

First Aid, CPR, and AED **ADVANCED**

Meets CPR and ECC Guidelines

EIGHTH EDITION



American College of
Emergency Physicians®

ADVANCING EMERGENCY CARE



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23142-7

Production Credits

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Library of Congress Cataloging-in-Publication Data

Names: Thygeson, Alton L. First aid, CPR, and AED. Advanced. | American Academy of Orthopaedic Surgeons, issuing body.
Title: First aid, CPR, and AED. Advanced / American Academy of Orthopaedic Surgeons.

Description: Eighth edition. | Burlington, MA : Jones & Bartlett Learning,

[2022] | Preceded by First aid, CPR, and AED. Advanced / Alton L.

Thygeson, Steven M. Thygeson. Seventh edition. [2017]. | Includes

bibliographical references and index.

Identifiers: LCCN 2021010019 | ISBN 9781284231427 (paperback)

Subjects: MESH: First Aid | Emergencies | Cardiopulmonary Resuscitation | Electric Countershock

Classification: LCC RC86.7 | NLM WA 292 | DDC 616.02/52--dc23

LC record available at <https://lcn.loc.gov/2021010019>

6048

Printed in the United States of America

25 24 23 22 21 10 9 8 7 6 5 4 3 2 1



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Printing and Binding: LSC Communications

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Preface

2020 Guideline Updates and the COVID-19 Pandemic

This book exceeds the requirements of the 2020 American Heart Association (AHA) Emergency Cardiovascular Care (ECC) Guidelines and the 2020 International Liaison Committee on Resuscitation (ILCOR) Consensus on Science with Treatment Recommendations (CoSTR). At this time, we find ourselves in the middle of a 100-year event: the COVID-19 pandemic. These updates were made with the pandemic in mind.

Although we are perhaps more mindful than ever of the importance of personal protective equipment (PPE) during first aid treatment, readers will still notice some variability throughout this textbook with regard to PPE worn by first aid providers as they care for those who are injured or ill. They may also question the inclusion of skills and techniques that are discouraged in the context of COVID-19.

We have tried throughout the text to apply the best current knowledge and practices available. However, that science is developing rapidly, and we will make every attempt to make supplemental material available that reflects the most updated knowledge.

Face Masks

Prior to 2020, the level of PPE commonly worn by all first aid providers during first aid treatment typically included disposable gloves when possible. Face masks are now standard equipment for all interpersonal encounters, not just during first aid treatment. Social distancing guidelines mandate the use of masks in public. People without symptoms can still be infected with the virus and thus transmit it to others. Asking everyone

to wear a mask during first aid treatment can make those encounters safer.

Art and Photos

Revising the illustrations and images throughout the book has been a challenge. Organizing photo shoots has been dramatically hindered by necessary social distancing restrictions. For this reason, we ensured that first aid providers and other relevant parties were wearing face masks and appropriate eye protection in any new images that were shot for this textbook. However, we were not able to update all the photos to reflect new practice guidelines. It is certainly our hope that by the time the next edition is published, our knowledge of best practices with regard to PPE will be more static and there will be more consistency in the appearance of PPE in images throughout the text.

Cardiopulmonary Resuscitation

This revised text includes coverage of mouth-to-mouth cardiopulmonary resuscitation (CPR) and mouth-to-barrier CPR. These techniques are still key competencies for the first aid provider whose partner or family member has, for example, experienced cardiac arrest. This text also includes coverage of hands-only CPR for instances where the first aid provider is unable or unwilling to provide rescue breaths. In the midst of the COVID-19 pandemic, ILCOR recommends that layperson first aid providers consider hands-only CPR and defibrillation for treating those who are not members of the provider's household and consider rescue breaths and chest compressions for infants and children.

Acknowledgments

The authors, medical editors, Jones & Bartlett Learning Public Safety Group, American Academy of Orthopaedic Surgeons, and American College of Emergency Physicians would like to thank all of the reviewers who generously offered their time, expertise, and talent to the making of this eighth edition.

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FIRST AID

Introduction

Why Is First Aid Important?

A large truck swings around a corner, crashes into an automobile, and pushes it over an embankment. Bystanders rush to the rescue. They pull the injured driver from the car, lift him to his feet, stop a passing car, and send the injured man to a nearby hospital in a sitting position. Because of the lack of knowledge and unskilled handling, the man's spinal cord is injured by the sharp edge of a broken vertebra, and he will remain paralyzed for the rest of his life. This tragic outcome could have been avoided if someone had known what to do in an emergency.

A backcountry hiker is bitten by a rattlesnake. Her frantic companion cuts and sucks the bitten area, not realizing that this is an outdated and harmful procedure. They have now unnecessarily been exposed to her blood. By the time the woman seeks appropriate professional medical care, she has suffered extensive tissue damage. A trained first aid provider would have known the proper procedures to care for this person.

A group of beachgoers removes an unresponsive swimmer from the water. No one helps because no one knows cardiopulmonary resuscitation (CPR). The emergency medical services (EMS) ambulance arrives, and because nothing has been done so far, they are unable to revive the swimmer. CPR would have served as an interim action and preserved life for the few minutes needed until the ambulance arrived,

CHAPTER AT A GLANCE

- › Why Is First Aid Important?
- › Who Needs First Aid?
- › What Is First Aid?
- › Legal Aspects of First Aid
- › Injury Prevention

potentially giving the EMS providers a chance of reviving the swimmer.

Late at night, a man who had earlier smashed a finger in a car door can no longer stand the excruciating pain caused by the pressure of blood accumulating underneath the fingernail. He drives himself to a hospital emergency department where a physician relieves a blood clot. The man later receives an expensive hospital bill. If he had known the proper first aid procedure, he could have potentially relieved the pain sooner and saved money.

These cases clearly point out the need for first aid training. *It is better to know it and not need it than to need it and not know it.* Everyone should be able to perform first aid, because most people will eventually find themselves in a situation requiring it for another person or for themselves. First aid providers do not diagnose (this is what physicians do); however they can suspect what the problem is and then provide first aid.

Who Needs First Aid?

Just as heart disease and cancer demand public attention because of the critical health risks they pose in the United States, injury—both unintentional and intentional—must be recognized as a major threat to public health. This threat has been called the neglected epidemic. **TABLE 1-1** shows the role of injury as a cause of death by age group and ranking compared with other causes of death.

Death statistics do not always reflect the extent or severity of the injury problem. Most injuries and sudden illnesses do not result in death, but rather result in hospitalization; treatment in an emergency department, urgent care center, or physician office; or treatment from a first aid provider. According to the World Health Organization, in the world's high-income countries, for every person killed by injury, 30 people are hospitalized and 300 people are treated in emergency departments; even more are treated in other health care facilities and by first aid providers.

FYI

OSHA (Occupational Safety and Health Administration) Regulations

Standard 29 CFR 1910.151: Medical Services and First Aid—General Industry:

“In the absence of an infirmary, clinic, or hospital in near proximity to workplace which is used for the treatment of all injured employees, a person or persons shall be adequately trained to render first aid. Adequate first aid supplies shall be readily available.”

The injury pyramid, as shown in **FIGURE 1-1**, helps illustrate the distribution of injury severity. The top of the pyramid is composed of deaths caused by injury. Although deaths from injury are fewer in number than other types of injuries, they are more visible because they are considered newsworthy and often appear on radio and television, in the print newspapers, social media, and online news resources. The second category is composed of severe injuries that result in hospitalization

and disability. Severe injuries are followed on the pyramid by less-severe injuries, those that require emergency department care or urgent care centers, and those that are treated in basic health care facilities. Finally, at the bottom of the pyramid are injuries that do not require professional medical care and that are instead treated by a first aid provider.

TABLE 1-2 shows the leading causes of nonfatal injuries treated at hospital emergency departments by age group in the United States. Each year, one in four people experiences a non-fatal injury serious enough to need professional medical care or to restrict activity for at least 1 day. More sports-related nonfatal injuries are treated in hospital emergency departments than any other type of unintentional injury.

Death occurs when a person's heart stops. Therefore, what a bystander does can mean the difference between life and death. Fortunately, most injuries and sudden illnesses do not require life-saving efforts. During their entire lifetimes, most people will rarely, if ever, see a life-threatening condition outside of a medical facility. Saving lives is important, but first aid providers are more frequently called upon to provide initial care for less-severe conditions. If not properly treated, these less-severe injuries can evolve into something more serious. As such, these skills demand attention during first aid training.

Each year, the injuries of millions of Americans go unreported. For many of these people, the injury causes temporary pain and inconvenience; for others, however, the injury leads to disability, chronic pain, and a profound change in lifestyle. Given the size of the injury and sudden illness problem, everyone should be prepared to deal with an emergency.

Value of First Aid to Self

Although many people learn first aid to help others, the training primarily helps oneself. It enables first aid providers to give proper immediate care to their own injuries and sudden illnesses. If people are too seriously injured to help themselves, they could be able to direct others in proper care. First aid training also helps develop safety awareness. Discussing injuries teaches people how injuries occur and thus promotes injury prevention.

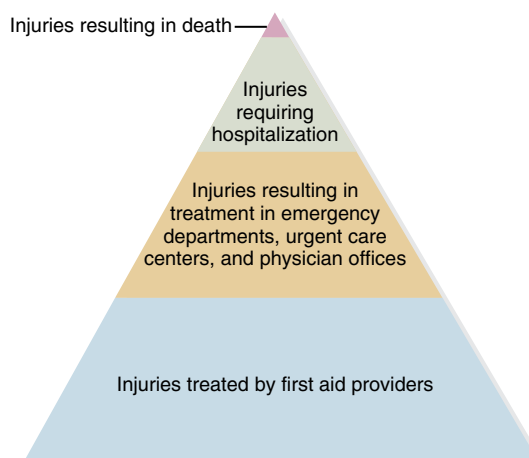


FIGURE 1-1 Injury pyramid.

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TABLE 1-1 Ten Leading Causes of Death by Age Group, United States, 2018

Age Groups (Years)										
<1	1-4	5-9	10-14	15-24	25-34	35-44	45-54	55-64	65+	Total
Congenital anomalies 4,473	Unintentional injury 1,226	Unintentional injury 734	Unintentional injury 692	Unintentional injury 12,044	Unintentional injury 24,614	Unintentional injury 22,677	Malignant neoplasms 37,301	Malignant neoplasms 113,957	Heart disease 526,509	Heart disease 655,381
Short gestation 3,679	Congenital anomalies 384	Malignant neoplasms 393	Suicide 596	Suicide 6,211	Suicide 8,020	Malignant neoplasms 10,640	Heart disease 32,220	Heart disease 81,042	Malignant neoplasms 431,102	Malignant neoplasms 599,274
Maternal pregnancy complications 1,358	Homicide 353	Congenital anomalies 201	Malignant neoplasms 450	Homicide 4,607	Homicide 5,234	Heart disease 10,532	Unintentional injury 23,056	Unintentional injury 23,693	Chronic lower respiratory disease 135,560	Unintentional injury 167,127
SIDS 1,334	Malignant neoplasms 326	Homicide 121	Congenital anomalies 172	Malignant neoplasms 1,371	Malignant neoplasms 3,684	Suicide 7,521	Suicide 8,345	Chronic lower respiratory disease 18,804	Cerebrovascular causes 127,244	Chronic lower respiratory disease 159,486
Unintentional injury 1,168	Influenza and pneumonia 122	Influenza and pneumonia 71	Homicide 168	Heart disease 905	Heart disease 3,3561	Homicide 3,304	Liver disease 8,157	Diabetes mellitus 14,941	Alzheimer disease 120,658	Cerebrovascular causes 147,810
Placenta cord membranes 724	Heart disease 115	Chronic lower respiratory disease 68	Heart disease 101	Congenital anomalies 354	Liver disease 1,088	Liver disease 3,108	Diabetes mellitus 6,414	Liver disease 13,945	Diabetes mellitus 60,182	Alzheimer disease 122,019
Bacterial sepsis 579	Perinatal period 62	Heart disease 68	Chronic lower respiratory disease 64	Diabetes mellitus 246	Diabetes mellitus 837	Diabetes mellitus 2,282	Cerebrovascular causes 5,128	Cerebrovascular causes 12,789	Unintentional injury 57,213	Diabetes mellitus 84,946
Circulatory system disease 428	Septicemia 54	Cerebrovascular causes 34	Cerebrovascular causes 54	Influenza and pneumonia 200	Cerebrovascular causes 567	Cerebrovascular causes 1,704	Chronic lower respiratory disease 3,807	Suicide 8,540	Influenza and pneumonia 48,888	Influenza and pneumonia 59,120
Respiratory distress 390	Chronic lower respiratory disease 50	Septicemia 34	Influenza and pneumonia 51	Chronic lower respiratory disease 165	HIV 482	Influenza and pneumonia 956	Septicemia 2,380	Septicemia 5,956	Nephritis 42,232	Nephritis 51,386
Neonatal hemorrhage 375	Cerebrovascular 43	Benign neoplasms 19	Benign neoplasms 30	Complicated Pregnancy 151	Influenza and pneumonia 457	Septicemia 829	Influenza and pneumonia 2,339	Influenza and pneumonia 5,858	Parkinson disease 32,988	Suicide 48,344

Data from National Vital Statistics System, National Center for Health Statistics, CDC.

TABLE 1-2 Ten Leading Causes of Nonfatal Injuries Treated in Hospital Emergency Departments in the United States, 2017

	Age Groups (Years)										Total
	<1	1-4	5-9	10-14	15-24	25-34	35-44	45-54	55-64	65+	
Fall 1,20,007		Fall 699,107	Fall 530,390	Struck by/against 451,267	Struck by/against 755,114	Fall 647,408	Fall 623,997	Fall 828,731	Fall 1,047,959	Fall 2,970,720	Fall 8,591,683
Struck by/against 23,356		Struck by/against 254,793	Struck by/against 323,525	Fall 451,183	Fall 671,408	MV-occupant 579,446	Other specified 436,726	Other specified 473,726	Other specified 356,187	Struck by/against 312,954	Struck by/against 3,685,012
Other bite/sting 13,505		Other bite/sting 139,941	Other bite/ sting 107,577	Overexertion 222,433	MV-occupant 595,092	Struck by/against 528,104	Struck by/against 396,695	Overexertion 362,246	Struck by/against 278,211	Overexertion 227,817	Overexertion 2,569,850
Other specified 9,737		Foreign body 121,422	Cut/pierce 88,488	Cut/pierce 99,249	Overexertion 493,072	Other specified 517,628	Overexertion 395,791	Struck by/ against 360,767	Overexertion 258,488	MV-occupant 215,666	MV-occupant 2,500,353
Foreign body 8,618		Cut/pierce 60,421	Overexertion 65,413	Unknown/ unspecified 67,107	Cut/pierce 345,982	Overexertion 482,430	MV-occupant 381,110	Poisoning 337,444	MV-occupant 249,192	Cut/pierce 162,819	Other specified 2,365,891
Inhalation/ suffocation 8,518		Overexertion 58,727	MV-occupant 53,791	MV-occupant 64,349	Other specified 331,389	Poisoning 401,819	Poisoning 321,267	MV-occupant 331,388	Poisoning 245,289	Other specified 143,563	Cut/pierce 1,823,358
Fire/burn 7,567		Other specified 47,348	Foreign body 52,756	Other bite/ sting 57,014	Other assault, struck by/ against 312,205	Cut/pierce 327,787	Cut/pierce 269,865	Cut/pierce 235,597	Cut/pierce 184,284	Poisoning 137,849	Poisoning 1,755,044
Unknown/ unspecified 4,618		Fire/burn 41,066	Pedal cyclist 39,388	Other assault, struck by/ against 54,366	Poisoning 246,611	Other assault, struck by/ against 355,927	Other assault, struck by/ against 212,483	Other assault, struck by/ against 171,022	Other bite/ sting 115,933	Other bite/ sting 116,191	Other assault, struck by/ against 1,261,580
Cut/pierce 3,844		Unknown/ unspecified 38,207	Dog bite 33,586	Pedal cyclist 49,283	Pedal cyclist 147,861	Other bite/ sting 176,855	Other bite/ sting 131,323	Other bite/ sting 135,907	Other assault, struck by/ against 95,550	Unknown/ unspecified 96,304	Other bite/ sting 1,142,130
Poisoning 3,459		Poisoning 37,493	Unknown/ unspecified 32,336	Other transport 40,876	Unknown/ unspecified 122,980	Unknown/ unspecified 120,116	Unknown/ unspecified 98,759	Unknown/ unspecified 95,913	Unknown/ unspecified 78,898	Other transport 79,829	Unknown/ unspecified 755,567

* With the exception of the "Other assault" category, all causes of injury in this table are unintentional.

Abbreviation: MV, motor vehicle

Data from Office of Statistics and Programming, National Center for Injury Prevention and Control, CDC.

Value of First Aid to Others

People with first aid training are more likely to give proper assistance to injured family members. Although the main beneficiaries are the trained person and their family, the benefits of knowing appropriate first aid techniques extend further, usually to coworkers, acquaintances, and strangers.

Value of First Aid in Remote Areas

Should an injury or sudden illness require professional medical care, time, distance, and availability are major considerations. EMS can reach most people who are severely injured or suddenly ill within 10 to 20 minutes. However, some people are long distances from professional medical care. Although many people associate long distances and lack of professional medical care with wilderness settings involving outdoor recreational activities (eg, hiking, camping, hunting, and snowmobiling), other settings also demand that people be prepared to give first aid for an extended time. The following are some examples:

- Urban areas after a disaster that destroys or overwhelms EMS
- Remote areas relating to one's occupation (eg, farming, ranching, commercial fishing, and forestry)
- Remote communities
- Developing countries

First aid needed in remote locations is similar to that needed in urban settings, but extra skills are sometimes required. See Chapter 24, *Wilderness First Aid*, for information on delivering first aid in remote locations.

What Is First Aid?

The International Liaison Committee on Resuscitation (ILCOR) guidelines define **first aid** as the helping behaviors and initial care provided for an acute illness or injury. According to the guidelines, the goals of the first aid provider include “preserving life, alleviating suffering, preventing further illness or injury, and promoting recovery.” First aid, which includes self-care, can be initiated by anyone in any situation but should be based on medical and scientific evidence or expert consensus. First aid competencies include the following:

- Recognizing, assessing, and prioritizing the need for first aid
- Providing care by using appropriate knowledge, skills, and behaviors
- Recognizing limitations and seeking additional care when needed

First aid does not take the place of professional medical care. In most cases, professional medical care is unnecessary and the ill or injured person will safely recover.

Legal Aspects of First Aid

Legal and ethical issues concern all first aid providers. For example, are you required to stop and give care at an automobile crash? Are you allowed to treat a child with a broken arm even

Q&A

What level of care am I expected to give?

The level of care required of a provider is referred to as the **standard of care**. A first aid provider cannot provide the same level of care as a physician or an emergency medical technician. When you are providing first aid, you must do the following to meet the standard of care: (1) do what is expected of someone with first aid training and experience working under similar conditions, and (2) treat the person to the best of your ability. If the first aid you provide is not up to the expected standard, you may be held liable for your actions.

when the parents cannot be contacted for their consent? These and many other legal and ethical questions confront first aid providers.

A first aid provider can be sued. However, do not become overly concerned about being sued; it rarely happens. Ways to minimize the risk of a lawsuit include the following:

- Obtain the person's consent before helping and touching them.
- Follow this text's guidelines, and do not exceed your training level.
- Review the standards of first aid, and stay up to date on best practices.
- Explain any first aid you are about to give.
- Treat everyone with respect.
- Once you have started to care for a person, stay with that person. You are legally bound to remain with the person until care is turned over to an equally or better trained person.

Consent

A first aid provider must have the person's **consent** (permission) before giving first aid. Touching another person without their consent (which is known as **battery**) is unlawful and could be grounds for a lawsuit. The lawsuit could also include a charge of **assault**, a threat or attempt to touch another person. Likewise, giving first aid without the person's consent is unlawful.

Informed (Expressed) Consent

Consent must be obtained from every alert, mentally competent (able to make a rational decision) person of legal age. Tell the person that you have first aid training and explain what you will be doing. The person may give permission verbally or with a nod of the head, which would indicate **expressed consent**.

Implied Consent

Implied consent involves an unresponsive person with a life-threatening condition. It is assumed or implied that an unresponsive person would consent to life-saving interventions. An alert person who does not resist the care of a first aid provider is also assumed to have given implied consent.

Children and Incompetent Adults

Consent must be obtained from the parent or guardian of a child, as legally defined by the state. In some states, a minor can give consent to receive medical care, depending on the minor's age and maturity. In many states, minors who are married, are members of the armed services, or are parents are legally considered adults. Consent must also be obtained from the parent or guardian of an adult who is mentally incompetent (unable to make a rational decision). A care giver or health care proxy could provide consent for an adult who has dementia and is unable to consent for themselves.

When life-threatening situations exist and a parent or legal guardian is not available for consent, first aid should be given based on implied consent. Do not withhold first aid just to obtain consent from a parent or guardian.

Psychiatric emergencies present difficult issues of consent. Under most conditions, a police officer is the only person with the authority to restrain and transport a person against that person's will. A first aid provider should not intervene unless directed to do so by a police officer or unless it is obvious that the person is about to do life-threatening harm to themselves or others.

Q & A

How can I avoid a lawsuit resulting from giving first aid?

Before giving first aid, get the person's consent or permission. Then provide quality care, keep within your training level, be nice to the person, and try to ensure that witnesses are on hand. Afterward, write down what you did, who was present (ie, names of witnesses), and who took over the person's care from you.

Refusing Help

Although it seldom happens, a person might refuse assistance for countless reasons, such as religious grounds, avoidance of possible pain, or the desire to be examined by a physician rather than by a first aid provider. Whatever the reason for refusing first aid, or even if no reason is given, an alert and mentally competent adult can reject help.

Generally, the wisest approach is for you to inform the person of their medical condition, what you propose to do, and why the help is necessary. If the person understands the consequences and still refuses treatment, there is little else you can do. Call 9-1-1 and, while awaiting arrival, do the following:

- Try again to persuade the person to accept care, and encourage others at the scene to persuade the person. A person could change their mind after a short time.
- Make certain you have witnesses. A person could refuse consent and then deny having done so.
- Consider calling for law enforcement assistance. In most locations, the police can place a person in protective custody and require them to go to a hospital.

Do not worry about the legal implications if someone denies refusing consent. Unless you have a duty to act (see the "Duty to Act" section below), you are not required to give first aid.

Abandonment

Abandonment means leaving a person after starting to give help without first ensuring that the person will receive continued care at the same level or higher. Once you have responded to an emergency, you must not leave a person who needs continuing first aid until another competent and trained person takes responsibility for the person. This might seem obvious, but cases exist in which critically ill or injured people were left unattended and then died. Thus, a first aid provider must stay with the person until another equally or better trained person takes over.

Negligence

Negligence means not following the accepted standards of care, resulting in further injury to the person. Negligence involves the following:

1. Having a duty to act (ie, an obligation to give first aid)
2. Breaching that duty (either by not giving care or by giving substandard care)
3. Causing injury and damages
4. Exceeding your level of training

Duty to Act

No one is required to give first aid unless a legal **duty to act** exists. Usually, the decision to help in an emergency is an ethical (moral) one. However, a legal duty to act could apply in the following situations:

- *When employment requires it.* If your employer designates you as the person responsible for providing first aid to meet OSHA requirements and you are called to an injury scene, you have a duty to act. Examples of occupations that involve a legal obligation to give first aid include law enforcement officers, park rangers, athletic trainers, lifeguards, flight attendants, and fire fighters.

A person's employment-related duty to act may extend to off-duty hours. Some states require certain people who are trained by the state to give emergency care regardless of their on- or off-duty status. In other words, these people are considered to be always on duty. Other states require such people to act when on duty but not generally when they are off duty, unless they are in uniform or have other visible insignia and appear to be on duty, in which case these people must respond.

- *When a preexisting responsibility exists.* You might have a preexisting relationship with other people that makes you responsible for them, which means you must give first aid should they need it. For example, a parent has a preexisting responsibility for a child and teachers for their students.

- *When you were involved in the events that led to the person's injuries.* Regardless of who was at fault, if you possess first aid training, you are legally obligated to offer care to any person who has been injured or becomes ill as a result of actions in which you are involved. For example, all drivers are required to provide reasonable assistance, including contacting 9-1-1 if professional medical care is needed.

Duty to act means following guidelines for standards of care. *Standards of care* ensure quality care and protection for injured or suddenly ill people. The elements that make up standards of care include the following:

- *The type of rescuer.* A first aid provider should provide the level and type of care expected of a reasonable person with the same amount of training and in similar circumstances. Different standards of care apply to physicians, nurses, emergency medical technicians (EMTs), and first aid providers.
- *Published guidelines.* Organizations and societies devoted to emergency care publish recommended first aid procedures. For example, the American Heart Association publishes guidelines for giving CPR, and the Wilderness Medical Society publishes guidelines for assisting people who are in remote locations. Once trained, you should stay up to date on the latest first aid practices.

Breach of Duty

A **breach of duty** happens when a first aid provider fails to provide the type of care that would be given by a person having the same or similar training. A breach of duty can occur in two ways: through omission and through commission. An **act of omission** is the failure to do what a reasonably prudent person with the same or similar training would do in the same or similar circumstances. An **act of commission** is doing something that a reasonably prudent person would not do under the same or similar circumstances. Forgetting to apply a dressing is an act of omission; cutting the site of a snakebite is an act of commission.

Injury and Damages Inflicted

The unfortunate outcome of a breach of duty is harm to the person in need of care. The most obvious harm is the physical damage produced at the point of contact. However, injury and damage can include subsequent physical pain and suffering, mental anguish, medical expenses, and sometimes loss of earnings and earning capacity. First aid providers can help prevent such adverse outcomes, and can avoid any liability should they occur, by conforming to the appropriate standard of care.

Level of Training Restrictions

As mentioned in the discussion of duty to act, the standard of care expected of a provider depends on the provider's training level and on organizational recommendations. It may seem that meeting the prescribed standard of care is the bare

minimum to which a provider should aspire and that going beyond this standard would be commendable. However, in meeting the standard of care, doing the minimum is enough. Providers should not exceed their skill level. Doing more than what is defined by the standard of care may be dangerous to the injured or ill person and possibly even to the provider. If a provider chooses to exceed the standard of care, they can be held liable for any damage done in the process. For example, watching a professional medical procedure portrayed on a medical drama television show or actual procedures shown on the Internet or social media does not qualify a layperson to perform it.

Confidentiality

First aid providers might learn confidential information. It is important that you be extremely cautious about revealing information you learn while caring for someone. The law recognizes that people have the right to privacy. Do not discuss what you know with anyone other than those who have a medical need to know. The exception to this rule is when state laws require the reporting of certain incidents, such as rape, abuse, and gunshot wounds.

Good Samaritan Laws

Starting in the late 1950s, a number of states (beginning with California in 1959) enacted laws designed to protect physicians and other medical personnel from legal actions that might arise from emergency treatment they provided while not in the line of duty. These laws, known as **Good Samaritan laws**, encourage people to assist others in distress by granting them protection from lawsuits. Although the laws vary from state to state, Good Samaritan protection generally applies only when the rescuer (1) is acting during an emergency; (2) is acting in good faith, which means they have good intentions; (3) is acting without compensation; and (4) is not guilty of malicious misconduct or gross negligence toward the person (deviating from rational first aid guidelines).

Although Good Samaritan laws originally covered physician and other health care providers, all states have expanded them to include laypeople serving as first aid providers. In fact, some states have several Good Samaritan laws that cover different types of people in various situations. These laws will not protect first aid providers who have caused further injury to a person. Good Samaritan laws are not a protection for poorly given first aid, nor do they authorize providers to exceed their scope of training. Fear of lawsuits has made some people hesitant about becoming involved in emergency situations. First aid providers, however, are rarely sued.

Some Good Samaritan laws have been expanded to protect the injured or ill and witnesses calling 9-1-1 to report an illness or injury related to illegal activity. For example, certain immunity is offered to people calling in an opioid overdose. Callers may be protected from arrest, charge, and prosecution. These life-saving laws are aimed at reducing the numbers of unintentional deaths from opioid overdoses.

Q & A

What is the rescue doctrine?

The rescue doctrine is an unfamiliar concept to most first aid providers and emergency personnel. The rescue doctrine says that people who are injured while performing a rescue may, unless they have acted rashly or recklessly, recover damages from the person whose negligence created the peril that necessitated the rescue in the first place. In other words, in some cases, an injured first aid provider has the right to recover for injuries sustained while attempting to assist others from those responsible for causing the dangerous rescue. The following are examples of situations covered by the rescue doctrine:

- A person intervenes to rescue another person who is being attacked by a dog and the rescuer is injured. The owner of the dog will be held responsible for the injury.
- A distracted driver fails to see a stop sign. A bystander on a nearby street curb realizes that the driver is about to hit a pedestrian, runs into the street to push the pedestrian out of the way and is hit by the vehicle instead. The driver will be liable for bystander's injury as well for any injuries to the other pedestrian.

Injury Prevention

“An ounce of prevention is worth a pound of cure” refers to the fact that it is better to prevent an injury or illness than it is to treat one. Effective prevention requires a combination of interventions known as the **3Es**: education, enforcement, and engineering.

Educational interventions are the most well known because they are the easiest to implement. Education attempts to change behavior by informing a target group about potential hazards, explaining risks, and persuading people to adopt safer behavior.

Enforcement tries to reduce dangerous behaviors through enforcing laws and regulations. For most laws to be effective, they should incorporate the following elements:

- A perceived high likelihood of apprehension
- Swift penalty delivery
- Penalties that do not always have to be extreme or severe

Engineering makes changes to the environment or product design to protect everyone automatically. This is called a passive or automatic intervention because it requires no work on the part of the person.

Examples of interventions are listed in **TABLE 1-3**.

Haddon Matrix

The **Haddon Matrix** is a strategy for identifying interventions that can be applied to any type of illness or injury. As seen in

TABLE 1-3 Examples of Interventions

Education/ Persuasion	Enforcement/Laws	Engineering/ Technology
■ Swimming lessons ■ Gun safety course ■ Social media clip showing a safety procedure or message ■ Weather and road condition alerts for drivers	■ Laws requiring seat belt and helmet use ■ Prohibition of fireworks ■ Laws requiring that personal flotation devices be worn when boating ■ Building codes and inspections	■ Airbags in cars ■ Helmets ■ Child-resistant packaging on medications and chemicals ■ Smoke and carbon monoxide detectors

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TABLE 1-4 Sample Haddon Matrix

Injury Type	Pre-event	Event	Post-event
Motor vehicle crash	Passing and enforcing drinking and driving laws	Wearing seat belts	Initiating rapid EMS response
Poisoning	Labeling toxic products	Packaging poisons in small, nonlethal amounts	Calling the National Poison Control telephone number
Drowning	Constructing fences around backyard swimming pools	Wearing personal flotation devices	Performing CPR

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TABLE 1-4, the three major phases progress horizontally from left to right and can be viewed as time phases:

- **Pre-event.** In this phase, interventions attempt to stop or hinder an event (eg, drowning) from happening. This phase involves prevention efforts.
- **Event.** This phase attempts to modify the consequences of such events either to prevent or to reduce the severity of an injury (eg, airbag inflating on impact).
- **Post-event.** This phase focuses on returning the person to optimal functioning in society after an injury or illness. This phase involves rescue, first aid, medical treatment, and rehabilitation.

Table 1-4 shows examples of interventions related to crashes, poisoning, and drowning.

PREP KIT

Ready for Review

- Everyone should be able to perform first aid because most people will eventually find themselves in a situation requiring it for another person or for themselves.
- First aid is the immediate care given to an injured or suddenly ill person. First aid does not take the place of professional medical care.
- Legal and ethical issues concern all first aid providers.
- A first aid provider must have the person's consent (permission) before giving first aid.
- First aid providers might learn confidential information. It is important that first aid providers be extremely cautious about revealing information they learn while caring for someone.
- Varying from state to state, Good Samaritan laws encourage people to assist others in distress by granting them protection from lawsuits.

Vital Vocabulary

abandonment Failure to continue first aid until relieved by someone with an equal or higher level of training.

act of commission A breach of duty in which the provider does something that a reasonably prudent person would not do under the same or similar circumstances.

act of omission A breach of duty in which the provider fails to do what a reasonably prudent person with the same or similar training would do in the same or similar circumstances.

assault A threat or attempt to touch another person without consent.

battery Touching a person or providing first aid without consent.

breach of duty Failure of a first aid provider to deliver the type of care that would be given by a person having the same or similar training.

consent An agreement by a person in need of care to accept treatment offered as explained by medical personnel or first aid providers.

duty to act A person's responsibility to provide care.

expressed consent Permission for care that a person gives verbally or with a head nod.

first aid Immediate care given to an injured or suddenly ill person.

Good Samaritan laws Laws that encourage people to voluntarily help an injured or suddenly ill person by minimizing the liability for errors made while rendering emergency care in good faith.

Haddon Matrix A strategy for identifying interventions that can be applied to any type of illness or injury. Interventions proceed through three stages: pre-event, event, and post-event.

implied consent The legally permissible assumption that an unconscious person in need of emergency life-saving treatment would accept treatment, were they alert and able.

negligence Deviation from the accepted standard of care that results in further injury to the person.

standard of care The level of care legally and ethically required of a provider. To meet the standard of care when providing first aid, a provider must (1) do what is expected of someone with first aid training and experience working under similar conditions, and (2) treat the person to the best of their ability.

3Es A strategy to produce effective prevention by combining three types of intervention: education, enforcement, and engineering.

Assessment in Action

Toward the end of the ski season, you hear that a ski resort in a neighboring state is nearly empty of skiers and the resort is offering reduced ticket prices during weekdays. You decide to take advantage of the reduced prices and take a few days off to go skiing. As you ski down the mountain on a run with trees bordering on both sides, you come across a man lying motionless in the snow near a tree that he may have crashed into. No other skiers are in sight and you are alone. As you approach the person, you see no obvious injuries. You have no first aid supplies. Your first aid certification is current.

Directions: Circle Yes if you agree with the statement; circle No if you disagree.

1. You have to stop to help the man.
YES NO

2. You have implied consent to help this man.
YES NO

PREP KIT continued

3. After tapping on the man's shoulder to see if he is okay, he remains unresponsive but is breathing. You can leave and assume that the ski patrol will be coming shortly.

YES NO

4. You are an off-duty paramedic and you decide to help. Can you expect to be paid for the time spent helping the skier?

YES NO

Check Your Knowledge

Directions: Circle Yes if you agree with the statement; circle No if you disagree.

1. Because an ambulance can arrive within minutes in most locations, most people do not need to learn first aid.

YES NO

2. Correct first aid can mean the difference between life and death.

YES NO

3. During your lifetime, you are likely to encounter many life-threatening emergencies.

YES NO

4. All injured people require professional medical care.

YES NO

5. Before giving first aid to an alert, competent adult, you must get consent (permission) from the person.

YES NO

6. If you ask an injured adult if you can help, and they say, "No," you can ignore them and proceed to provide care.

YES NO

7. People who are designated as first aid providers by their employers must give first aid to injured employees while on the job.

YES NO

8. First aid providers who help injured people are rarely sued.

YES NO

9. Good Samaritan laws provide a degree of protection for first aid providers who act in good faith and without compensation.

YES NO

10. You are required to provide first aid to any injured or suddenly ill person you encounter.

YES NO



Action at an Emergency

Emergencies

Emergencies have the following distinctive characteristics:

- *Dangerous.* People's lives, well-being, or property are threatened.
- *Unusual and rare.* The average person will probably encounter fewer than a half dozen serious emergencies in a lifetime.
- *Different from one another.* Each emergency presents a unique set of issues.
- *Unforeseen.* Emergencies happen suddenly and without warning.
- *Urgent.* If the emergency is not dealt with immediately, the situation will escalate.

Bystander Actions

The bystander is a vital link between **emergency medical services (EMS)** and the injured or suddenly ill person. Typically it is a bystander who recognizes a situation as an emergency and acts to help the person. If a bystander is to intervene in an emergency, they must

CHAPTER AT A GLANCE

- › Emergencies
- › Bystander Actions
- › What Should Be Done?
- › Seeking Professional Medical Care
- › How to Call EMS
- › Rescuer Reactions
- › Scene Size-up
- › Disease Precautions
- › Death and Dying

make not just one but a series of decisions and actions quickly and reliably. These include the following:

1. Recognizing the emergency
2. Deciding to help
3. Calling 9-1-1 if EMS is needed
4. Checking the injured or ill person
5. Giving first aid

Compared with health care providers, ordinary bystanders are significantly less likely to offer help in emergencies that occur in public places. Some reasons for this include the following:

- Lack of knowledge and training
- Confusion about what constitutes an emergency
- Characteristics of the emergency (eg, unpleasant physical appearance of the person, the presence of other bystanders)
- Fear of being infected with a disease
- Concern about legal consequences of helping (see Chapter 1, *Introduction*, Legal Aspects of First Aid)

Lack of Knowledge

The average layperson is unaware of many aspects of emergency care and has difficulty recognizing common medical emergencies and deciding to call 9-1-1 for help. In addition, a person who does not feel competent to deal with an emergency is not likely to offer even minimal help. The person who does not feel competent can escape this uncomfortable feeling by failing to acknowledge the situation as an emergency. The implication is that bystanders who are uncertain of their ability to deal with a seriously injured person are more likely to assume that the person is not seriously injured.

Confusion About What Is an Emergency

Sometimes, laypeople have difficulty deciding when an emergency exists **FIGURE 2-1**. For example, motor vehicle crashes can be easier to recognize as emergencies than heart attacks. Underestimating the severity of an emergency can lead to



FIGURE 2-1 It is not always clear at first glance whether an emergency exists.

© Jose Luis Pelaez Inc/DigitalVision/Getty Images.

delays in calling 9-1-1 and to inappropriate decisions, such as transporting people with life-threatening conditions by private vehicles rather than calling 9-1-1.

Other Factors That Influence Whether a Bystander Helps

In addition to lack of knowledge and confusion, bystanders encounter other barriers that can slow or prevent action in an emergency. Many people are put off by unpleasant physical characteristics such as blood, vomitus, or alcohol on the breath. An unwillingness to approach or touch a person who is bleeding is a common impediment to providing care. Concerns about contracting such diseases as human immunodeficiency virus (HIV, the virus that can cause acquired immunodeficiency syndrome [AIDS]), coronavirus disease 19 (COVID-19), and tuberculosis (TB) can worsen this issue.

Another factor involved in helping behavior is the bystander's time of arrival. A bystander who sees the emergency happen is more likely to help than a bystander who arrives after the event.

Fear of being sued may also prevent some people from assisting during an emergency. Good Samaritan laws offer first aid providers protection from lawsuits as long as the first aid provider is not guilty of malicious misconduct and gross negligence. These laws are described further in Chapter 1, *Introduction*. The care must also be provided during an emergency, in good faith, and without compensation.

Quality of Help Provided by Bystanders

First aid and other assistance given by bystanders can be inadequate or potentially dangerous. Failure to keep an open airway and the decision to transport the person in a private vehicle rather than by EMS are two examples. Usually, transporting a person in a private vehicle can be dangerous. However, in mass casualty incidents, such as the Las Vegas shooting when the system was overwhelmed, the decision to use private vehicles was seen as correct. Many people, trained decades ago or remembering a home remedy, might use outdated and unproven first aid procedures for various injuries or sudden illnesses. A few examples include the following:

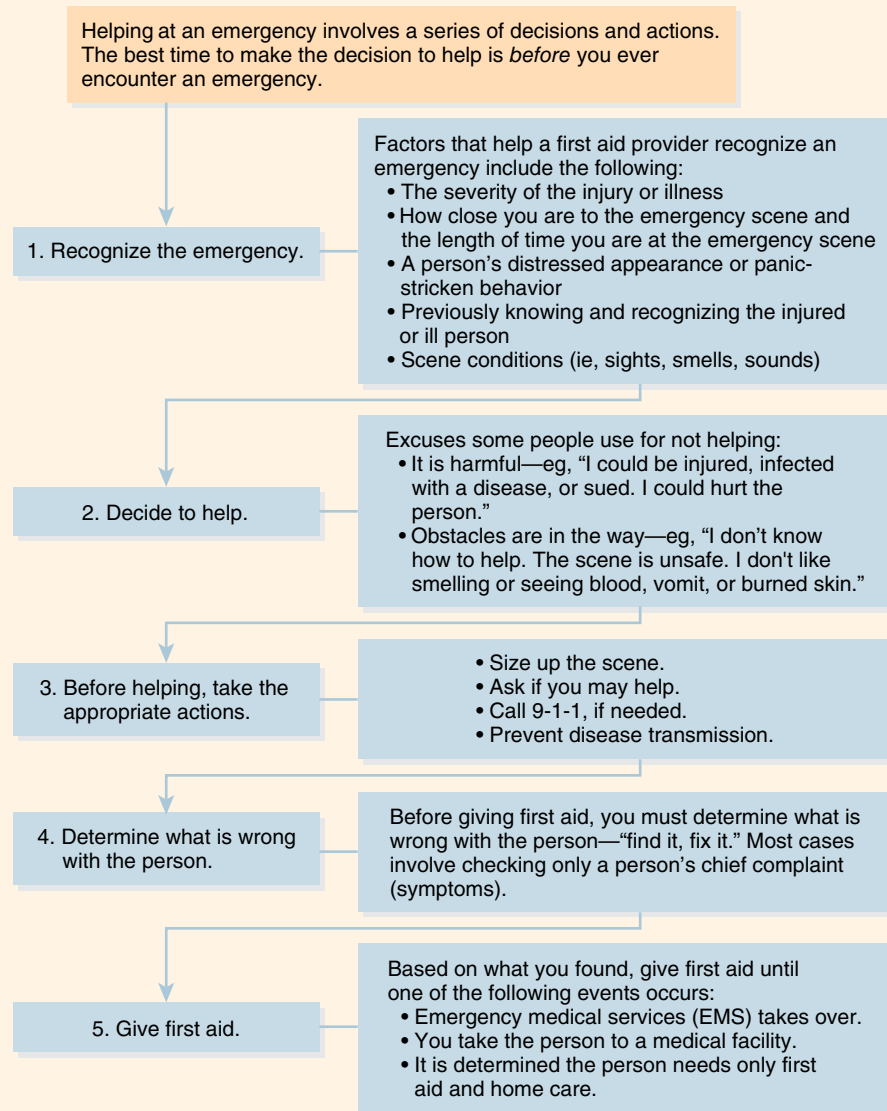
- Putting butter on a burn
- Treating a nosebleed by tilting the head back
- Using hydrogen peroxide to clean a wound
- Sticking an object between the teeth of a person experiencing a seizure to prevent the person from biting their tongue
- Giving syrup of ipecac for a swallowed poison
- Applying suction on a venomous snake bite

What Should Be Done?

As stated at the beginning of this chapter, injured or suddenly ill people would benefit if bystanders could quickly and reliably do the following **FLOWCHART 2-1**:

1. Recognize the emergency.
2. Decide to help.

Flowchart 2-1 Role of the First Aid Provider



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3. Call 9-1-1 if EMS is needed.
4. Check the person.
5. Give first aid.

Recognize the Emergency

To help in an emergency, the bystander first has to notice that something is wrong. Factors that help a first aid provider recognize that something is wrong include the following:

- **Severity.** Severe, catastrophic emergencies such as a motor vehicle crash involving an overturned vehicle or several vehicles attract attention.
- **Physical distance.** The closer a bystander is to an emergency situation, the more likely they are to notice it.
- **Relationship.** Knowing the person increases the likelihood of noticing an emergency. For example, you

would notice your child's injuries before you might notice the same injuries on a stranger.

- **Time exposed.** Evidence indicates that the longer a bystander is aware of the situation, the more likely they are to recognize it as an emergency.
- **Scene conditions.** Gory sights, terrible smells, and gruesome sounds repel many people.
- **Person's appearance.** A bystander is likely to notice a person who has a distressed appearance or is exhibiting panic-stricken behavior.

Decide to Help

At some time, everyone will have to decide whether to help another person **FIGURE 2-2**. Unless the decision to act in an emergency is considered well in advance of an actual emergency, the many obstacles that make it difficult or unpleasant



FIGURE 2-2 Be willing to take the time to help.

© Fertnig/E+/Getty Images.

for a bystander to help a stranger are almost certain to impede action. One important strategy that people use to avoid action is to refuse (consciously or unconsciously) to acknowledge the emergency. Many emergencies do not look like the ones portrayed on television, and the uncertainty of the real event can make it easier for the bystander to avoid acknowledging the emergency.

Bystanders are more likely to promptly get involved at the time of an emergency if they have previously considered the possibility of helping others. Thus, the most important time to make the decision to help is before ever encountering an emergency. Deciding to help is an attitude about emergencies and about one's ability to deal with emergencies. It is an attitude that takes time to develop and is affected by a number of factors. To develop such a helping attitude, people must do the following:

- Appreciate the importance of bystander help to an injured or suddenly ill person.
- Feel confident about helping someone who is seriously injured or suddenly ill, even if someone else is present.
- Be willing to take the time to help.
- Be able to put the potential risks of helping in perspective.
- Feel comfortable about taking charge at an emergency scene. This is accomplished by maintaining skill competency as well as by gaining experience, either actual or simulated.
- Feel comfortable about seeing or touching a person who is bleeding or vomiting or who appears dead.

Deciding Not to Help

A bystander could always find excuses for not helping in emergency situations. The following are reasons, some of them more legitimate than others, that people often give for not aiding others:

- *Helping could be harmful.* Bystanders have lost their lives or been severely injured while attempting to rescue others. Attempting any rescue must be made as safe as possible based on the surrounding hazards and the first aid provider's training. The fear of being sued or contracting a disease such as HIV or tuberculosis

can also act as a deterrent. Some would-be first aid providers have been attacked by dogs protecting their disabled owners.

- *Helping is not worth the effort.* Some bystanders might feel that the person is getting what they deserve. Rewards, if any, are not significant for first aid providers.
- *Helping requires advanced training and skills.* Many bystanders do not know how to help. They cannot swim, do not know how to control bleeding or perform cardiopulmonary resuscitation (CPR), or do not have other necessary rescue and first aid skills.
- *Unpleasant conditions.* The sight of blood, vomit, and other unpleasant conditions sometimes found at emergency scenes may be all that some would-be first aid providers need to justify not getting involved.
- *No other bystanders are helping.* The likelihood that a person will help in an emergency decreases as the number of bystanders increases. When bystanders see that others are not taking action, they may conclude that the situation is not serious. Further, the presence of other bystanders may encourage a person to leave the situation to someone else.

Call 9-1-1 if EMS Is Needed

People sometimes make the wrong decision about calling 9-1-1. They may delay calling 9-1-1 until absolutely sure that an emergency exists, or they may decide to bypass EMS and transport the person to professional medical care in a private vehicle. Such actions can endanger a person. Fortunately, most injuries and sudden illnesses do not require professional medical care—only first aid. Size up the scene to determine if EMS or first aid is needed. Be sure to always ask for consent before helping any injured person. Use appropriate personal protective equipment (PPE) to prevent disease transmission.

Check the Person

You must decide whether life-threatening conditions exist and what kind of help a person needs. In most cases, this involves checking signs and symptoms of a person's main (chief) complaint. See Chapter 4, *Finding Out What Is Wrong*, for details.

FYI

Actual Versus Perceived EMS Response Time

People's perceptions of ambulance response times are inaccurate. They tend to overestimate response time while underestimating scene time and time to professional medical care.

Data from Harvey AH, Gerard WC, Rice GF, Finch H. Actual vs. perceived EMS response time. *Prehosp Emerg Care*. 1999;3(1):11–14.

Give First Aid

Often the most critical life support measures are effective only if started immediately by the nearest available person. That person usually will be a layperson—a bystander. Continue to give first

aid until EMS takes over or it is determined the person needs only first aid and home care.

Seeking Professional Medical Care

Knowing when to call 9-1-1 for help from EMS is important. To know when to call, you must be able to tell the difference between a minor injury or illness and a life-threatening one. For example, upper abdominal pain may be attributed to something as simple as indigestion or ulcers, but it may also be an early sign of a heart attack. Wheezing could be related to a person's asthma, for which the person can use their prescribed inhaler for quick relief, or it can be as serious as a severe allergic reaction from a bee sting.

Not every cut requires stitches, nor does every burn require professional medical care. It is, however, always best to err on the side of caution. According to the American College of Emergency Physicians (ACEP), if the answer to any of the following questions is "yes," or if you are unsure, call 9-1-1 for professional medical help:

- Is the condition life-threatening?
- Could the condition get worse on the way to the hospital?
- If you move the person, will it cause further injury?
- Does the person need the skills or equipment of EMS?
- Would distance or traffic cause a delay in getting the person to the hospital?

ACEP also recommends immediate transport to the hospital emergency department, by EMS or by private vehicle, for the following conditions that are warning signs of more serious conditions:

- Difficulty breathing, especially if it does not improve with rest
- Chest or upper abdominal pain or pressure lasting 2 minutes or more
- A fast heartbeat (more than 120 to 150 beats per minute) at rest, especially if associated with shortness of breath or feeling faint
- Fainting (passing out) or unresponsiveness
- Difficulty speaking, or numbness or weakness of any part of the body
- Sudden dizziness
- Confusion or changes in mental status, unusual behavior, or difficulty walking
- Sudden blindness or vision changes
- Bleeding from any wound that will not stop with direct pressure
- Broken bones visible through an open wound, or a broken leg
- Drowning (submersion)
- Choking
- Severe burn
- Allergic reaction, especially if there is any difficulty breathing

- Extremely hot or cold body temperature
- Poisoning or drug overdose
- Sudden, severe headache
- Any sudden or severe pain
- Severe or persistent vomiting or diarrhea
- Coughing or vomiting of blood
- Behavioral emergencies (threatening to hurt or kill themselves or someone else)

Wounds requiring immediate professional medical care include the following (see Chapter 9, *Wounds*, for additional information on wounds requiring professional medical care):

- Bleeding from a cut that does not slow during the first 15 minutes of steady direct pressure
- Signs of shock
- Breathing difficulty resulting from a cut to the neck or chest
- All penetrating wounds, especially from a gunshot or a sharp weapon, to the chest or abdomen
- A cut to the eyeball
- A cut that amputates or partially amputates an extremity

When a serious situation occurs, call 9-1-1 *first*. **DO NOT** call your physician, the hospital, a friend, relatives, or neighbors for help before you call 9-1-1. Calling anyone else first only wastes time. Calling 9-1-1 has several advantages over driving to the hospital emergency department by private vehicle:

- Many injured or suddenly ill people should not be moved except by trained personnel.
- The EMS personnel who arrive with the ambulance know what to do. In addition, they are in radio contact with hospital physicians.
- Care provided by EMS personnel at the scene and on the way to the hospital can increase a person's chances of survival and rate of recovery. The condition could get worse and become life threatening on the way to the hospital, in which case, the presence of trained professionals is vital.
- An ambulance usually can get a person to the hospital more quickly.

If the situation is not an emergency, call your physician. However, if you have any doubt about whether the situation is an emergency, call 9-1-1. Later chapters identify when to call 9-1-1 for specific conditions.

Q & A

Should the family be present during resuscitation?

Controversy exists regarding this question. Studies indicate that most family members want to be present. Offering select family members the opportunity to be present is reasonable. If family members are present during resuscitation, be sensitive to them by answering their questions, clarifying information, and providing them comfort.

Data from: Kleinman ME, et al. 2015 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care science. *Circulation*. 2015;132:S424.

How to Call EMS

According to the National Emergency Number Association, over 98% of people in the United States and Canada are covered by some type of 9-1-1 service. Many areas also have Enhanced 9-1-1, which allows the dispatcher to see the caller's phone number and address if the call is placed on a landline. When you call 9-1-1 from a mobile phone, however, Enhanced 9-1-1 cannot identify your exact address, because mobile phone signals only provide a general location **FIGURE 2-3**. Because of this key difference, make sure you know your exact address or location to give the 9-1-1 dispatcher.

When you call 9-1-1, speak slowly and clearly. Be ready to give the dispatcher the following information:

1. *The person's location.* Give the address, names of intersecting roads, and other landmarks, if possible. Location details are the most important information you can provide. Also, tell the specific location of the person. (For example, "in the basement" or "in the backyard.")
2. *The phone number you are calling from and your name.* This information allows dispatchers to detect false reports, thus minimizing their frequency, and it allows a dispatch center without Enhanced 9-1-1 to call back if disconnected or if additional information is needed.
3. *A description of what happened.* State the nature of the emergency. (For example, "My husband fell off a ladder and is not moving.")
4. *The number of people needing help and any special conditions.* (For example, "There was a car crash involving two cars. Three people are trapped.")
5. *A description of the person's condition.* (For example, "My husband's head is bleeding.") List any first aid you have attempted, such as pressing on the site of the bleeding.

DO NOT hang up the phone unless the dispatcher instructs you to do so **FIGURE 2-4**. The EMS dispatcher could tell you how best to care for the person. If you send someone

else to call, have the person report back to you so you can be sure the call was made. Other tips include the following:

- Teach children what 9-1-1 is for and how and when to call. Refer to "nine-one-one," not "nine-eleven," because children might expect to find an eleven on the keypad.
- Do not hang up without explanation if you call 9-1-1 by mistake; if you hang up, the dispatcher will have to call back to see if you need help.

Rescuer Reactions

The sight of blood and the cries of people can be upsetting to people attempting to rescue and help an injured person. Seeing a grotesque amputation, being splattered with vomit or blood, or smelling disagreeable odors from urine and feces can be unnerving. More than one first aid provider has felt nauseated and weak, vomited, or fainted when helping injured people. Even the toughest of physicians and emergency medical technicians have difficult moments when exposed to certain situations.

It is essential that first aid providers stay alert and keep working at an injury scene. A first aid provider who collapses while aiding an injured person diverts attention from the original person, whose condition is usually more serious. All the knowledge and skills a first aid provider has are useless if they collapse or have to leave the scene because of weakness or fainting.

Desensitization

Some emergency care providers seem to have ice in their veins. They always appear calm and unaffected by even the worst injuries. These people might seem callous, but the proper psychological term is *desensitized*. A specialty within psychology deals with **desensitization** and suggests ways of overcoming anxieties caused by unpleasant sights and sounds. Desensitization is a deconditioning or a counterconditioning process that can reduce fears and anxieties. The idea is to weaken an undesirable response such as fainting by strengthening an incompatible response. When responses are incompatible (calmness versus anxiety), the occurrence of either one prevents the



FIGURE 2-3 For help, call 9-1-1 or the local emergency number.

© oneinchpunch/Shutterstock.



FIGURE 2-4 9-1-1 dispatch center.

© Jones & Bartlett Learning. Courtesy of MIEMSS.

occurrence of the other. By desensitizing, you learn to associate relaxation with situations that elicit anxiety so that eventually you do not experience anxiety. But you first need to learn how to invoke relaxation before gradually exposing yourself to anxiety-producing situations such as the sight of blood.

A simple way to desensitize (calm) yourself while helping another person is to change your thought patterns from the unpleasant to the pleasant by singing a favorite song to yourself (not out loud, of course, for the obvious reason of how you might appear to the person or observers). You can begin a process of gradual exposure to unpleasant scenes by viewing television programs, movies, or pictures of injuries in medical journals. You might eventually consider volunteering at a hospital emergency department where you can see injuries.

Physical–Emotional Intersect

A provider's ability to withstand emotional strains can be directly affected by their physical condition. In a number of cases, a first aid provider who fainted had failed to eat breakfast. It is strongly recommended that everyone maintain an adequate blood glucose level through proper eating habits. Eating breakfast is especially important.

Postcare Reactions

After giving first aid for severe injuries, a person might feel an emotional letdown, which is frequently overlooked. A stressful event can be psychologically overwhelming and can result in a condition known as **posttraumatic stress disorder (PTSD)**. Its symptoms include depression and flashbacks of the event.

Discussing your feelings, fears, and reactions within 24 to 72 hours of helping at an emergency helps prevent later emotional conditions. You could discuss your feelings with a trusted friend, a mental health professional, or a member of the clergy. Bringing out your feelings quickly can relieve personal anxieties and stress.

Scene Size-up

If you are at the scene of an emergency situation, do a quick **scene size-up FLOWCHART 2-2**, trying to answer the following questions:

- Are hazards present that could be dangerous to you, the injured or suddenly ill person or people, or bystanders?
- How many people are involved?
- What is wrong?
- What happened?
- Are bystanders available to help?

Are Hazards Present?

As you approach an emergency scene, scan the area for immediate dangers to yourself or to the person **FIGURE 2-5**. For example, if a car crash is obstructing traffic, you have to consider whether you can safely approach the vehicle of the person requiring help. Or you might notice that gasoline is dripping from the gas tank and that the battery has shorted out and is sparking. Other conditions include hazardous conditions such



FIGURE 2-5 The scene size-up includes evaluating the scene for hazardous conditions.

Courtesy of Lara Shane/FEMA.

as chemical spills, toxic fumes, explosives, gas leaks, or live electric wires. In some locations, dangers such as an avalanche, landslides, fires, flash floods, or attack dogs might exist. If the scene is dangerous, stay away and call 9-1-1. You are not being cowardly, merely realistic. Never attempt a rescue that you have not been specifically trained to do. You cannot help another person if you also become injured or ill.

How Many People Are Involved?

The second step is to determine how many people are involved. There could be more than one person in need of help, so look around and ask about others involved.

What Is Wrong? What Happened?

Next, try to determine what is wrong and what happened. For example, if the emergency department physician knows that a person's abdomen hurts and they were thrown against a steering wheel, they will check for liver, spleen, and cardiac injuries. Be sure to tell EMS personnel about your findings so they can identify the extent of any injuries.

Are Bystanders Available to Help?

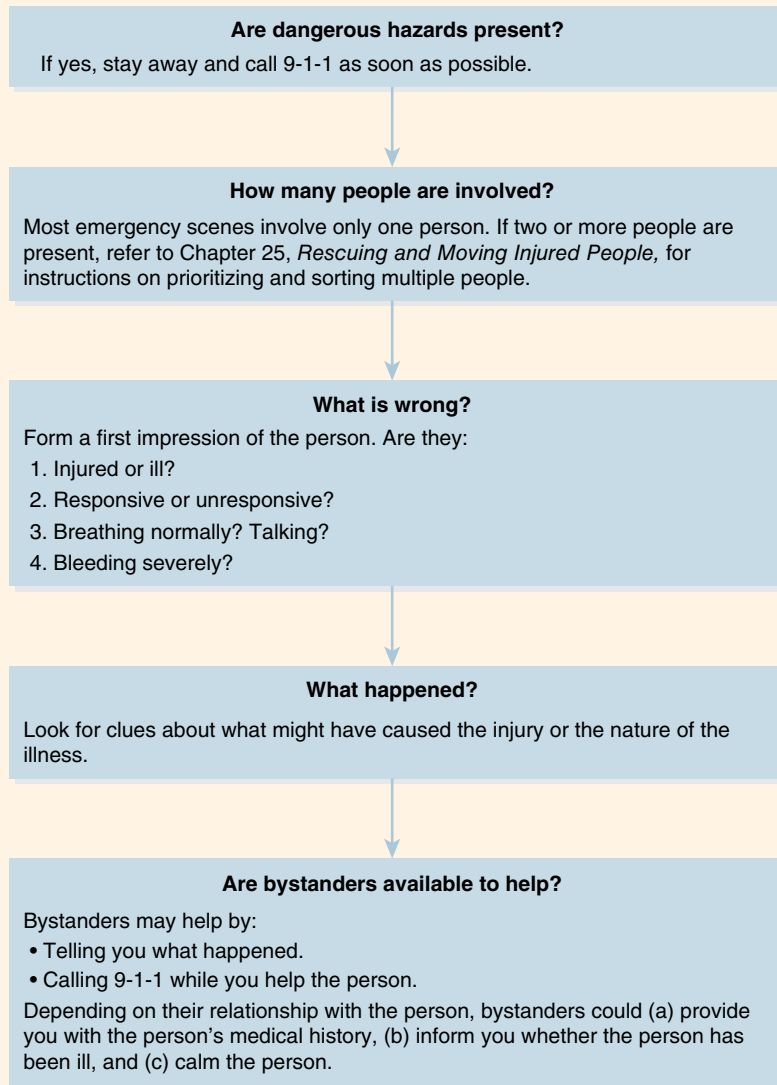
Finally, see if there are other bystanders available to help. They can tell you what happened, call 9-1-1, or help calm the injured person.

Q&A

Should I leave my vehicle headlights on at a crash scene?

Always turn your hazard lights on at a scene. Unless your headlights are needed to light up the scene, turn off your headlights when parked. Your headlights can blind approaching vehicles, making it difficult for the drivers to see rescue personnel walking around the scene.

Flowchart 2-2 Scene Size-up



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Disease Precautions

First aid providers must understand the risks from infectious diseases, which can range in severity from mild to life threatening. First aid providers should know how to reduce the risk of contamination to themselves and to others.

An **infectious disease** is a medical condition caused by the growth and spread of small, harmful organisms within the body. A **communicable disease** is a disease that can spread from one person to another. Immunizations, protective techniques, and handwashing can minimize the risk of infection. Because there are so many different infectious diseases to be concerned about, the Centers for Disease Control and Prevention (CDC) developed a set of **standard precautions**,

which advise you to assume that all people are infected and can spread an organism that poses a risk for transmission of infectious diseases. These protective measures are designed to prevent first aid providers from coming into direct contact with infectious agents.

Handwashing

Handwashing is one of the simplest, yet most effective ways to control disease transmission **FIGURE 2-6**. Even if you are wearing medical exam gloves, you should wash your hands before, if possible, and definitely after every contact with an ill or injured person. The longer the germs remain with you, the greater their chance of infecting you.



FIGURE 2-6 Handwashing.
© Diy13/Shutterstock.

The proper procedure for washing your hands is as follows:

1. Use soap and warm water, if possible. All types of soap are acceptable when washing with water.
2. Rub your hands together for 20 seconds (Sing “Happy Birthday” to yourself two times) to work up a lather. Wash all surfaces well, including wrists, palms, backs of hands, and fingers. Clean the dirt from under your fingernails.
3. Rinse the soap from your hands.
4. Dry your hands completely with a clean cloth or paper towel if possible (this helps remove the germs). If towels are not available, however, it is okay to allow your hands to air dry.

If soap and water are not available, use a hand sanitizer that contains at least 60% alcohol to clean your hands **FIGURE 2-7**. Apply the gel to one hand and rub your hands together, covering all surfaces of your hands and fingers, until the hands are dry. If your mucous membranes (eg, your eyes, nose, or mouth) are splashed by blood or body fluid, immediately flush the area with clean water.

Personal Protective Equipment

Personal protective equipment (PPE) for first aid providers includes such items as medical exam gloves, mouth-to-barrier devices, face masks, and eye protection. PPE provides a barrier between the first aid provider and infectious diseases.

Medical Exam Gloves

Medical exam gloves are the most common type of PPE and should always be worn when there is any possibility of exposure to blood or body fluids. All first aid kits should contain several pairs of gloves **FIGURE 2-8**. Because some people may have allergic reactions to latex, use latex-free gloves when giving first aid. When handling blood or other potentially infectious body fluids, use nitrile gloves, which are latex-free. Although vinyl gloves are latex-free, they are not recommended for first aid. Store medical exam gloves in their original packaging away from direct heat and sunlight. Gloves



FIGURE 2-7 Use a 60% alcohol hand sanitizer if there is no running water available.
© yurakrasil/Shutterstock.



FIGURE 2-8 Disposable gloves.
© Jones & Bartlett Learning. Photographed by Kimberly Potvin.

should not be used past their expiration date or if they are cracked, torn, or discolored.

It is important to use the proper technique when removing used gloves so you do not contaminate yourself. When removing used gloves, do not touch their outer surface **SKILL SHEET 2-1**.

You might consider putting on a second pair of gloves over the first if there is major, significant external bleeding or body fluid. If the gloves are cut or torn, replace them.

Q&A

Why is the use of latex gloves a concern?

Natural latex, which is used in latex gloves, contains natural proteins that have been shown to sensitize and cause allergic reactions in some people over time with repeated use. People who are sensitive or allergic to latex may experience a wide variety of symptoms, including rash, asthma, moderate or life-threatening food allergies, anaphylaxis, and death. A large amount of literature is available regarding concerns over the use of latex gloves. Alternative materials used in making gloves are nitrile, neoprene, and vinyl.

SKILL SHEET 2-1 Removing Gloves



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- 1** Begin by removing one glove. Pinch one glove on the outside near the wrist.



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- 2** Gently pull the glove off, turning it inside out as you pull it off with the hand that is still gloved.



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- 3** When removed, hold it in your gloved hand.

SKILL SHEET 2-1 Removing Gloves (*Continued*)

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- 4** To remove the second glove, slide two fingers of your bare hand inside the remaining glove at the wrist.



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- 5** Gently stretch the glove away from the hand and gently pull the glove off, keeping the inside out. The first glove remains inside the second glove.



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- 6** If possible, dispose of the gloves in a biohazard container or a sealed plastic bag. If one is not available, dispose in a trash can. Wash your hands with soap and running water. If they are not available, use an alcohol-based hand sanitizer.

Masks

For years the terms “face mask” and “face shield” were used to refer to mouth-to-barrier devices used when giving rescue breaths during CPR. Currently, “face mask” is more commonly used to refer to coverings worn in public for disease prevention, such as those used during the COVID-19 pandemic. “Face shield” is used to refer to a clear plastic mask that covers the eyes, nose, and mouth **FIGURE 2-9**.

Wearing a face mask is new for first aid providers because in years past, only health care providers wore them. Wearing a mask that covers your nose and mouth helps protect you from being infected by others. Mask wearing also keeps you from spreading infection to others. As directed by local or state health officials, it is important to wear a mask even if you have no symptoms. This is especially true when helping people who are not members of your household. When putting on a mask, handle it only by the ear loops or around-the-head strings. **DO NOT** touch the portion of the mask that will cover your face. If you touch any part other than the loops or strings, wash your hands or use hand sanitizer with 60% alcohol.

Wearing a proper face mask is strongly recommended during first aid care. **DO NOT** put the mask under your nose, around your neck, or up on your forehead. To put on a face mask, take the following steps **FIGURE 2-10**. When possible and appropriate, the person receiving first aid care should

also wear a face mask or face covering over their mouth and nose.

1. Wash your hands.
2. Pick up the mask by the ear loops or around-the-head strings only. **DO NOT** touch the front of the mask.
3. Using the ear loops or strings, pull the mask to your face, covering your nose and mouth.
4. Fit the mask snugly against the sides of your face and under your chin, and secure the ear loops or around-the-head strings.

Mouth-to-Barrier Devices For CPR

Mouth-to-barrier devices are recommended **FIGURE 2-11**. Although there are few documented cases of disease transmission to first aid providers as a result of performing unprotected mouth-to-mouth resuscitation on a person with an infection, use a barrier device such as a pocket mask when providing CPR whenever possible.

Other Personal Protective Equipment

Other PPE includes eye protection, gowns, and aprons. The Occupational Safety and Health Administration (OSHA) requires these items to be available in some workplaces, especially for health care workers. They are not required for first aid providers and usually will not be available.



FIGURE 2-10 A correctly fitting face mask should cover your nose and mouth and be secured around your ears or head.
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FIGURE 2-9 **A.** Face mask for public health. **B.** Face shield for public health.

Photo A: © Fizes/Shutterstock. Photo B: © Pixfly/Shutterstock.



FIGURE 2-11 Pocket face mask with a one-way valve for CPR.
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Cleaning Up After an Emergency

When cleaning up blood or other body fluids, protect yourself and others against disease transmission by following these steps:

1. Wear thicker gloves over disposable medical exam gloves.
2. If you have been trained in the correct procedures, use absorbent barriers to soak up blood or other infectious materials.
3. Clean the spill area using soap and water. After cleaning, disinfect with a solution of 1 part bleach and 10 parts water. Isopropyl alcohol can also be used to disinfect. At stronger concentrations these solutions can corrode or discolor certain fabrics, leathers, plexiglass, vinyl, or other synthetic materials.
4. Discard contaminated materials in an appropriate waste disposal container.

If you have been exposed to blood or body fluids, follow these steps:

1. Use soap and water to wash the parts of your body that have been contaminated.
2. If the exposure happened at work, report the incident to your supervisor. Otherwise, contact your personal

physician. If the exposure was significant, seek professional medical care. Early action can prevent the development of certain infections.

The best protection against disease is using the safeguards described here. By following these guidelines, first aid providers can decrease their chances of contracting bloodborne illnesses.

Some Diseases of Special Concern

Bloodborne Diseases

Some diseases are carried in the blood of a person with an infection (**bloodborne diseases**). **Human immunodeficiency virus (HIV)** is the virus that can cause AIDS. The virus is transmitted by direct contact with infected blood, semen, or vaginal secretions; there is no scientific documentation that the virus is transmitted by contact with sweat, saliva, tears, sputum, urine,

FYI

On-the-Job Protection

People infected with hepatitis B virus (HBV) or HIV might not show symptoms and might not even know they are infected. For that reason, consider all human blood and body fluids potentially infectious, and take precautions to avoid contact. Standard precautions recommend that you assume that all body fluids are a possible risk. EMS personnel routinely follow standard precautions, even if blood or body fluids are not visible.

OSHA requires any company with employees who are expected to give first aid in an emergency to follow standard precautions. OSHA applies the Good Samaritan definition to an employee who assists another with a nosebleed or a cut. Such acts, however, are not considered occupational exposure unless the employee who provides the assistance is a member of a first aid team or is designated or expected to provide first aid as part of their job. In essence, OSHA's requirement excludes unassigned employees who perform unanticipated first aid.

Whenever there is a chance that you could be exposed to bloodborne pathogens, your employer must provide appropriate PPE, which might include eye protection, gloves, gowns, and masks. The PPE must be accessible, and your employer must provide training to help you choose the right PPE for your work.

EMS personnel follow standard precautions, and OSHA requires designated worksite first aid providers to follow standard precautions. But what procedures should a typical first aid provider follow? It makes sense for first aid providers to follow standard precautions and assume that all blood and body fluids are infectious.

FYI

Emergency Medical Services

If you or someone you know is ever sick or injured and needs emergency help, remember, there are a lot of people who are specially trained to help you!

- *Emergency medical technicians.* Emergency medical technicians (EMTs) have different amounts of training, depending on their jobs. Sometimes EMTs are dispatchers who answer calls for help and send ambulances and rescue vehicles to the scene of the emergency. Other EMTs drive the ambulance, assist with rescues, and perform basic emergency medical care.
- *Paramedics.* Paramedics have a high level of training. They are able to perform many medical procedures at the scene of the emergency or in the ambulance on the way to the hospital. Using a radio to communicate, paramedics often get instructions from a physician at the emergency department or at the base station (the paramedic's headquarters).
- *Emergency nurses.* If you were a patient in the emergency department, an emergency nurse would probably be the first person you would see. One of the nurse's jobs is to ask you questions about your medical condition and help decide when you can see the physician. Emergency nurses are specially trained to help treat emergency patients.
- *Emergency physicians.* Emergency physicians are specially trained to take care of a certain type of patient: emergency patients. Physicians who are specially trained are often called specialists. Emergency physicians specialize in helping people who are injured or who suddenly become sick, such as someone who is having a heart attack or has a very high fever.
- *Emergency medical responders.* Police officers and firefighters are some of the other people who might help you, especially if you have to be rescued.

Data from American College of Emergency Physicians.

feces, vomitus, or nasal secretions, unless these fluids contain visible signs of blood. No vaccine is currently available to prevent HIV infection, however, postexposure prophylaxis is one way to help prevent the transmission of HIV in a person who may have recently been exposed to the virus.

Hepatitis B virus (HBV) is also spread by direct contact with infected blood. The term *hepatitis* refers to an inflammation (and often infection) of the liver. A vaccine is available for HBV and is recommended for all infants and for adults who might have contact with carriers of the disease or with blood. **Hepatitis C virus (HCV)** can cause liver disease or cancer. It cannot be cured, and no vaccine currently exists.

Airborne Diseases

Airborne diseases are transmitted through the air by coughing or sneezing. **Tuberculosis (TB)**, a chronic bacterial disease that usually affects the lungs, is becoming a common condition and is hard to distinguish from other diseases. People who present the highest risk often have a cough. TB is more common in people who have lived in a homeless shelter or in a developing country.

New and reemerging diseases such as **severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)**, which causes an infection called coronavirus disease 2019 (COVID-19) can be potentially life threatening. Currently, coronavirus disease is a major concern for first aid providers and the people they are helping. The virus is thought to spread mainly from person-to-person through respiratory droplets produced when an infected person coughs, sneezes, or talks. These droplets can land in the mouths or noses of people who are nearby or possibly be inhaled into the lungs. COVID-19 can be spread by people who are not showing symptoms. Several vaccines are now available. For the most up-to-date information on the COVID-19 pandemic, check your county or state health departments or the CDC website.

Death and Dying

Few incidents are as emotionally stressful as a life-and-death situation. Witnessing death and dying is an unfortunate possibility accepted by those who provide emergency care.

The Dying Person

Assisting a person who is dying presents a difficult situation. The following guidelines can help you provide compassionate, effective care:

- Avoid negative statements about the person's condition. Even an unresponsive person can hear what is being said.
- Assure the person that you will locate and inform their family of what has happened. Attempt to have family members present; they can provide great comfort to the person.
- Allow some hope. Do not tell the person that they are dying. Instead, say something like, "I will not give up on you, so do not give up on yourself."
- Do not volunteer information about the person or others who might also be injured. However, if the person asks a question about a family member, tell the truth. Provide simple, honest, clear information if it is requested, and repeat it as often as necessary.
- Use a gentle tone of voice.
- Use a reassuring touch, if appropriate.
- Let the person know that everything that can be done to help will be done.
- Give realistic answers to the person's questions, but try to be positive. Do not make a promise you cannot keep.

The Stages of Grieving

People who lose a loved one go through a **grieving process**. This process generally involves five stages, but not all people move through the process in the same way or at the same pace.

1. *Denial* ("Not me."). The person cannot believe what is happening. This stage serves as a buffer for the person experiencing the situation. This reaction is normal.
2. *Anger* ("Why me?"). First aid providers and bystanders could be the target of the anger. Do not take the anger or insults personally. Be tolerant, use good listening skills, and be empathetic.
3. *Bargaining* ("OK, but first let me . . ."). In the person's mind, an agreement will postpone an unpleasant event, such as death.
4. *Depression* ("But I have not . . ."). This stage is characterized by sadness and despair. The person is usually silent and retreats into their own world.
5. *Acceptance* ("OK, I am not afraid."). Acceptance does not mean a person is happy about the situation. The family often requires more support during this stage than the person does.

With an understanding of these five stages, you can better understand the reactions of those who are grieving as well as your own reactions to stressful situations.

Interacting With Survivors

Interact with the family members of a dead or dying person as follows:

- Do not pronounce death; leave the confirmation of death to a physician.
- Allow survivors to grieve in whatever way seems right to them (eg, anger, rage, crying).
- Provide simple, honest, clear information as it is requested, and repeat it as often as necessary.
- Offer as much support and comfort as possible by your presence and by your words. Do not leave an individual survivor alone, but respect that person's right to privacy.
- Use a gentle tone of voice.
- Use a reassuring touch, if appropriate.

PREP KIT

Ready for Review

- Emergencies are dangerous, unusual, rare, and unforeseen, and they must be dealt with before the situation becomes worse.
- A bystander is a vital link between the EMS system and the person in need of care.
- Injured or suddenly ill people would benefit if bystanders could quickly and reliably do the following:
 - Recognize the emergency.
 - Decide to help.
 - Call 9-1-1 if EMS is needed.
 - Check the person.
 - Give first aid.
- Knowing when to call 9-1-1 is important. To do so, you must be able to tell the difference between a minor injury or illness and a life-threatening one.
- In most communities, call 9-1-1 to receive emergency assistance.
- The sight of blood and the cries of people at an emergency scene can be upsetting, but it is essential that first aid providers remain alert and keep working at an injury scene.
- If you are at the scene of an emergency situation, do a quick scene size-up looking for hazards, the cause of the injury or illness, and the number of people involved.
- First aid providers should take precautions to protect against infectious diseases.
- Few incidents are as emotionally stressful as the life-and-death situations that you might face when providing emergency care.

Vital Vocabulary

airborne disease An infection transmitted through the air, such as tuberculosis (TB).

bloodborne disease An infection transmitted through the blood, such as human immunodeficiency virus (HIV) or hepatitis B virus (HBV).

communicable disease A disease that can spread from person to person or from animal to person.

desensitization A process of deconditioning or counterconditioning designed reduce a person's fears and anxieties. The idea is to weaken an undesirable response such as fainting by strengthening an incompatible response.

emergency medical services (EMS) A system that represents the combined efforts of several professionals and agencies to provide emergency medical care.

grieving process The emotional process that a person works through after a stressful situation that causes personal pain. People go through several stages of grieving.

hepatitis B virus (HBV) A viral infection of the liver for which a vaccine is available.

hepatitis C virus (HCV) A viral infection of the liver for which no vaccine is currently available.

human immunodeficiency virus (HIV) The virus that can cause acquired immunodeficiency syndrome (AIDS).

infectious disease A medical condition caused by the growth of small, harmful organisms within the body.

personal protective equipment (PPE) Equipment, such as exam gloves, used to block the entry of an organism into the body.

posttraumatic stress disorder (PTSD) A delayed stress reaction to a prior emergency event.

scene size-up A quick assessment of the scene and the surroundings for safety issues, the cause of injury or nature of illness, and the number of people; it is completed before starting first aid.

severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) The virus that causes an infection called coronavirus 2019 (COVID-19), which primarily affects the lungs and can lead to respiratory failure and death.

standard precautions Protective measures that have traditionally been developed by the Centers for Disease Control and Prevention (CDC) for use in dealing with objects, blood, body fluids, or other potential exposure risks of communicable disease.

tuberculosis (TB) A bacterial disease usually affecting the lungs.

PREP KIT continued**Assessment in Action**

You are walking from house to house in an unfamiliar neighborhood collecting donated clothing for a local charitable organization. You find no one home at a particular house but hear a loud explosion in the garage. You decide to see what happened. On entering the garage, you find a teenage boy lying on the ground. There is a strong gasoline odor. You have a mobile phone with you.

Directions: Circle Yes if you agree with the statement; circle No if you disagree.

- | | |
|--|---|
| <p>1. This scene could be dangerous.
YES NO</p> <p>2. You should not be concerned about other people.
YES NO</p> | <p>3. In most communities, 9-1-1 can be used to contact EMS.
YES NO</p> <p>4. If you do not know the exact address of the emergency, be prepared to give a description of the location as best as you can.
YES NO</p> |
|--|---|

Check Your Knowledge

Directions: Circle Yes if you agree with the statement; circle No if you disagree.

- | | |
|---|---|
| <p>1. A quick scene survey should be done before giving first aid to an injured person.
YES NO</p> <p>2. For a severely injured person, call the person's physician before calling for an ambulance.
YES NO</p> <p>3. Nitrile are the recommended gloves for first aid providers.
YES NO</p> <p>4. First aid providers should assume that blood and all body fluids are infectious.
YES NO</p> <p>5. If you are exposed to blood while on the job, report it to your supervisor, and if off the job, to your personal physician.
YES NO</p> | <p>6. First aid kits should contain exam gloves.
YES NO</p> <p>7. Wash your hands with soap and water after giving first aid.
YES NO</p> <p>8. Protective eyewear, medical exam gloves, and face shields are examples of PPE.
YES NO</p> <p>9. Exam gloves can be made of almost any material as long as they fit the hand well.
YES NO</p> <p>10. TB is a bloodborne disease.
YES NO</p> |
|---|---|



The Human Body

The Human Body

To assess a person's condition adequately and to give effective first aid, a first aid provider must be familiar with the basic structure and functions of the human body. This knowledge provides a solid cornerstone for building the essentials of quality assessment and emergency first aid. By using the proper medical terms, you will be able to communicate more effectively with the person you are assessing and with professional medical care providers.

Directional Terms

When you are discussing where an injury is located or how a pain moves throughout the body, you need to know the correct directional terms **FIGURE 3-1**. The terms right and left refer to the person's right and left sides, not to your right and left sides. **Anterior** refers to the front of the body and **posterior** refers to the back of the body. **Superior** parts of the body are closer to the head; the parts closer to the feet are called **inferior**. **Lateral** (outer) parts of the body are farther from the middle of the body; the parts closer to the middle of the body are called **medial** (inner).

The terms *proximal* and *distal* are used when discussing an arm or leg. **Proximal** (close) refers to areas that are close to the center of

CHAPTER AT A GLANCE

- › The Human Body
- › Directional Terms
- › The Body Systems
- › The Respiratory System
- › The Cardiovascular System
- › The Nervous System
- › The Skeletal System
- › The Muscular System
- › The Skin

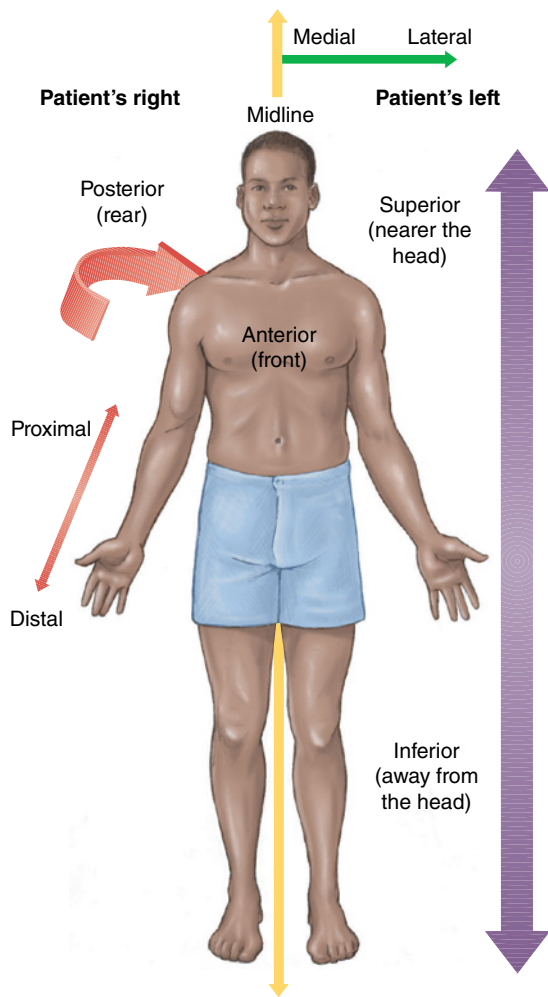


FIGURE 3-1 Directional terms indicate distance and direction from the middle of the body.
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the body or to the point where the arm or leg is attached to the body. **Distal** (distant) refers to areas that are distant from the center of the body or from the point of attachment.

Superficial means closer to or on the skin. **Deep** means farther inside the body and away from the skin.

The term **quadrant** indicates a section of the abdominal cavity. Imagine a horizontal line and a vertical line intersecting at the umbilicus (navel), dividing the **abdomen** into four equal areas. These areas are referred to as the right upper quadrant (RUQ), left upper quadrant (LUQ), right lower quadrant (RLQ), and left lower quadrant (LLQ) **FIGURE 3-2**.

The Body Systems

In injuries and illnesses, most life-threatening conditions affect the respiratory, cardiovascular, and nervous systems. These three body systems include the most important and sensitive organs: the lungs, the heart, the brain, and the spinal cord. The other body systems are also important, and thorough assessment of the person can locate injury and/or sudden illnesses affecting them as well. The major body systems

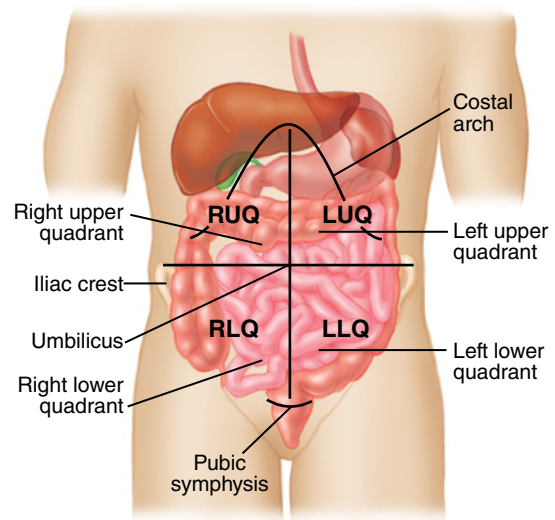


FIGURE 3-2 The abdomen is divided into four quadrants.
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described in this chapter are the respiratory, cardiovascular, nervous, skeletal, and muscular systems. The skin is also described. The other body systems—including the endocrine, gastrointestinal, and genitourinary systems—are summarized in **TABLE 3-1**.

The Respiratory System

The body can store food to last several weeks and water to last several days, but it can store enough oxygen for only a few minutes. Ordinarily, this limited oxygen reserve is not a concern because we only have to inhale air to get the oxygen we need. However, if the body's oxygen supply is cut off, as in drowning, choking, or smothering, death will result in about 4 to 6 minutes unless the oxygen intake is restored. Oxygen from air is made available to the blood through the **respiratory system** **FIGURE 3-3** and then to the body cells by the cardiovascular system.

Nose

Air normally enters the body during inhalation through the nostrils. It is warmed, moistened, and filtered as it flows over the damp, mucous membrane (sticky lining) of the nose. When a person breathes through the mouth instead of the nose, there is less filtration and warming. After passing through the nasal passages, air enters the nasal portion of the **pharynx** (throat).

Pharynx and Trachea

From the back of the nose or the mouth, air enters the pharynx. The pharynx is a common passageway for food and air. At its lower end, the pharynx divides into two passageways: one for food and the other for air. Muscular control in the back of the throat routes food to the **esophagus** (food tube), which leads to the stomach; air is routed from the pharynx

TABLE 3-1 The Human Body Systems

System	Function	Major Components	Interactions With Other Systems
Digestive	■ Takes in food (ingestion) ■ Digests food into smaller molecules and absorbs nutrients ■ Removes indigestible food from body (feces)	■ Mouth ■ Esophagus ■ Stomach ■ Small intestine ■ Large intestine ■ Rectum ■ Anus ■ Salivary glands ■ Pancreas ■ Liver ■ Gallbladder	■ Cardiovascular system: Absorbs and delivers the digested nutrients to the cells ■ Muscular system: Controls the contractions of many of the digestive organs to pass food along ■ Nervous system: Hypothalamus maintains homeostasis by triggering appetite (stomach growling)
Cardiovascular	Transports materials (oxygen, nutrients, hormones, cellular waste products) to and from cells	■ Heart ■ Veins ■ Arteries ■ Capillaries ■ Blood	■ Respiratory system: Delivers O₂ from lungs to cells and transports CO₂ from cells to lungs ■ Digestive system: Absorbs and delivers digested nutrients to cells ■ Excretory system: Kidneys filter cellular waste out of blood for removal ■ Lymphatic system: Transports tissue fluid back to the cardiovascular system ■ Immune system: Transports WBCs throughout the body to fight disease ■ Nervous system: Brain controls heartbeat ■ Endocrine system: Transports hormones
Nervous	■ Gathers and interprets information ■ Responds to information ■ Helps maintain homeostasis	■ Brain ■ Spinal cord ■ Nerves ■ Neurons	■ Controls all other systems ■ Maintains homeostasis by working with all systems
Excretory	■ Removes waste products from cellular metabolism ■ Filters blood	■ Kidneys ■ Ureters ■ Bladder ■ Urethra ■ Lungs ■ Skin ■ Liver	■ Cardiovascular system: Filters waste out of blood ■ Lungs: Removes excretory waste ■ Integumentary system: Removes excretory waste
Respiratory	Takes in O ₂ and removes CO ₂ and water	■ Nose ■ Trachea ■ Bronchi ■ Bronchioles ■ Alveoli ■ Lungs	■ Cardiovascular system: Takes in O₂ for delivery to cells and removes CO₂ brought from cells ■ Excretory system: Removes excretory waste ■ Nervous system: Controls breathing ■ Muscular system: Diaphragm assists breathing
Skeletal	■ Protects organs ■ Provides shape and support ■ Stores materials (fats, minerals) ■ Produces blood cells ■ Allows movement	■ Bones ■ Cartilage ■ Ligaments	■ Muscular system: Allows movement ■ Cardiovascular system: Produces blood cells ■ Immune system: Produces WBCs ■ Cardiovascular and respiratory systems: Protects its organs
Muscular	Allows for movement by contracting	■ Skeletal muscle ■ Tendons	■ Skeletal system: Allows movement ■ Digestive system: Allows organs to contract to push food through ■ Respiratory system: Diaphragm assists breathing ■ Cardiovascular system: Controls pumping of blood ■ Nervous system: Controls all muscle contractions
Endocrine	Regulates body activities using hormones (slow response, long lasting)	■ Glands • Hypothalamus • Pituitary • Thyroid • Thymus • Adrenal • Pancreas • Ovaries • Testes	■ Cardiovascular system: Transports hormones to target organs ■ Nervous system: Maintains homeostasis, hormone release ■ Reproductive system: Controlled by hormones ■ Skeletal system: Controls growth of bones

Continues

TABLE 3-1 The Human Body Systems (Continued)

System	Function	Major Components	Interactions With Other Systems
Immune	Fights off foreign invaders in the body	■ WBCs ■ T cells ■ B cells ■ Macrophages ■ Skin	■ Cardiovascular system: Transports WBCs to fight invaders ■ Lymphatic system: Has lots of WBCs to fight invaders; spleen filters bacteria/viruses out of blood ■ Skeletal system: WBCs made in bone marrow ■ Integumentary system: Prevents invaders from getting in
Integumentary	■ Acts as barrier against infection ■ Helps regulate body temperature ■ Removes excretory waste ■ Protects against sun's ultraviolet rays ■ Produces vitamin D	■ Skin ■ Epidermis ■ Dermis	■ Excretory system: Removes cellular waste ■ Nervous system: Controls body temperature ■ Immune system: Prevents pathogens from entering
Lymphatic	■ Stores and carries WBCs that fight disease ■ Collects excess fluid and returns it to blood (acts as a second cardiovascular system; reaches places the cardiovascular system cannot)	■ Lymph (liquid part of blood) ■ Lymph vessels ■ Lymph nodes ■ WBCs	■ Immune system: Holds lots of WBCs to fight pathogens ■ Cardiovascular system: Transports materials from cells
Reproductive	Allows organisms to reproduce, which prevents their species from becoming extinct	■ Ovaries ■ Testes	■ Endocrine system: Controls production of sex cells ■ Muscular system: Uterus contracts to give birth; controlled by hormones

Abbreviations: CO₂, carbon dioxide; O₂, oxygen; WBCs, white blood cells
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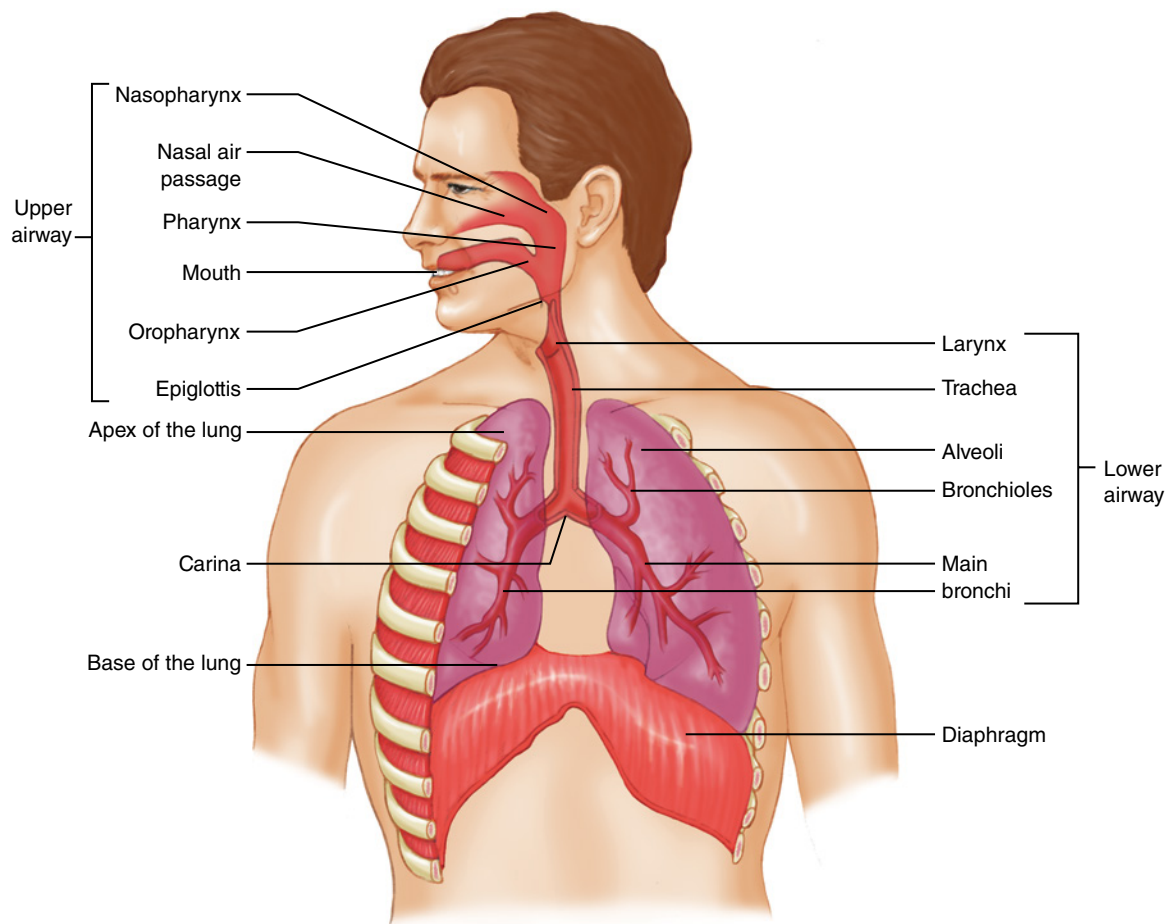


FIGURE 3-3 Respiratory system.
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to the **trachea** (windpipe), which leads to the lungs. The trachea and the esophagus are separated by a small flap of tissue, the **epiglottis**, which diverts food away from the trachea. Usually this diversion works automatically to keep food out of the trachea and to prevent air from entering the esophagus. If the muscles of the pharynx and larynx are not coordinated, food or other liquid can enter the trachea instead of the esophagus.

Normal swallowing controls (gag reflex) do not operate if a person is unresponsive. That is why a first aid provider should never pour liquid into the mouth of an unresponsive person in an attempt to revive them. The liquid could flow into the trachea and suffocate the person. Foreign objects, such as false teeth or a piece of food, might also lodge in the throat or trachea and cut off the passage of air. In the upper 2 inches (5 cm) of the trachea, just below the epiglottis, is the **larynx** (voice box), which contains the vocal cords. The larynx can be felt in the front of the throat.

Lungs

The trachea branches into two tubes (**bronchial tubes** or bronchi), one for each lung. Each bronchus divides and subdivides somewhat like the branches of a tree. The smallest bronchioles end in thousands of tiny pouches (**alveoli**, or air sacs), just as the twigs of a tree end in leaves. Each air sac is enclosed in a network of capillaries. The walls that separate the air sacs and the capillaries are very thin. Through those walls, oxygen combines with the hemoglobin in red blood cells to form oxyhemoglobin, which is carried to all parts of the body. Carbon dioxide and certain other waste gases in the blood move across the capillary walls into the air sacs and are exhaled from the body. The lungs occupy most of the chest cavity.

Mechanics of Breathing

The passage of air into and out of the lungs is called respiration. Breathing in is called inhalation; breathing out is called exhalation. Ventilation is a mechanical process brought about by alternately increasing and decreasing the size of the chest cavity. When the **diaphragm** (the dome-shaped muscle dividing the chest from the abdomen) contracts, the chest expands, drawing air into the lungs (inhalation). An exchange of oxygen and carbon dioxide takes place in the lungs. When the diaphragm relaxes, it exerts pressure on the lungs, causing air to flow out (exhalation).

Infants and children differ from adults. Their respiratory structures are smaller and more easily obstructed than those of adults. Infants' and children's tongues take up proportionally more space in the mouth than do the tongues of adults. The trachea is more flexible in infants and children. The primary cause of cardiac arrest in infants and children is an uncorrected respiratory condition.

The average rate of breathing in an adult at rest is 12 to 20 complete respirations per minute **TABLE 3-2**. Normal rates for children are 18 to 40 respirations per minute; infant rates are 30 to 60 respirations per minute. Normally the rate slows when a person is lying down and speeds up during vigorous exercise. The rate of breathing is controlled by a nerve center

TABLE 3-2 Typical Vital Signs Values Based on Age

Age	Pulse Rate (Heart Rate) (beats/min)	Respirations (breaths/min)
Infants (newborn to age 1 year)	90–180	25–60
Children (ages 1 to 12 years)	70–150	15–30
Adults	60–100	12–20

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in the brain. Signs of inadequate breathing include a rate of breathing outside the normal range, cool or clammy skin that is pale or cyanotic (blue-purple), and nasal flaring, especially in children.

When a person performs hard muscular work, the lungs cannot get rid of carbon dioxide or take in oxygen fast enough at the normal rate of breathing. As carbon dioxide increases in the blood and tissues, the brain sends impulses along its nerves to cause deeper and more rapid respirations. At the same time, the heart rate increases. This faster heart rate increases the supply of oxygen available to the body as the heart pumps more blood through the lungs.

The Cardiovascular System

The **cardiovascular system** is made up of the blood, the heart, and the blood vessels **FIGURE 3-4**. Blood is the delivery system for cells throughout the body. It carries nutrients and other products from the digestive tract in its plasma, and it carries oxygen from the lungs in its hemoglobin. It also transports wastes produced by the cells to the lungs, kidneys, and other excretory organs for removal from the body.

Heart

The human cardiovascular system is a completely closed circuit of tubelike vessels through which blood flows. The **heart**, by contracting and relaxing, pumps blood through the vessels **FIGURE 3-5**. It is a powerful, hollow, muscular organ about as big as a man's clenched fist, shaped like a pear, and located in the left center of the chest, behind the sternum (breast bone). The heart is divided by a wall in the middle. Right and left compartments are divided into two chambers, the atrium above and the ventricle below. Valves are located between each atrium and its corresponding ventricle and at the exit of the major arteries leading out of each ventricle. The opening and shutting of these valves at just the right time in the heartbeat keeps the blood from backing up.

At each beat, or contraction, the heart pumps blood rich in carbon dioxide and low in oxygen from the right ventricle to the lungs and returns oxygen-rich blood to the left atrium of the heart from the lungs. The left ventricle pushes freshly obtained, oxygen-rich blood to the rest of the body and returns oxygen-poor blood to the right atrium. At each relaxation of the heart, blood flows into the left atrium from the lungs and into the right atrium from the rest of the body.

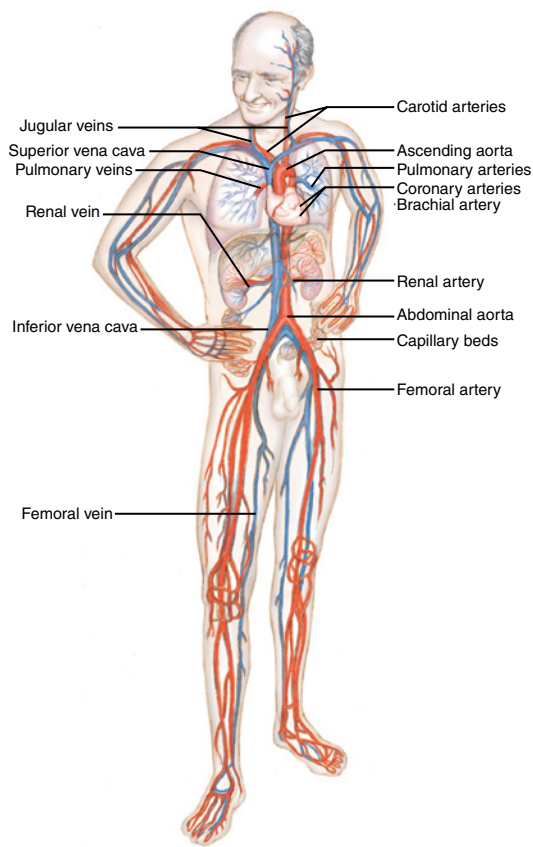


FIGURE 3-4 Cardiovascular system.
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FYI

Did You Know?

The carotid arteries along the neck convey blood to the head, and if pressure is applied to them, the individual becomes unresponsive, seeming to drop off into a stupor or slumber. Hence, the Greeks called these arteries the karotides from the Greek word *karoun*, meaning “to stupefy.”

Data from Skinner HA. *The Origin of Medical Terms*. 2nd ed. Baltimore, MD: Williams & Wilkins; 1961.

Blood Vessels

The **arteries** are elastic, muscular tubes that carry blood away from the heart **FIGURE 3-6**. They begin at the heart as two large tubes: the pulmonary artery, which carries blood to the lungs for the carbon dioxide and oxygen exchange, and the **aorta**, which carries blood to all the other parts of the body. The aorta divides and subdivides until it ends in networks of extremely fine vessels (**capillaries**) smaller than hairs. Through the thin walls of the capillaries, oxygen and nourishment pass out of the bloodstream into the stationary cells of the body, while the body cells discharge their waste products into the bloodstream. In the capillaries of the lungs, carbon

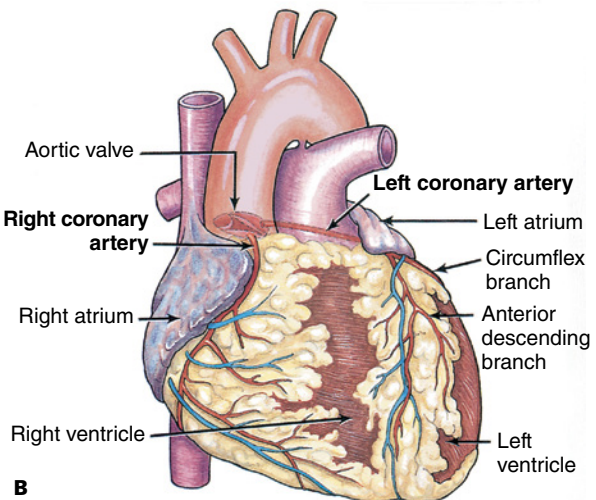
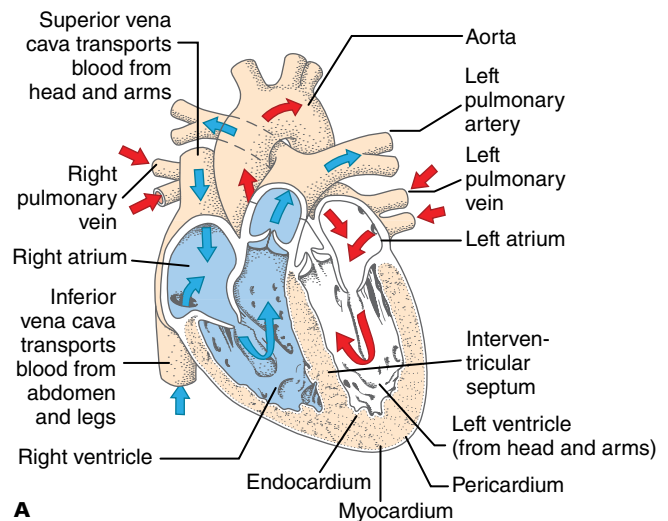


FIGURE 3-5 The heart. **A.** Circulation (internal view). **B.** The two main coronary arteries supply the heart with blood.
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dioxide is released and oxygen is absorbed. Capillaries, having reached their limit of subdivision, begin to join together again into veins. The **veins** become larger and larger and finally form major trunks that empty blood returning from the body into the right atrium and blood from the lungs into the left atrium.

FYI

Word Origins

Arteries received their name from the Greek term for windpipe because the Greek physician Praxagoras thought they carried air. In corpses, they are usually empty and that was probably where his observations were made.

Data from Skinner HA. *The Origin of Medical Terms*. 2nd ed. Baltimore, MD: Williams & Wilkins; 1961.

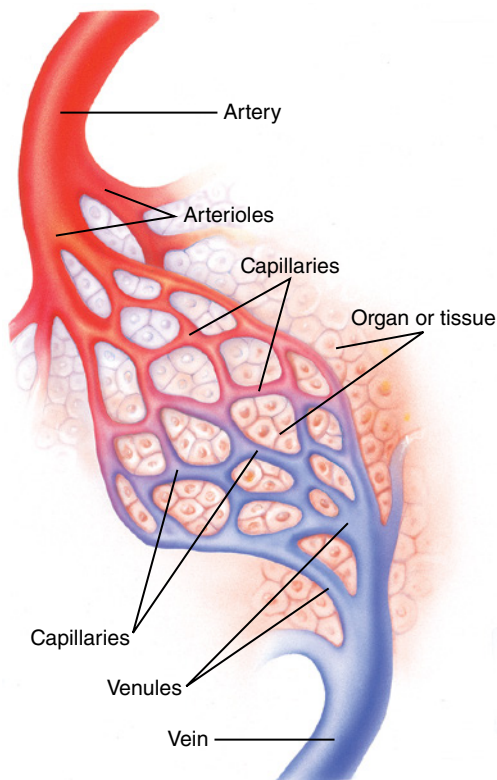


FIGURE 3-6 Blood enters an organ or tissue through the arteries and leaves through the veins. This process provides adequate blood flow to the tissue to meet the cells' needs.

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It is impossible to prick normal skin anywhere without puncturing capillaries. Because the flow of blood through the capillaries is relatively slow and under little pressure, blood merely oozes from a punctured capillary and usually has time to clot, promptly plugging the leak.

Each time the heart contracts, the surge of blood can be felt as a **pulse** at any point where an artery lies close to the surface of the body, near the skin surface and over a bone. When an artery is cut, blood spurts out. There is no pulse in a vein because the pressure wave is lost by the time the blood has passed through the capillaries. Hence, blood from a cut vein flows out in a steady stream. It has much less pressure behind it than blood from a cut artery. Blood makes its way back to the heart through a series of one-way valves in the veins.

Major locations for feeling pulses include the following

FIGURE 3-7:

- **Carotid artery:** The major artery in the neck, which supplies the head with blood. Pulsations can be palpated (felt) on either side of the neck (do not try to feel both at the same time). Health care providers use the carotid artery to check an unresponsive person's pulse.
- **Femoral artery:** The major artery of the thigh, which supplies the thigh and leg with blood. There are two femoral arteries, one for each leg. Pulsations can be palpated in the groin area (the crease between the abdomen and the thigh).

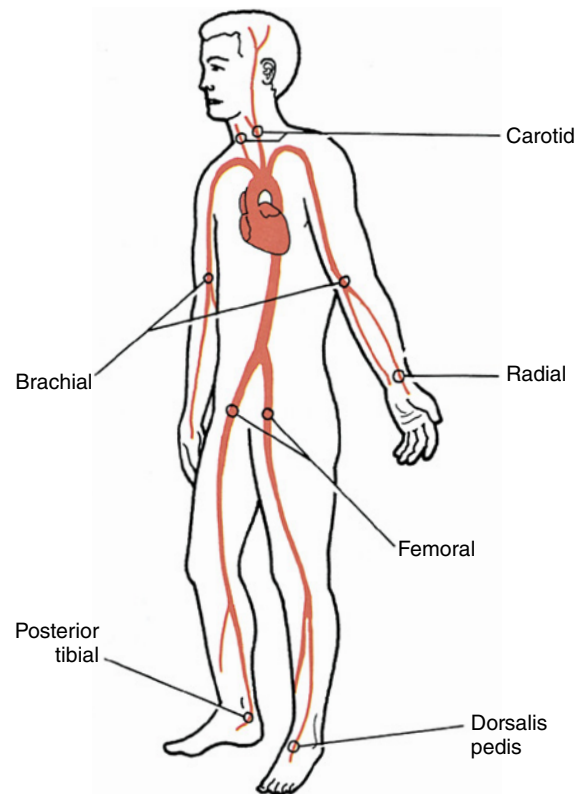


FIGURE 3-7 Locations for feeling pulses.

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- **Radial artery:** One of two main arteries of the lower arm (along with the ulnar artery). Pulsations can be palpated at the palm side of the wrist on the thumb side. Use the radial location to check an alert person's pulse.
- **Brachial artery:** An artery of the upper arm. Pulsations can be palpated on the inside of the arm between the elbow and the armpit. Health care providers use the brachial location to determine a pulse in an infant.
- **Posterior tibial artery:** Located behind the inside ankle knob (medial malleolus). Pulsations can be palpated behind the posterior surface of the medial malleolus.
- **Dorsalis pedis artery:** Pulsations can be palpated on the top surface of the foot (many people have no pulsations here).

Blood Pressure

Blood pressure is a measure of the pressure exerted by the blood on the walls of the arteries. Blood pressure might be high or low according to the resistance offered by the walls to the passage of blood. This difference in resistance could have several causes. For example, if blood does not fill the system, as occurs following a hemorrhage, the pressure will be low (hypotension). High blood pressure (hypertension) is when the blood is pushing too hard against the walls of the artery. It might be present when the arterial walls have become hard and cannot expand readily. A diet high in salt, fat, and/or cholesterol can lead to hardening of the arteries or atherosclerosis and cause high blood pressure.