and activate the emergency response system.
2. Gently place the infant on a firm surface in a supine position.
3. Begin administering high quality CPR, starting with chest compressions.
4. As you open the mouth to provide rescue breaths, observe for the foreign object. Only attempt to remove the object if it is visible and perform a finger sweeping motion. Avoid performing a blind finger sweep as this can cause the object to become further dislodged.[2,12]

Section 3: Key Words

Foreign body airway obstruction - refers to a partial or complete blockage of the breathing tubes to the lungs from a foreign body (like a toy, food, etc.)

Choking - occurs when the airway becomes either partially or completely blocked by a foreign object

Mild airway obstruction - occurs when the airway is partially blocked by a foreign object in which air is still allowed to flow freely to the lungs

Severe airway obstruction - occurs when the airway is completely blocked by a foreign object in which air is cannot flow freely to the lungs

Universal choking sign - refers to a hand gesture that is performed by a person who is choking. He or she may wrap both hands around his/her neck to indicate the presence of a foreign body in the airway. This usually occurs with a severe airway obstruction.

Abdominal thrusts/Heimlich Maneuver - Describes the process to relieve a foreign body airway obstruction in a person who is conscious or responsive. The rescuer stands behind the victim and places a fist against the victim's abdomen, above the navel but below the xiphoid process. Then, the rescuer provides quick forceful thrusts in an upward direction into the victim's abdomen until the object is expelled or until the victim is rendered unconscious due to lack of oxygen from the foreign body.

Section 3: Clinical Scenario

You are visiting the local zoo and eating lunch with your family. Suddenly, a man at a neighboring table gets a panicked look on his face and begins to clutch his throat. You ask him if he is choking and he cannot answer you.

1. Would this be considered a mild or severe airway obstruction? Why?
2. What is the next appropriate step to perform on an adult who is responsive?
3. How would the steps during life saving care change if the adult became unresponsive?

You are attending a birthday party when you notice a commotion near the cake. A mother is frantically searching for the baby's toy as the infant is awake but appears to be struggling to breathe. The infant is not making any sounds.

1. Would this be considered a mild or severe airway obstruction? Why?
2. What is the next appropriate step to perform on an infant who is responsive?
3. How would the steps during life saving care change if the infant became unresponsive?

Section 3: Summary

- Choking occurs as a result of an airway obstruction that partially or fully blocks the individual's ability to breathe. Risk factors for choking include eating while talking, medical conditions that affect one's ability to chew or swallow, and dental problems that affect chewing. Choking is also a common cause of injury and mortality in children.
- Foreign airway obstruction can be classified as mild or severe. Determining the type of airway obstruction based upon its classification will dictate treatment trajectories. The universal choking sign, which may arguably be one of the most widely recognized signs of danger, indicates a severe airway obstruction.
- For mild airway obstructions, it is important to allow the victim to cough or attempt to expel the foreign object without assistance. If the victim's coughs begin to weaken or the victim shows signs of worsening, then the rescuer should immediately begin to perform abdominal thrusts.
- For severe airway obstructions in which the victim is unable to talk or cough, the rescuer should immediately begin to perform abdominal thrusts until the object is expelled. In infants, it is recommended to perform back slaps and chest thrusts as opposed to abdominal thrusts.
- Bystanders or the rescuer should activate the emergency response system and perform CPR if the victim becomes unresponsive.
- If the object is visible in the victim's mouth, then perform a sweeping motion with 1-2 fingers to remove the object. Blind finger sweeps when the object is not visible are not recommended as this may further dislodge the foreign object into the airway.

Section 4: Opioid-associated emergencies/Opioid overdose[2,3,12,13,14]

The United States is in the midst of an opioid overdose crisis, and health care providers should receive training to respond to potential opioid overdoses. Historically, persons trained in BLS have been hesitant to provide quality care to those experiencing opioid-associated emergencies or opioid overdoses.[3] Experts have recognized this critical gap in knowledge and have attempted to address it by incorporating the use of life-saving

measures into current practice. Thus, it is important that healthcare providers are prepared to respond to opioid-associated emergencies and potential overdoses in order to improve outcomes from life-threatening events associated with opioid use.[3]

What Are Opioids?

Opioids are medications that are prescribed primarily for pain relief. Commonly prescribed opioids include hydrocodone, morphine, and fentanyl. Illicit opioid drugs include heroin.

An overdose and opioid-associated emergency can occur as a result of taking a higher dosage than prescribed, combining it with other drugs or alcohol, or taking it with certain pre-existing medical conditions like liver disease or sleep apnea.

Excessive amounts of opioid in the body can depress the brain's natural tendency to breath due to depression of the central nervous system which can lead to respiratory or cardiac arrest. Most deaths related to opioid emergencies or overdoses involve digestion of opioids, other drugs, and/or medical and mental health illness(es). Additionally, cardiotoxicity has been reported with drugs like methadone and propoxyphene.

Signs of an opioid overdose[12]

- Slow or shallow breaths
- Choking or gurgling sounds
- Loss of consciousness or severe drowsiness
- Small and constricted pupils
- Cyanosis

If you are first to arrive on the scene of an emergency, check the victim for injection sites, a medication patch, discarded medication vials, or other signs of opioid use.

Treatment for an opioid overdose[12,13]

Opioid-associated emergencies are defined as the presence of cardiac or respiratory arrest or severe life-threatening instability like central nervous system depression, hypotension, or cardiac arrhythmia that may have been caused by opioid toxicity. It is important to understand that there may be difficulty in accurately determining the presence of an opioid-associated emergency from other causes of cardiac and respiratory arrest.

Due to the nature of opioid-associated emergencies and unless the overdose was witnessed and known to be opioid-induced respiratory depression, rescuers cannot be certain of the victim's clinical presentation and may misidentify it as unconsciousness. This observation is particularly true in the context of unwitnessed cardiac arrests or in emergency scenarios when the presence or absence of a pulse is unreliable. Therefore, any treatment recommendations that are intended to be life saving measures should have benefits that exceed harm when applied in populations that may include victims with potential severe central nervous system and respiratory depression, respiratory arrest, and cardiac arrest.

First responders may choose to administer naloxone, also known as NARCAN, that can temporarily reverse the effects of respiratory depression. Naloxone is a strong opioid receptor antagonist in the brain, spinal cord, and gastrointestinal system. Its use can rapidly reverse central nervous system and respiratory depression in a victim with a suspected opioid-associated emergency.

Based on the rescuer's training and the victim's medical condition, naloxone can be administered intravenously, intramuscularly, intranasally, or subcutaneously. It can also be nebulized for inhalation or instilled through an endotracheal tube into the lungs. Dosage and appropriate concentrations will vary according to route of entry. It should be given as soon as it is available for optimal outcomes, and the victim should be monitored for responsiveness. If the victim's responsiveness improves (purposeful movement, regular breathing pattern, moaning, etc.), then rescuers should continue to monitor until advanced medical providers arrive. If the victim becomes unresponsive again, then rescuers should check the pulse rate and ensure that the victim's airway is open. CPR should be administered if warranted and a second dose of naloxone can be provided after 4 minutes has passed since the first dose.

Currently, there are no major clinical effects associated with the administration of naloxone in victims who are not opioid-intoxicated or dependent. However, effects of naloxone have been documented following administration and mimic acute withdrawal syndrome in people with opioid dependency. These signs and symptoms are not life-threatening and can be minimized by providing the lowest effective dose of naloxone. Common signs and symptoms that may present following immediate administration of naloxone in people with opioid-dependency include:

- Hypertension
- Tachycardia

- Piloerection
- Vomiting
- Agitation
- Drug cravings

Although uncomfortable, victims experiencing withdrawal symptoms should expect symptoms to last about 30 minutes.[14] Rescuers should be aware that post-withdrawal agitation after naloxone administration may place them at risk for injury.

The US Food and Drug Administration approved the use of naloxone autoinjectors by lay rescuers in 2014. Since then, both intramuscular and intranasal routes of administration have been produced for inclusion in first aid kits. Also, products containing naloxone for intramuscular, intranasal, and nebulizer use have been successfully used to treat opioid-associated emergencies and opioid overdoses under BLS settings. Studies have demonstrated that community-based opioid overdose response education and naloxone distribution programs are severely needed and feasible due to the fact that people with suspected central nervous system and respiratory depression from opioid-associated emergencies cannot self-administer naloxone.

Table 2.9 One rescuer decision tree for opioid-associated emergencies

Step 1	**Suspect opioid positioning.** Check surroundings for evidence of opioid use, shout for help, and activate the emergency response system. If the victim is unresponsive, then activate the emergency response system and instruct a bystander to find an AED and naloxone. If no one is in sight, grab the AED and naloxone yourself.

Step 2	**Check for breathing.** If the victim is breathing normally, then proceed to step 3. If the victim is not breathing normally, proceed to step 4.
Step 3	**Prevent deterioration of condition.** Make sure the airway is open and reposition the victim if necessary. This may occur when the victim is not able to maintain an open airway due to a low level of consciousness. Administer naloxone if available and you suspect an opioid-associated emergency or overdose. Follow the instructions on the package and monitor for any immediate reaction. Stay with the victim until advanced medical professionals arrive on the scene to transport the victim to a hospital.

Step 4	**Assess for a pulse.** If a pulse is not felt, then proceed to Step 5. If a pulse is palpable, then encourage airway exchange. Make sure that the victim's airway is sufficiently open and reposition the victim if needed. Provide rescue breaths or use bag-mask ventilation to prevent cardiac arrest. Continue until you observe normal, spontaneous breathing by the victim. Recheck the pulse every 2 minutes. If the pulse becomes faint or disappears, then immediately begin to administer high quality CPR. Give naloxone according to the instructions on the package.
Step 5	**Start high-quality CPR**, with 30 chest compressions followed by 2 breaths. Use an AED as soon as it is available. Minimize interruptions between compressions and allow for complete chest recoil in order to ensure adequate refilling of the heart's ventricles between compressions. **Consider administering naloxone if available.** However, high quality CPR should take priority over the administration of naloxone. **Use the AED as soon as it is available**. Follow the AED directions to check the rhythm.

Step 6	If the AED detects a shockable rhythm, give 1 shock. Resume CPR immediately until prompted by the AED to allow a rhythm check, about every 2 minutes. **Continue CPR and use the AED until advanced life support providers take over** or the victim begins to breathe, move, or otherwise react. If the AED detects a non-shockable rhythm, resume high-quality CPR until prompted by the AED to allow a rhythm check, about every 2 minutes. Continue CPR and use the AED until advanced life support providers take over or the victim begins to breathe, move, or otherwise react.

Considerations when providing life saving care in the presence of an opioid-associated life-threatening emergency

- Preventing deterioration of the victim's condition is essential in preventing poor outcomes. You may need to reposition the victim's airway to maintain normal breathing, especially if the victim is unresponsive or unable to maintain an open airway.
- Naloxone should be administered according to the package directions and protocol. If you suspect an opioid overdose, then it is reasonable to administer the antidote and monitor for response. However, even those who receive naloxone can still be at risk for developing respiratory distress and problems that lead to cardiac arrest.
- High quality CPR should be prioritized over the administration of naloxone.

Section 4: Key Words

Opioids - prescription medications that are prescribed primarily for pain relief

Opioid overdose/opioid-associated emergency - can result from taking a higher dose of opioid medication than what was originally prescribed, combining it with other drugs or alcohol, or taking an opioid with certain pre-existing medical conditions like liver disease or sleep apnea. Ingestion of such drugs can cause cardiac or respiratory arrest or severe life-threatening instability like central nervous system depression, hypotension, or cardiac arrhythmia that may have been caused by opioid toxicity.

Cyanosis - refers to a bluish discoloration of the skin due to poor perfusion

Naloxone - an opioid antagonist that can temporarily reverse the effects of respiratory depression

Respiratory depression - a breathing disorder that is characterized by slow and ineffective breathing

Intramuscularly - refers to the technique in which medications are injected into the muscle for quick absorption

Intranasally - refers to the technique in which medications are injected into the nasal cavity

Intravenously - refers to the technique in which medications are injected into a vein

Section 4: Clinical Scenario

You are renting a vacation home along with several other families. After returning home one night from the local bar, you find one of the women unresponsive on the bathroom floor with a needle beside her body. You suspect a possible opioid overdose.

1. After instructing another individual to activate the emergency medical system, what is the most appropriate action that you should take?

2. You observe that the victim barely has a pulse, but the vacation home does not have a First Aid kit with naloxone. What should you do?

Section 4: Summary

- Opioid-associated emergencies and overdoses are on the rise in the United States. It is critical for healthcare providers to be knowledgeable about opioid abuse and

appropriate lifesaving measures in order to improve outcomes related to opioid use.

- Opioids are medications that are primarily prescribed for pain relief. An opioid-associated emergency or overdose can occur as a result of taking a higher dosage than prescribed, combining it with other drugs or alcohol, or taking it despite having certain pre-existing medical conditions.
- Copious amounts of opioid can be lethal to the central nervous system due to the fact that it can cause respiratory depression leading to respiratory and cardiac arrest.
- Treatment for a suspected opioid overdose can be delayed, especially if the event was unwitnessed. Due to the clinical presentation of opioid-associated emergencies, rescuers may misidentify the victim's presentation as unconsciousness.
- Naloxone (also known as NARCAN) can temporarily reverse the effects of respiratory depression because it is a strong opioid receptor antagonist in the brain, spinal cord, and gastrointestinal system. It can be administered intravenously, intramuscularly, intranasally, or subcutaneously. When the situation is identified to be related to opioid abuse, naloxone should be given as soon as possible and the victim should be carefully monitored for immediate effects following administration. The use of Naloxone was approved by the US Food and Drug Administration in 2014 and is included in many first aid kits.
- If a victim becomes unresponsive, rescuer(s) should immediately begin high quality CPR and chest compressions. In the event that two rescuers are present, one rescuer should initiate CPR while the second rescuer activates the emergency response system, finds an AED, and locates naloxone.
- High quality CPR should be prioritized over the administration of naloxone.

Section 5: Clinical Scenarios Revisited

Section 1: Clinical Scenario Prompt

You are in the parking lot of the mall when you hear someone shouting, "There's something wrong with my baby!" You look around and see a woman kneeling next to a small child who is lying face-up on the pavement.

1. What is the first step that you should take as a healthcare provider who is certified in Basic Life Support and cardiopulmonary resuscitation?
2. Provide 3-4 questions that you may have prior to determining the best course of action for the child in need.
3. How would you gain consent in this clinical scenario?
4. Which link in the Pediatric Chain of Survival would be activated by your decision to help?

Section 1: Clinical Scenario Revisited

1. **What is the first step that you should take as a healthcare provider who is certified in Basic Life Support and cardiopulmonary resuscitation?**

   You should observe the scene and form an initial impression prior to engaging in action.

2. **Provide 3-4 questions that you may have prior to determining the best course of action for the child in need.**

   Is the scene safe for me, or others, to enter?

   What factors may have contributed to this emergency?

   How many people are involved?

   Does the child appear to have any illness or injury?

   Who may be available to assist me?

3. **How would you gain consent in this clinical scenario?**

   You should gain consent from the parent by stating your name, the type and level of training that you have, your impression of the emergency and how you may be able to help, and asking permission to provide care to the child.

4. **Which link in the Pediatric Chain of Survival would be activated by your decision to help?**

   Your actions would activate the first two phases of the Pediatric Chain of Survival, preparation and alerting the emergency medical services.

Section 2: Clinical Scenario Prompt 1

You and a friend are walking in a park when you notice a crowd gathering on the sidewalk. As you walk closer, you notice a middle-aged woman is slumped over on a park bench. There are no other signs of trauma or bleeding.

1. What are the first 3 steps that you should take as a healthcare professional who is certified in BLS?
2. Once you recognize that the woman does not appear to be breathing or have a pulse, what should you immediately do?
3. Your friend, who is also certified in BLS, has retrieved a nearby AED. What are the next steps to be taken as a high performance rescue team?

Section 2: Clinical Scenario 1 Revisited

1. **What are the first 3 steps that you should take as a healthcare professional who is certified in BLS?**

   You are responsible for observing the scene and checking for safety prior to engaging in action. Next, you should check the victim for responsiveness by gently shaking him/her on the shoulder and shouting, "Are you okay?". Depending on the patient's level of responsiveness, you may need to instruct a bystander to find an AED as you activate emergency medical services.

2. **Once you recognize that the woman does not appear to be breathing or have a pulse, what should you immediately do?**

   This victim may be entering cardiac arrest and should receive life saving care immediately. You should administer high-quality CPR, beginning with chest compressions at 100-120 compressions per minute. If a bystander is nearby, instruct him/her to find the closest AED and activate the emergency medical response system. If you are alone, call EMS on your speakerphone as you begin high quality compressions.

3. **Your friend, who is also certified in BLS, has retrieved a nearby AED. What are the next steps to be taken as a high performance rescue team?**

   High performance rescue teams are coordinated efforts by several rescuers who perform various components of CPR during a resuscitation attempt. Performing CPR as part of a high-performance rescue team has been shown to increase the

victim's chances for survival. Once your friend has retrieved and set-up the AED according to the prompts, you should switch roles as the device is analyzing the victim's heart rhythm. If a shock is advised, then all rescuers need to step back as the AED delivers a resuscitation shock. The high performance rescue team should immediately resume chest compressions, with the AED connected, until advanced medical professionals arrive on scene. Rescuers should switch roles every 2 minutes, 5 cycles, or when one rescuer becomes fatigued.

Section 2: Clinical Scenario Prompt 2

While waiting at a restaurant, a 5-year-old girl collapses in her chair, and her mother cries out for help. You are nearby at the time of the event and observe that the child is unresponsive without signs of trauma.

1. What is the first step that you should take as a healthcare professional after observing that the child is unresponsive?
2. After the mother grants consent for you to perform life-saving measures on her daughter, you measure the pulse, which is 50 beats per minute, and notice that the child is turning cyanotic. What are the next steps that you should take?
3. If you are the only BLS-certified healthcare provider, what is your main role in this life-threatening emergency?
4. While providing life-saving measures as a solo rescuer, what is the appropriate compression:breath ratio? If there are two rescuers present, how does the compression:breath ratio change?

Section 2: Clinical Scenario 2 Revisited

1. **What is the first step that you should take as a healthcare professional after observing that the child is unresponsive?**

   Activate the emergency response system and instruct a bystander to find an AED.

2. **After the mother grants consent for you to perform life-saving measures on her daughter, you measure the pulse, which is 50 beats per minute, and notice that the child is turning cyanotic. What are the next steps that you should take?**

   Immediately begin CPR, starting with chest compressions, while you await the arrival and set-up of the AED device.

3. **If you are the only BLS-certified healthcare provider, what is your main role in this life-threatening emergency?**

   Provide life-saving measures and instruct bystanders as needed.

4. **While providing life-saving measures as a solo rescuer, what is the appropriate compression:breath ratio? If there are two rescuers present, how does the compression:breath ratio change?**

   The appropriate compression:breath ratio for one rescuer is 30 compressions and 2 rescue breaths. If there are two rescuers present, then the compression to breath ratio changes in children to 15 compressions to 2 rescue breaths.

Section 3: Clinical Scenario Prompt 1

You are visiting the local zoo and eating lunch with your family. Suddenly, a man at a neighboring table gets a panicked look on his face and begins to clutch his throat. You ask him if he is choking and he cannot answer you.

1. Would this be considered a mild or severe airway obstruction? Why?
2. What is the next appropriate step to perform on an adult who is responsive?
3. How would the steps during life saving care change if the adult became unresponsive?

Section 3: Clinical Scenario 1 Revisited

1. **Would this be considered a mild or severe airway obstruction? Why?**

   This would be considered a severe airway obstruction if the victim is exhibiting the universal choking sign and unable to talk.

2. **What is the next appropriate step to perform on an adult who is responsive?**

   If the victim is responsive, then the next step would be to perform abdominal thrusts in an attempt to dislodge the foreign object that is obstructing the airway. Abdominal thrusts should be performed until the object is expelled or the victim becomes unresponsive.

3. **How would the steps during life saving care change if the adult became unresponsive?**

If the adult becomes unresponsive, then the rescuer should immediately stop performing abdominal thrusts and administer CPR, beginning with high quality chest compressions. Also, the rescuer should shout for help and/or activate the emergency response system. If rescue breaths are administered, then the rescuer should open the victim's mouth and observe for a foreign object. Attempts should be made to remove the foreign object only if it is visible and then, if so, the rescuer should perform a finger sweeping motion to remove the object from the victim's mouth. Rescuers should never perform a blind finger sweep as this can cause the object to become further dislodged in the airway.

Section 3: Clinical Scenario Prompt 2

You are attending a birthday party when you notice a commotion near the cake. A mother is frantically searching for the baby's toy as the infant is awake but appears to be struggling to breathe. The infant is not making any sounds.

1. Would this be considered a mild or severe airway obstruction? Why?
2. What is the next appropriate step to perform on an infant who is responsive?
3. How would the steps during life saving care change if the infant became unresponsive?

Section 3: Clinical Scenario 2 Revisited

1. **Would this be considered a mild or severe airway obstruction? Why?**

   This would be considered to be a severe airway obstruction because the infant is not making any sounds which may indicate a complete airway obstruction.

2. **What is the next appropriate step to perform on an infant who is responsive?**

   The next appropriate step would be to perform back slaps and chest thrusts to dislodge the foreign object.

   Gently turn the infant face down and hold his/her chest against your forearm with the head angled slightly below the torso. Support the jaw and head with your hand, making sure not to constrict the infant's throat. Then, rest your arm and the infant on your thigh for support.

   With the heel of your other hand, deliver 5 forceful slaps between the infant's scapula. Next, cradle the back of the infant's head with your hand and forearm

and quickly turn over, making sure the infant's head remains lower than the torso. Administer 5 forceful chest thrusts using your 2 fingers on the lower half of the infant's sternum. Deliver chest thrusts at a rate of 1 per second. Repeat this sequence until the object is dislodged or the infant becomes unresponsive.

3. **How would the steps during life saving care change if the infant became unresponsive?**

   If the infant becomes unresponsive while administering back slaps and chest thrusts, then CPR should be immediately initiated by performing high quality compressions. Also, the rescuer should shout for help and/or activate the emergency response system. If rescue breaths are administered, then the rescuer should open the infant's mouth and observe for a foreign object. Attempts should be made to remove the foreign object only if it is visible and then, if so, the rescuer should perform a finger sweeping motion to remove the object from the infant's mouth.

   Rescuers should never perform a blind finger sweep as this can cause the object to become further dislodged in the infant's airway.

Section 4: Clinical Scenario Prompt

You are renting a vacation home along with several other families. After returning home one night from the local bar, you find one of the women unresponsive on the bathroom floor with a needle beside her body. You suspect a possible opioid overdose.

1. After instructing another individual to activate the emergency medical system, what is the most appropriate action that you should take?
2. You observe that the victim barely has a pulse, but the vacation home does not have a First Aid kit with naloxone. What should you do?

Section 4: Clinical Scenario Revisited

1. **After instructing another individual to activate the emergency medical system, what is the most appropriate action that you should take?**

   The rescuer should assess the victim for responsiveness by shaking the victim on the shoulder and shouting, "Are you ok?". Next, the rescuer should assess for a pulse and breathing pattern. The findings from these steps will dictate the most appropriate life saving measures to be taken by the rescuer.

2. **You observe that the victim barely has a pulse, but the vacation home does not have a First Aid kit with naloxone. What should you do?**

   As a healthcare provider who is certified in BLS, you should be knowledgeable about opioid-associated emergencies and potential opioid overdoses. Because the victim is unresponsive with a low pulse, you should suspect cardiac arrest and prepare to administer high quality CPR and shock resuscitation through the AED. Although the victim may be experiencing an opioid-associated emergency, administering naloxone does not replace high quality CPR and should not be prioritized in the immediate time frame. The healthcare provider should instruct a bystander to activate emergency medical services and find an AED while he/she administers high quality CPR, beginning with 30 compressions at a rate of 100-120 compressions per minute. Once the AED arrives, the rescuer should instruct the bystander to follow the AED prompts as he/she continues to deliver high quality compressions and rescue breaths.

Conclusion

This course contained valuable information regarding the necessary skills to perform Basic Life Support, choking relief, and care for opioid-associated emergencies and overdoses.

Basic life support is foundational knowledge to save someone's life after cardiac arrest. Learning how to perform high quality CPR for victims of all ages is paramount in order to give victims the best chance for survival. Because of this course, you will know how to recognize cardiac arrest, activate the emergency response system, and respond quickly and with confidence.

Please note that completion of this course only fulfills the academic component of the Basic Life Support for Providers certification. Participants should confirm that this course meets the necessary requirements of your state and will need to complete a hands-on skills demonstration with a certified instructor in order to achieve full BLS certification.

References

1. Soar, J., Maconochie, I., Wyckoff, M. H., Olasveengen, T. M., Singletary, E. M., Greif, R., Aickin, R., Bhanji, F., Donnino, M. W., Mancini, M. E., Wyllie, J. P., Zideman, D., Andersen, L. W., Atkins, D. L., Aziz, K., Bendall, J., Berg, K. M., Berry,

D. C., Bigham, B. L., Bingham, R., … Hazinski, M. F. (2019). 2019 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations: Summary From the Basic Life Support; Advanced Life Support; Pediatric Life Support; Neonatal Life Support; Education, Implementation, and Teams; and First Aid Task Forces. Circulation, 140(24), e826–e880. https://doi.org/10.1161/CIR.0000000000000734

2. Nolan, J. P., Maconochie, I., Soar, J., Olasveengen, T. M., Greif, R., Wyckoff, M. H., Singletary, E. M., Aickin, R., Berg, K. M., Mancini, M. E., Bhanji, F., Wyllie, J., Zideman, D., Neumar, R. W., Perkins, G. D., Castrén, M., Morley, P. T., Montgomery, W. H., Nadkarni, V. M., Billi, J. E., … Hazinski, M. F. (2020). Executive Summary 2020 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations. Resuscitation, 156, A1–A22. https://doi.org/10.1016/j.resuscitation.2020.09.009

3. Berland, N., Fox, A., Tofighi, B., & Hanley, K. (2017). Opioid overdose prevention training with naloxone, an adjunct to basic life support training for first-year medical students. *Substance abuse*, *38*(2), 123–128. https://doi.org/10.1080/08897077.2016.1275925

4. American Red Cross. (2019). Basic Life Support Instructor's Manual for Instructor-Led Training. American Red Cross.

5. Centers for Disease Control and Prevention. (2014, August). Healthcare-associated Infections. Retrieved January 5, 2021, from Centers for Disease Control and Prevention website: https://www.cdc.gov/hai/prevent/ppe.html

6. Centers for Disease Control and Prevention. (2019, May). Disinfection and Sterilization. Retrieved January 5, 2021, from Centers for Disease Control and Prevention website: https://www.cdc.gov/infectioncontrol/guidelines/disinfection/index.html

7. American Red Cross. (2017). Responding to Emergencies: Comprehensive First Aid/CPR/AED Textbook. StayWell.

8. Merchant, R. M., Topjian, A. A., Panchal, A. R., Cheng, A., Aziz, K., Berg, K. M., Lavonas, E. J., Magid, D. J., & Adult Basic and Advanced Life Support, Pediatric Basic and Advanced Life Support, Neonatal Life Support, Resuscitation Education Science, and Systems of Care Writing Groups (2020). Part 1: Executive Summary: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation

and Emergency Cardiovascular Care. Circulation, 142(16_suppl_2), S337–S357. https://doi.org/10.1161/CIR.0000000000000918

9. Panchal, A. R., Bartos, J. A., Cabañas, J. G., Donnino, M. W., Drennan, I. R., Hirsch, K. G., Kudenchuk, P. J., Kurz, M. C., Lavonas, E. J., Morley, P. T., O'Neil, B. J., Peberdy, M. A., Rittenberger, J. C., Rodriguez, A. J., Sawyer, K. N., Berg, K. M., & Adult Basic and Advanced Life Support Writing Group (2020). Part 3: Adult Basic and Advanced Life Support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation, 142(16_suppl_2), S366–S468. https://doi.org/10.1161/CIR.0000000000000916

10. Topjian, A. A., Raymond, T. T., Atkins, D., Chan, M., Duff, J. P., Joyner, B. L., Jr, Lasa, J. J., Lavonas, E. J., Levy, A., Mahgoub, M., Meckler, G. D., Roberts, K. E., Sutton, R. M., Schexnayder, S. M., & Pediatric Basic and Advanced Life Support Collaborators (2020). Part 4: Pediatric Basic and Advanced Life Support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation, 142(16_suppl_2), S469–S523. https://doi.org/10.1161/CIR.0000000000000901

11. American Red Cross. (2017). First Aid/CPR/AED Instructors Manual.

12. American Heart Association. (2020). Basic Life Support (BLS) Provider Manual. Amer Heart Assoc.

13. Olasveengen, T. M., Mancini, M. E., Perkins, G. D., Avis, S., Brooks, S., Castrén, M., Chung, S. P., Considine, J., Couper, K., Escalante, R., Hatanaka, T., Hung, K., Kudenchuk, P., Lim, S. H., Nishiyama, C., Ristagno, G., Semeraro, F., Smith, C. M., Smyth, M. A., Vaillancourt, C., … Adult Basic Life Support Collaborators (2020). Adult Basic Life Support: International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations. Resuscitation, 156, A35–A79. https://doi.org/10.1016/j.resuscitation.2020.09.010

14. Chou, R., Korthuis, P. T., McCarty, D., Coffin, P., Griffin, J., Davis-O'Reilly, C., Grusing, S., & Daya, M. (2017). Management of Suspected Opioid Overdose With Naloxone by Emergency Medical Services Personnel. Agency for Healthcare Research and Quality (US).