VOLUME 1 INTRODUCTION TO ADVANCED PREHOSPITAL CARE

PARAMEDIC
CARE Principles
& Practice

Fifth Edition

Meets National EMS
Education Standards

Bledsoe

Porter

Cherry

Paramedic Care: Principles & Practice

Fifth Edition

Volume 1
Introduction to Paramedicine

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Notice

The author and the publisher of this book have taken care to make certain that the information given is correct and compatible with the standards generally accepted at the time of publication. Nevertheless, as new information becomes available, changes in treatment and in the use of equipment and procedures become necessary. The reader is advised to carefully consult the instruction and information material included in each piece of equipment or device before administration. Students are warned that the use of any techniques must be authorized by their medical advisor, where appropriate, in accordance with local laws and regulations. The publisher disclaims any liability, loss, injury, or damage incurred as a consequence, directly or indirectly, of the use and application of any of the contents of this book.

This text is respectfully dedicated to all EMS personnel
who have made the ultimate sacrifice. Their memory
and good deeds will forever be in our thoughts and prayers.

BEB, RAC

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Preface to Volume 1

Modern EMS is based on sound principles and practice. Today's paramedic must be knowledgeable in all aspects of EMS. This begins with a fundamental understanding of EMS operations, basic medical science, and basic procedures. We have followed the *National EMS Education Standards* and the accompanying *Paramedic Instructional Guidelines* to provide the appropriate introductory material in *Volume 1, Introduction to Paramedicine.*

This volume provides paramedic students with the principles of advanced prehospital care and EMS operations. The first four chapters detail EMS systems and paramedic roles and responsibilities with added emphasis on personal wellness and injury and illness prevention. The next chapters deal with EMS research and the importance of evidence-based medicine, the EMS role in public health, the medical/legal aspects of emergency care, and ethics in paramedicine. The next two chapters deal with EMS system communications and documentation of patient care. The final chapters of this volume cover life span development, pathophysiology, emergency pharmacology, intravenous access and medication administration, and airway management and ventilation.

Overview of the Chapters . . . and What's New in the 5th Edition?

CHAPTER 1   Introduction to Paramedicine introduces the paramedic student to the world of paramedicine. It summarizes the importance of professionalism and the expanding roles of the paramedic.

New in the 5th Edition: An introduction to **Mobile Integrated Health Care** and **Community Paramedicine**, both concepts relating to paramedicine expanding beyond emergency response and transport to community health initiatives.

CHAPTER 2   EMS Systems reviews the history of EMS and provides an overview of EMS today. It details the aspects of EMS system design and operation. It emphasizes the importance of medical direction in all aspects of prehospital care.

New in the 5th Edition: A new section **Healthcare System Integration**, emphasizing, per newest AHA guidelines, the role of EMS in all types of cardiac emergencies, especially in the identification of acute coronary syndrome and ST-segment myocardial infarction (STEMI).

CHAPTER 3   Roles and Responsibilities of the Paramedic is a detailed discussion of the expectations and responsibilities of the modern paramedic. It emphasizes the various aspects of professionalism as they pertain to the paramedic.

New in the 5th Edition: A note acknowledging that aspects of the **Affordable Care Act of 2010** have changed health care in numerous ways.

CHAPTER 4   Workforce Safety and Wellness presents material crucial to the survival of the paramedic in EMS. It addresses such important issues as prevention of work-related injuries, personal protection from disease, and safety concerns. It discusses physical fitness and nutrition. It discusses ways of dealing with death and dying, details the role of stress in EMS, and presents important coping strategies.

New in the 5th Edition: Notes on diseases introduced by international travel. A new section **Ebola virus disease**, how it is carried, and how to protect against an exposure. A new section on **post-traumatic stress disorder**.

CHAPTER 5   EMS Research discusses the importance of research and evidence-based practices in EMS. It emphasizes ethical considerations in human research. Additionally, it explains how to read, evaluate, and participate in research.

New in the 5th Edition: Updated **American Heart Association Levels of Evidence.**

CHAPTER 6   Public Health discusses the increasingly important role of EMS in public health, public education, and prevention of illness and injury—stopping injuries and illnesses before they happen.

CHAPTER 7 Medical/Legal Aspects of Prehospital Care is a detailed treatise on law and emergency care. In addition to an overview of the law and the legal system, this chapter discusses how the legal system can impact the paramedic. It also provides important tips on how the paramedic can avoid liability in a malpractice action.

New in the 5th Edition: Emphasis that **EMS laws and regulations differ** between states and even between cities and counties. Emphasis on the importance of individual **liability insurance**. Emphasis on **invasion of privacy issues concerning cell phone cameras and social media.** A new section on **physician orders for life-sustaining treatment (POLST).**

CHAPTER 8 Ethics in Paramedicine presents the fundamentals of medical ethics. As EMS becomes more sophisticated, the paramedic will be faced with an ever-increasing number of ethical dilemmas. This chapter provides the paramedic student with an overview of medical ethics so as to be able to make sound decisions when confronted with ethical problems.

CHAPTER 9 EMS System Communications discusses communication as the key component linking all phases of an EMS run, discusses the current state of EMS communications, and presents anticipated advances in EMS communications and communications technology.

CHAPTER 10 Documentation explains how to write a prehospital care report (PCR), including examples of narrative report-writing styles, and discusses the elements and uses of electronic patient care records.

CHAPTER 11 Pathophysiology provides a detailed description of basic pathophysiology. The first part of the chapter introduces the concept of disease, including predisposing factors to disease and classifications of disease. The next parts of the chapter discuss disease at the chemical level, the cellular level, the tissue level, and the organ level. Finally, the chapter details the body's defenses against disease and injury.

CHAPTER 12 Human Life Span Development provides an overview of physiologic and psychosocial developmental and age-related changes from infancy to late adulthood.

CHAPTER 13 Emergency Pharmacology is a comprehensive chapter covering the various medications used in medical practice, especially paramedic practice. It presents an overview of pharmacology, followed by a discussion of drug classifications.

New in the 5th Edition: Tables listing **antiarrhythmic and hormone-related drugs updated per latest American Heart Association guidelines.**

CHAPTER 14 Intravenous Access and Medication Administration is presented in three parts, the first part detailing principles and routes of medication administration; the second part concerning intravenous access, blood sampling, and intraosseous infusion; and the final part giving an overview of medical mathematics and dose calculation.

New in the 5th Edition: An updated section on **Venous Access Devices**, including tunneled catheters, medication ports, and peripherally inserted central catheters (PICCs). A new section on **Ultrasound-Guided Intravenous Access.**

CHAPTER 15 Airway Management and Ventilation presents the crucial prehospital skill of airway management. The first part of the chapter deals with respiratory anatomy, physiology, and assessment. The chapter then goes on to address both basic manual and advanced airway management techniques. In addition, this chapter details patient positioning, oxygenation, ventilation techniques, suction, rapid sequence intubation, surgical airways, the difficult airway, and other airway and ventilation issues and techniques.

New in the 5th Edition: A segment on **apneic oxygenation**, a new strategy used to minimize the likelihood of hypoxia during endotracheal intubation.

Bryan Bledsoe
Richard Cherry

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Chapter Contributors

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Instructor Reviewers

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Models

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FAO/Paramedic Wade Woody

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FF/Paramedic Matthew Daniel

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FF/Paramedic Waylon Palmer

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Mr. Cherry entered the emergency medical services field in 1974 with the DeWitt Volunteer Fire Department, where he served his community as a firefighter and EMS provider for more than 15 years. He took his first EMT course in 1977 and became an ALS provider two years later. He earned his paramedic certificate in 1985 as a member of the area's first paramedic class. He then worked both as a paid and volunteer paramedic for the next 15 years.

Mr. Cherry has authored several books for Brady. Most notable are *Paramedic Care: Principles & Practice, Essentials of Paramedic Care, Intermediate Emergency Care: Principles & Practice,* and *EMT Teaching: A Common Sense Approach.* He has made presentations at many state, national, and international EMS conferences on a variety of EMS clinical and teaching topics. He and his wife, Sue, reside in Sun City West, Arizona. In addition to riding horses, hiking, and playing softball, they volunteer their time at Banner Del Webb Medical Center. Mr. Cherry also plays lead guitar in a Christian band.

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A GUIDE TO KEY FEATURES

Emphasizing Principles

LEARNING OBJECTIVES

Terminal Performance Objectives and a separate set of Enabling Objectives are provided for each chapter.

KEY TERMS

Page numbers identify where each key term first appears, boldfaced, in the chapter.

Chapter 1
Introduction to Paramedicine

Bryan Bledsoe, DO, FACEP, FAAEM

STANDARD
Preparatory (EMS Systems)

COMPETENCY
Integrates comprehensive knowledge of EMS systems, the safety and well-being of the paramedic, and medical–legal and ethical issues, which is intended to improve the health of EMS personnel, patients, and the community.

Learning Objectives

Terminal Performance Objective: After reading this chapter your should be able to discuss the characteristics of the profession of paramedicine.

Enabling Objectives: To accomplish the terminal performance objective, you should be able to:

1. Define key terms introduced in this chapter.
2. Compare and contrast the four nationally recognized levels of EMS providers in the United States.
3. Describe the requirements that must be met for EMS professionals to function at the paramedic level.
4. Discuss the traditional and emerging roles of the paramedic in health care, public health, and public safety.
5. List and describe the various health care settings paramedics may practice in with an expanded scope of practice.

KEY TERMS

Advanced Emergency Medical Technician (AEMT), p. 3
community paramedicine, p. 4
critical care transport, p. 7
Emergency Medical Responder (EMR), p. 3

Emergency Medical Services (EMS) system, p. 2
Emergency Medical Technician (EMT), p. 3
mobile integrated health care, p. 4

National Emergency Medical Services Education Standards: Paramedic Instructional Guidelines, p. 5
Paramedic, p. 3
paramedicine, p. 4

1

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more rapid are the pulse and respiratory rates.

3.0 and 3.5 kg. Because of the excretion of extracellular

As newborns make the transition from fetal to pulmonary circulation in the first few days of life, several important

Table 11-1 Normal Vital Signs

	Pulse (Beats per Minute)	Respiration (Breaths per Minute)	Blood Pressure (Average mmHg)	Temperature	
Infancy:					
At birth:	100–180	30–60	60–90 systolic	98–100°F	36.7–37.8°C
At 1 year:	100–160	30–60	87–105 systolic	98–100°F	36.7–37.8°C
Toddler (12 to 36 months)	80–110	24–40	95–105 systolic	96.8–99.6°F	36.0–37.5°C
Preschool age (3 to 5 years)	70–110	22–34	95–110 systolic	96.8–99.6°F	36.0–37.5°C
School-age (6 to 12 years)	65–110	18–30	97–112 systolic	98.6°F	37°C
Adolescence (13 to 18 years)	60–90	12–26	112–128 systolic	98.6°F	37°C
Early adulthood (19 to 40 years)	60–100	12–20	120/80	98.6°F	37°C
Middle adulthood (41 to 60 years)	60–100	12–20	120/80	98.6°F	37°C
Late adulthood (61 years and older)	*	*	*	98.6°F	37°C

*Depends on the individual's physical health status.

TABLES

A wealth of tables offers the opportunity to highlight, summarize, and compare information.

components of the rule of threes. Whenever BVM ventilation is difficult, however, the rule of threes should be employed.

- *Three providers.* One provider on the mask, one on the bag, and one for cricoid pressure.

- *Three inches.* A reminder to place the patient in the sniffing position (elevate the head three inches) if not contraindicated.

- *Three fingers.* Three fingers on the cricoid cartilage to perform cricoid pressure.

- *Three airways.* In a worst-case scenario, the airway can be maintained, if necessary, with an oropharyngeal airway and two nasopharyngeal airways (one in each nostril).

CONTENT REVIEW

Content review boxes set off from the text are interspersed throughout the chapter. They summarize key points and serve as a helpful study guide—in an easy format for quick review.

index, and middle finger of one hand. If a lesser-trained provider is performing the maneuver, you should confirm that they are in the correct position (Figure 15-47).

Use caution not to apply so much pressure as to deform and possibly obstruct the trachea; this is a particular danger in infants. The necessary pressure has been estimated as the amount of force that will compress a capped 50-mL syringe from 50 mL to the 30 mL marking. In the event that the patient actively vomits, it is imperative to release the pressure to avoid esophageal rupture. Similarly, if cricoid pressure is being performed during intubation, reduce or release the pressure if the intubator is having difficulty visualizing the vocal cords.

Optimal BVM Ventilation Using the Rule of Threes
The *rule of threes* was developed to help providers recall the components of optimal BVM ventilation. Many patients can be easily oxygenated and ventilated without using all

- *Three PSI.* A gentle reminder to use the lowest pressure necessary to see the chest rise.

- *Three seconds.* A reminder to ventilate slowly and allow time for adequate exhalation.

- *Three PEEP.* Or up to 15 cm/H_2O positive-end expiratory pressure (PEEP) as needed to improve oxygen saturations.

Bag-Valve Ventilation of the Pediatric Patient
The differences in the pediatric patient's anatomy require some variation in ventilation technique. First, the child's relatively flat nasal bridge makes achieving a mask seal more difficult. Pressing the mask against the child's face to improve the seal can actually obstruct the airway, which is more compressible than an adult's. You can best achieve the mask seal with the two-person BVM technique, using a jaw-thrust to maintain an open airway.

For BVM ventilation, the bag size depends on the child's age. Full-term neonates and infants will require a pediatric BVM with a capacity of at least 450 mL. For children up to 8 years of age, the pediatric BVM is preferred, although for patients in the upper portion of that age range you can use an adult BVM with a capacity of 1,500 mL if you do not maximally inflate it. Children older than 8 years require an adult BVM to achieve adequate tidal volumes. Additionally, be

PHOTOS AND ILLUSTRATIONS

Carefully selected photos and a unique art program reinforce content coverage and add to text explanations.

FIGURE 15-47 Cricoid pressure.

Labels: Thyroid cartilage (Adam's apple), Cricothyroid membrane, Trachea, Esophagus, Cricoid cartilage occluding esophagus
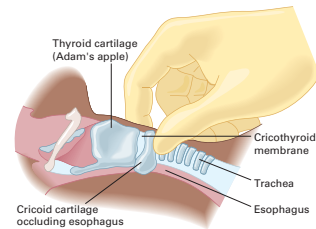
Summary

The scene size-up is the initial step in the patient care process. Sizing up the scene and situation begins at your initial dispatch and does not end until you are clear of the call. As the call unfolds, you should be making constant observations and adjustments to your plan of action. Remember that your safety and the safety of your partner are paramount—it is hard to effectively treat both yourself and others.

Scene size-up should be practiced so much that it becomes second nature to you. It is like noticing veins on people in public after you begin starting IVs. (You have all done it—looked across the room at the back of someone's hand and noticed what nice veins they had.) Sizing up a scene is no different. After a while, you begin to notice mechanisms of injury and other important details almost subconsciously. But be careful and do not get complacent! Always make it a point to pause for just a few seconds and consciously look around the scene before proceeding into any situation.

Scene size-up is not a step-by-step process, but a series of decisions you make when confronted with a variety of circumstances that are often beyond your control. It is a way to make order out of chaos, keep yourself and your crew safe, and ensure that all necessary resources are focused on patient care and outcomes. With time and experience, you will learn to perform a scene size-up quickly and focus on important issues. Your careful size-up lays the foundation for an organized and timely approach toward patient care and scene management. And always remember that scene size-up is not a one-time occurrence. It is an ongoing process.

SUMMARY

This end-of-chapter feature provides a concise review of chapter information.

airway management in every patient, you should learn and use advanced skills such as intubation, RSI, and cricothyrotomy. You must maintain proficiency in all airway skills, especially the more advanced techniques, through ongoing continuing education, physician medical direction, and testing with each EMS service. If you cannot do this, it is in the patient's best interest to focus on less sophisticated airway skills. If you anticipate that every airway will be complicated, apply basic airway skills before using advanced procedures, and perform frequent reassessments, you will give the patient his best chance for meaningful survival.

You Make the Call

You and your paramedic partner, Preston Connelly, are assigned to District 4, a quiet suburban neighborhood, on a warm Saturday in June. At 2:00 P.M., you are dispatched to care for a choking child at the Happy Hotdog Restaurant on Main Street. On your way to the location, the dispatcher advises you that they are currently giving prearrival choking instructions to the bystanders at the scene. On arrival, you find a frantic mother who tells you that her 6-year-old son was eating a hot dog and drinking a soda when he started coughing and gasping for air. She keeps yelling for you to do something. Bystanders surround the child and are attempting to perform the Heimlich maneuver without success. On your primary assessment, you find a 6-year-old boy lying on the floor, unconscious and apneic, with a pulse rate of 130. There is cyanosis surrounding his lips and fingernail beds, with a moderate amount of secretions coming from his mouth. There are no signs of trauma. You and Preston immediately start management of this child.

1. What is your primary assessment and management of this child?
2. What are your first actions?
3. What are your options for managing the airway after the obstruction is relieved?
4. What are the major anatomic differences between pediatric and adult patients in terms of airway management?

See Suggested Responses at the back of this book.

YOU MAKE THE CALL

A scenario at the end of each chapter promotes critical thinking by requiring students to apply principles to actual practice.

REVIEW QUESTIONS

These questions ask students to review and recall key information they have just learned.

Review Questions

1. When you couple the physical assessment findings with the patient's medical history, you are able to derive a list of _____
   a. clinical diagnostics.
   b. field prognoses.
   c. chief complaints
   d. differential field diagnoses.

2. The pain, discomfort, or dysfunction that caused your patient to request help is known as the _____
   a. primary problem.
   b. nature of the illness.
   c. differential diagnosis.
   d. chief complaint.

3. You are assessing a patient who complains of cardiac-type chest pain that is felt in the jaw and down the left arm. This pattern of pain is known as _____
   a. sympathetic pain.
   b. tenderness.
   c. referred pain.
   d. associated pain.

4. Your patient has smoked 2 packs of cigarettes each day for the past 35 years. He is a _____ pack/year smoker.
   a. 35   c. 730
   b. 70   d. 25,550

5. The CAGE questionnaire is used as an evaluation tool to assess a patient with what type of history?
   a. Alcoholism   c. Allergies
   b. Lung disease   d. Pregnancy

6. What interviewing mnemonic should be used for each presenting problem a patient has?
   a. SAMPLE
   b. DCAP–BTLS
   c. OPQRST–ASPN
   d. AEIOU–TIPS

7. The mnemonic GPAL is used to evaluate a patient's _____
   a. alcoholism.
   b. allergies.
   c. pregnancy history.
   d. endocrine dysfunction.

Match the following elements of the present illness of the patient with a chief complaint of chest pain with their respective examples:

1. O	**a.**	Pain is 6 on a scale of 1–10
2. P	**b.**	Patient also complains of shortness of breath and nausea
3. Q	**c.**	Pain had a sudden onset
4. R	**d.**	Pain began 2 hours ago
5. S	**e.**	Pain worsens while lying down
6. T	**f.**	Patient denies dizziness
7. AS	**g.**	Pain goes through to the back
8. PN	**h.**	Pain is heavy and vise-like

See Answers to Review Questions at the back of this book.

6. Which radio frequencies may be used by cities and municipalities for their ability to better transmit through concrete and steel?
   a. UHF   c. 800-mHz
   b. VHF   d. none of the above

7. Which frequency band is typically used by county and suburban agencies due to its ability to transmit over various terrains and longer distances?
   a. UHF   c. 800-mHz
   b. VHF   d. none of the above

8. What is the name of the basic communications system that uses the same frequency to both transmit and receive?
   a. Multiplex   c. Simplex
   b. Duplex   d. Complex

9. A communications system that uses a different transmit and receive frequency allowing for simultaneous communications between two parties is called _____
   a. multiplex.
   b. duplex.
   c. simplex.
   d. complex.

10. _____ communications systems are capable of transmitting both voice and electronic patient data simultaneously.
   a. Multiplex   c. Simplex
   b. Duplex   d. Complex

See answers to Review Questions at the back of this book.

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Further Reading

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REFERENCES

This listing is a compilation of source material providing the basis of updated data and research used in the preparation of each chapter.

FURTHER READING

This list features recommendations for books and journal articles that go beyond chapter coverage.

CASE STUDY

This feature at the start of each chapter draws students into the reading and creates a link between text content and real-life situations.

Case Study

Howard is a 15-year veteran of a high-volume, inner-city EMS service. When he first started his career, Howard thought he knew what he was getting into, but the years have taught him differently.

Right now, Howard is in the spotlight for saving the life of a police officer who was shot in a hostage situation. "That call forced me to reflect on a few important things," he says. "Two years ago, I had a minor heart problem, and it was a good wake-up call. Since then I've been lifting weights and running, so I was able to get to the officer with enough strength to carry him to safety.

"Another thing is that I always use personal protective equipment. I never go to work without steel-toed boots and I never leave the ambulance without a pair of disposable gloves. Can you believe there are still paramedics who knock the concept of infection control? If any one of my partners sticks a needle into the squad bench in my ambulance, they know I'll speak up."

Howard, a mild-mannered, nondescript man, doesn't realize that his young colleagues regard him as a role model. They've seen him handle himself at chaotic scenes as well as when a situation demands sensitivity, patience, and gentleness. "Howard is the man I'd want to tell bad news to my mother," one of his partners says. "He can handle people involved in just about any circumstance—death situations, panicked parents, lonely elderly people, and even hostile drunks. I've never seen anyone treat others with such dignity and respect. He's the best partner anyone could want, especially when we have to manage patients who are thrashing around. But that was not always so, was it, Howard?"

"No, it wasn't," Howard replies. "There was a time when no one wanted to work with me. I was a rebel, and I figured there was only one way to do things: my way. But an incident that occurred a few years ago changed all that. It's a long story. But the upshot is that when I recovered from the stress, my outlook had been altered. I realized that though I couldn't save the world, I could save myself. That's when I learned how to deal with the effects of a stressful job. I started eating right, lost a lot of weight, and adopted a new attitude. Anyway, if I can maintain my own well-being, I can do a lot more to help others. Right? Isn't that what we're about?"

Introduction

The safety and well-being of the workforce is a fundamental aspect of top-notch performance in EMS.[1] As a paramedic, it includes your physical well-being as well as your mental and emotional well-being. If your body is fed well and kept fit, if you use the principles of safe lifting, observe safe driving practices, and avoid potentially addictive and insidious infections. If you let your spirit appreciate the fear and sadness on other faces, you will find ways to combat your prejudices and treat people with dignity and respect. By doing all these things, you will also be able to promote the benefits of well-being to your EMS colleagues.

Death, dying, stress, injury, infection, fear—all these threaten your wellness and conspire to interfere with your good intentions. However, you can do something about

PROCEDURE SCANS

Visual skill summaries provide step-by-step support in skill instruction.

Procedure 7-4 Reassessment

7-4a Reevaluate the ABCs.

7-4b Take all vital signs again.

7-4c Perform your focused assessment again.

7-4d Evaluate your interventions' effects.

laryngospasm may be occurring. Airway and breathing management requires constant reevaluation.

oxygenation. Lip cyanosis indicates central hypoxia (overall oxygen status), whereas peripheral cyanosis indicates decreased oxygen to the tissues. Pallor and coolness sug-

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Special Features

the present illness. Common sense and clinical experience will determine how much of the following history to use.

Preliminary Data

For documentation, always record the date and time of the physical exam. Determine your patient's age, sex, race, birthplace, and occupation. This provides a starting point for the interview and establishes you as the interviewer. Who is the source of the information you receive about your patient? Is it the competent patient himself, his spouse, a friend, or a bystander? Are you receiving a report from a first responder, the police, or another health care worker? Do you have the medical record from a transferring facility?

After you have gathered the information, you should establish its reliability, which will vary according to the source's knowledge, memory, trust, and motivation. Again, reconfirm the information with the patient, if possible. This is a judgment call based on your experience. For example, if the patient information you received from a particular EMT first responder has been accurate in the past, you probably will trust it again. On the other hand, if the nurse at a physician's office has repeatedly provided you with erroneous information, you probably will doubt its accuracy.

scious patient, the chief complaint becomes what someone else identifies or what you observe as the primary problem. In some trauma situations, for instance, the chief complaint might be the mechanism of injury, such as "a penetrating wound to the chest" or "a fall from 25 feet."

Patho Pearls

The renowned Canadian physician Sir William Osler said, "Listen to the patient, and he will tell you what is wrong." This advice is as true today as it was 100 years ago. A great deal of information can be determined from a skillful history taking. As you listen to a patient's medical history, try to understand the underlying pathophysiologic processes that might cause the symptoms the patient describes. This will help you to fully comprehend the disease process or processes affecting the patient.

For example, consider the following case. Mrs. J. Franklin is a 72-year-old pensioner, twice widowed, who lives in an older section of town. She summons EMS with what initially seem like vague complaints. She reports to the dispatcher, when queried, that she is "just sick." You arrive and begin an assessment, starting with a pertinent history. The patient reports that her symptoms began about two weeks ago after several family members came to her house with dinner, which included a baked ham. Since that time, she has developed some fatigue, progressive dyspnea, and occasional chest pain. She now reports that she often wakes up at 3:00 a.m. with breathing trouble that resolves when she walks around the room or

PATHO PEARLS

Offer a snapshot of pathological considerations students will encounter in the field.

LEGAL CONSIDERATIONS

Offer a snapshot of pathological considerations students will encounter in the field.

FIGURE 2-11 Patients may be transported by ground or air. Medical helicopter transport was introduced in the 1950s during the Korean War. (© Ed Effron)

Vietnam, and success of military evacuation procedures led to their use in civilian ambulance systems. In 1970, the Military Assistance to Safety and Traffic (MAST) program was established. This demonstration project set up 35 helicopter transportation programs nationwide to test the feasibility of using military helicopters and paramedics in

Legal Considerations

Emergency Department Closures. Numerous factors have resulted in emergency department closures and ambulance diversions. This can have a significant impact on the EMS system. All systems must address this situation so that patient care does not suffer.

In 1974, in response to a request from the DOT, the General Services Administration (GSA) developed the "KKK-A-1822 Federal Specifications for Ambulances." This was the first attempt at standardizing ambulance design to permit intensive life support for patients en route to a definitive care facility. The act defined the following basic types of ambulance:

- **Type I (Figure 2-13).** This is a conventional cab and chassis on which a module ambulance body is mounted, with no passageway between the driver's and patient's compartments.
- **Type II (Figure 2-14).** A standard van, body, and cab form an integral unit. Most have a raised roof.

An important part of patient assessment is gathering information that is accurate, complete, and relevant to the present emergency. To begin, you must identify the patient's chief complaint. Although dispatch probably will have given you an idea of what the emergency is about, it is

Cultural Considerations

Eye contact is a major form of nonverbal communication. Short eye contact is often seen as friendly, whereas prolonged eye contact may be interpreted as threatening. Thus, timing is an important factor in how a person interprets eye contact.

One's culture also influences how eye contact is interpreted. Eye contact can mean respect in one culture and disrespect in another. Often, Asians will avoid eye contact even when they have nothing to hide. Eye contact between people of different sexes is problematic in Muslim cultures, in which a prolonged look in the face of a member of the opposite sex might be misinterpreted. Because of this, people in Middle Eastern countries might look a person of the same sex in the eye and not look into the eyes of a person of the opposite sex.

If you work in a culturally diverse community, you should learn the customs of eye contact and other forms of nonverbal communication of those you might encounter during the course of your work.

unexpected but important facts. For example, instead of asking your patient with abdominal pain, "Did you have breakfast today?" which can be answered with either a "yes" or a "no," ask: "What have you eaten today?"

- **Use direct questions when necessary.** Direct questions, or **closed questions**, ask for specific information. ("Did you take your pills today?" or "Does the abdominal pain come and go like a cramp, or is it constant?") These questions are good for three reasons: They fill in information generated by open-ended questions. They help to answer crucial questions when time is limited. And they can help to control overly talkative patients, who might want to tell you about their gallbladder surgery in 1969 when their chief complaint is a sprained ankle.
- **Ask only one question at a time, and allow the patient to complete his answers.** If you ask more than one question, the patient may not know which one to answer and may leave out portions of information or become confused. Equally important is having one person do the interview. Don't force your patient to discern questions from multiple interviewers.
- **Listen to the patient's complete response before asking the next question.** By doing so, you might find that

CULTURAL CONSIDERATIONS

Provide an awareness of beliefs that might affect patient care.

ASSESSMENT PEARLS

Offer tips, guidance, and information to aid in patient assessment.

PEDIATRIC PEARLS

Offer tips, guidance, and information on how to deal with pediatric patients encountered in the field.

CUSTOMER SERVICE MINUTE

Shows how extending extra kindness and compassion can make an important difference to patients and families coping with an emergency.

IN THE FIELD

Provides extra tips that can help ensure success in real-life emergency situations.

Chapter 1
Introduction to Paramedicine

Bryan Bledsoe, DO, FACEP, FAAEM

STANDARD
Preparatory (EMS Systems)

COMPETENCY
Integrates comprehensive knowledge of EMS systems, the safety and well-being of the paramedic, and medical–legal and ethical issues, which is intended to improve the health of EMS personnel, patients, and the community.

⌄ Learning Objectives

Terminal Performance Objective: After reading this chapter your should be able to discuss the characteristics of the profession of paramedicine.

Enabling Objectives: To accomplish the terminal performance objective, you should be able to:

1. Define key terms introduced in this chapter.

2. Compare and contrast the four nationally recognized levels of EMS providers in the United States.

3. Describe the requirements that must be met for EMS professionals to function at the paramedic level.

4. Discuss the traditional and emerging roles of the paramedic in health care, public health, and public safety.

5. List and describe the various health care settings paramedics may practice in with an expanded scope of practice.

KEY TERMS

Advanced Emergency Medical Technician (AEMT), p. 3

community paramedicine, p. 4

critical care transport, p. 7

Emergency Medical Responder (EMR), p. 3

Emergency Medical Services (EMS) system, p. 2

Emergency Medical Technician (EMT), p. 3

mobile integrated health care, p. 4

National Emergency Medical Services Education Standards: Paramedic Instructional Guidelines, p. 5

Paramedic, p. 3

paramedicine, p. 4

Case Study

Marcus Ward is a 65-year-old attorney who is celebrating his recent retirement with a week-long trip to Las Vegas. He has taken in the shows, eaten the fine food, and is spending his last night in town in one of the casinos on the famous Las Vegas strip. He sits down at a blackjack table and lights a cigarette. As the dealer is shuffling the cards, Marcus starts to feel warm. He turns to his friend Ray and says, "Does it feel warm in here to you?" Then, without another word, Marcus grasps at the collar of his shirt and collapses to the floor. Initially, Ray thinks his friend has slipped on the stool. Quickly, though, he realizes the situation is much worse. He starts screaming for help. The dealer presses a security button and several security officers immediately come to the table. After a quick exam, the security staff moves Marcus to a beverage area off the casino floor and calls 911. There they start CPR and immediately apply an automated external defibrillator (AED) to Marcus. The AED detects ventricular fibrillation and delivers a shock. Immediately, Marcus starts moving and soon opens his eyes. The security staff closely monitors Marcus, and soon a paramedic fire crew arrives. Shortly thereafter, paramedics from the ambulance service arrive.

The paramedics assess Marcus and obtain a 12-lead ECG. The ECG is consistent with an acute anterior ST-segment elevation myocardial infarction (STEMI). The ECG monitor electronically transmits Marcus's ECG to the hospital emergency department and the on-call STEMI team. The cardiologist reviews the ECG and calls for a "Code STEMI," after which the team is activated. Paramedics insert an IV and administer nitroglycerin and 325 mg of aspirin. Marcus is quickly moved to the ambulance and transported to the designated hospital.

Once Marcus arrives at the emergency department, he is quickly evaluated by the interventional cardiologist and an emergency physician. Finding no contraindications, the cardiologist has Marcus immediately moved to the cardiac catheterization suite. After he arrives in the lab, the team goes to work. Marcus is moved to the table. A nurse shaves his groin and applies an antiseptic soap. An anesthesiologist sedates Marcus and monitors his vital signs. The cardiologist quickly inserts a catheter into Marcus's femoral artery and threads it up the aorta to the heart. He injects a dye, and immediately Marcus's coronary arteries can be seen on the monitor. As expected, part of the left anterior descending coronary artery is blocked. The cardiologist then inserts a balloon catheter into the diseased artery and restores blood flow to the affected part of the heart. Some ventricular irritability and premature ventricular contractions follow, but these soon abate and the cardiologist then inserts a drug-eluting stent to keep the artery open. Additional dye is injected, blood flow through the stent looks good, and no other lesions require treatment. Marcus is moved to the coronary care unit, where he ultimately recovers and flies back to Irvine, California, four days later.

Marcus survived because the EMS and emergency health care system worked together cohesively. When he collapsed at the blackjack table, he was defibrillated within 3 minutes of his collapse. His STEMI was promptly identified and treated by prehospital personnel, who also notified and activated the STEMI team at the hospital. The time interval from Marcus's arrival at the hospital until blood flow was restored to his diseased artery (door-to-balloon time) was 31 minutes.

Back in Irvine, Marcus has vowed to improve his life and appears to be making important changes. He has quit smoking and has begun an exercise regimen. He now sees a local cardiologist on a regular basis. He and his wife have made major changes in their diet. His prognosis is good, and he should enjoy many more years of his retirement. A month after his cardiac arrest, Marcus purchased an AED and donated it to the fitness center where he now exercises. Moreover, he has developed a new understanding and appreciation for the EMS system.

Introduction

Congratulations on your decision to become a Paramedic. Before you begin this long but rewarding endeavor, it is important to understand what the job of a paramedic in the twenty-first century entails. As a member of the allied health professions (ancillary health care professions, apart from physicians and nurses), the paramedic is highly regarded by society (Figure 1-1).

The **Emergency Medical Services (EMS) system** has made significant advances over the past 30 years. Understandably, the roles and responsibilities of the paramedic have advanced accordingly. Not that long ago, the ambulance was simply a vehicle that provided rapid, horizontal transportation to the hospital. Today, equipped with the latest in equipment and technology, the modern ambulance is truly a mobile emergency room that brings sophisticated emergency medical care to the patient. The

FIGURE 1-1 The paramedic of the twenty-first century is a highly trained health care professional.

paramedic of the twenty-first century is a highly trained health care professional who provides comprehensive, compassionate, and efficient prehospital emergency medical care.

Description of the Profession

The paramedic is the highest level of prehospital care provider and the leader of the prehospital care team.[1] There are four nationally recognized levels of EMS providers in the United States:

- *Emergency Medical Responder (EMR).* The primary focus of the **Emergency Medical Responder (EMR)** is to initiate immediate lifesaving care to critical patients who access the emergency medical system. This individual possesses the basic knowledge and skills necessary to provide lifesaving interventions while awaiting additional EMS response and to assist higher level personnel at the scene and during transport. EMRs must successfully complete an accredited EMR educational program.

- *Emergency Medical Technician (EMT).* The primary focus of the **Emergency Medical Technician (EMT)** is to provide basic emergency medical care and transportation for critical and emergent patients who access the emergency medical system. The EMT possesses the basic knowledge and skills necessary to provide patient care and transportation. EMTs perform interventions with basic equipment and are an essential link in the prehospital emergency care continuum. EMTs must successfully complete an EMT educational program.

- *Advanced EMT (AEMT).* The primary focus of the **Advanced Emergency Medical Technician (AEMT)** is to provide basic and limited advanced emergency medical care and transportation for critical and emergent patients who access the EMS system. The AEMT possesses the basic knowledge and skills necessary to provide patient care and transportation. In addition, AEMTs perform interventions with both basic and advanced equipment. The AEMT must successfully complete an accredited EMT educational program.

- *Paramedic.* The **Paramedic** is an allied health professional whose primary focus is to provide advanced emergency medical care for critical and emergent patients who access the EMS system. The paramedic possesses the complex knowledge and skills necessary to provide patient care and transportation. Paramedics function as part of a comprehensive EMS response under medical oversight. Paramedics perform interventions with both basic and advanced equipment typically found on an ambulance. The paramedic is an essential link in the emergency care system. Because of the amount of complex decision making, paramedics must successfully complete a comprehensive accredited paramedic education program at the certificate or associate's degree level.[2]

The Modern Paramedic

The roles and responsibilities of the paramedic are diverse and encompass the disciplines of health care,

CONTENT REVIEW

➤ Levels of EMS Providers
  - Emergency Medical Responder (EMR)
  - Emergency Medical Technician (EMT)
  - Advanced Emergency Medical Technician (AEMT)
  - Paramedic
➤ The paramedic is the highest level of prehospital care provider and the leader of the prehospital care team.

CONTENT REVIEW

➤ Emerging Roles of the Paramedic
  - Public education
  - Health promotion
  - Illness and injury prevention
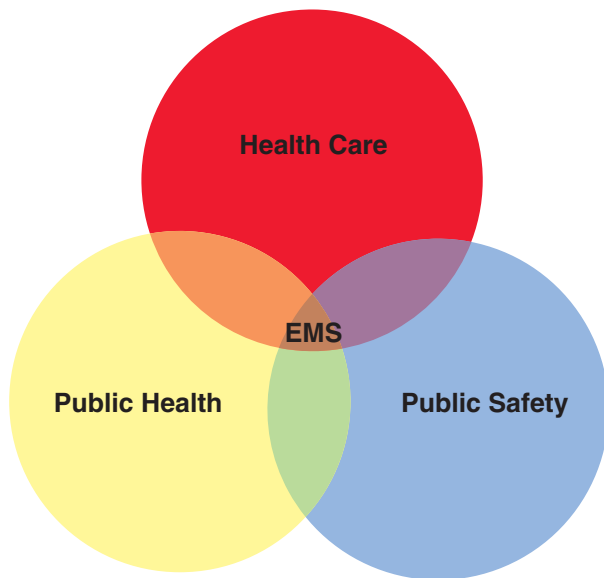
FIGURE 1-2 Modern EMS is a combination of public health, public safety, and health care.

FIGURE 1-3 The paramedic must always be an advocate for the patient.

public health, and public safety. Any of these might come into play on a given day. As EMS research evolves, it is becoming clear that illness and injury prevention are just as important as acute health care and public safety responsibilities (Figure 1-2). The totality of these roles and responsibilities of paramedic practice is known as **paramedicine**.

The primary task of the paramedic is to provide emergency medical care in an out-of-hospital setting. As a paramedic, you will use your advanced training and equipment to extend the care of the emergency physician to the patient in the field. However, you must also be able to make accurate independent judgments. The ability to do this in a timely manner is essential, as it can mean the difference between life and death for the patient.

To function as a paramedic—to practice the art and science of out-of-hospital medicine in conjunction with physician medical oversight—you must have fulfilled the prescribed requirements of the appropriate licensing or credentialing body. Licensing or credentialing is typically provided by a state or provincial agency. All paramedics must be licensed, registered, or otherwise credentialed by the appropriate agency in the area where they work.

Paramedics may function only under the direction of the EMS system's medical director. Because of this, in addition to being appropriately licensed or credentialed, the system's medical director must also approve and credential the paramedic before being permitted to practice advanced prehospital care. Paramedics must possess knowledge, skills, and attitudes consistent with the expectations of the public and the profession.

As a paramedic, you must recognize that you are an essential component in the continuum of care. Furthermore, paramedics often serve as a link between various

health resources in the community. In the future, there will be a continuing demand to control or cut health care costs. As a consequence, paramedics may find themselves in the role of gatekeepers to the health care system. For example, you may be charged with the responsibility of ensuring that your patient gets to the appropriate health care facility in a timely manner, even though the appropriate health care facility may not be a hospital emergency department.

Paramedics must always strive toward maintaining high-quality health care at a reasonable cost. Nevertheless, you must always be an advocate for your patient and ensure that the patient receives the best possible care—without regard to the patient's ability to pay or insurance status (Figure 1-3).

Paramedics of the twenty-first century will continue to fill the well-defined and traditional role of 911 response, but they will also find themselves taking on a wide variety of additional responsibilities. The emerging roles and responsibilities of the paramedic include public education, health promotion, and participation in injury and illness prevention programs. One rapidly expanding role of paramedics is **mobile integrated health care**. Mobile integrated health care, also called **community paramedicine**, is a new and evolving aspect of community-based health care in which paramedics function outside their customary emergency response and transport roles in ways that facilitate more appropriate use of emergency care resources (Figure 1-4). Paramedics also serve to enhance access to primary care for medically underserved populations and help to ensure that all members of the community have access to some level of health care.[3] As the scope of paramedic service continues to expand, the paramedic will function as a facilitator of access to care, as well as an individual treatment provider.

Paramedics are responsible and accountable to the system medical director, their agency, the public, and their peers. Although this may seem like a difficult standard to meet, if you always act in the best interest of the patient, you will seldom run into problems.

FIGURE 1-4 The modern EMS system has begun a new nontraditional role in nonemergent care through such programs as community paramedicine and mobile integrated health care.

(Photo courtesy © Dallas Fire-Rescue Department)

Paramedic Characteristics

There are many different types of EMS system designs and operations. As a paramedic, you may work for a fire department, private ambulance service, third city service, hospital, police department, or other operation. Regardless of the type of service provider you work for, you must be flexible to meet the demands of the ever-changing emergency scene.

As a paramedic, you must be a confident leader who can accept the challenge and responsibility of the position. You must have excellent judgment and be able to prioritize decisions to act quickly in the best interest of the patient. You must be able to develop rapport with a wide variety of patients so that, for example, you can safely interview hostile patients and communicate with members of diverse cultural groups and the various ages within those groups. Overall, you must be able to function independently at an optimum level in a nonstructured, constantly changing environment. The job is never easy and always challenging.

The Paramedic: A True Health Professional

Despite its relative youth as a profession, the field of emergency medical services is now recognized as an important part of the health care system. With this, paramedics are now highly respected members of the health care team. As a paramedic, you must never take this status for granted. Instead, you must always strive to earn your acceptance as a health care professional.

You should consider the completion of your initial paramedic course to be the start of your professional education, not the end. You should participate in various continuing education programs when they become available. Frequently review and practice skills that are infrequently

Legal Considerations

Which Hat Are You Wearing? The modern paramedic, whether career or volunteer, must wear several hats. Many paramedics are also cross trained as firefighters or police officers. The role of each of these professions is different, but there is often significant overlapping of duties. Paramedics may participate in rescue operations, directing traffic, firefighting, and other tasks on an emergency scene. However, it is essential that, when functioning in the role of paramedic, you remember that your primary responsibility is the patient and patient care. You must also be an advocate for the patient.

If you are cross trained, this can cause a certain degree of confusion and conflict. For example, if you are a cross-trained police officer/paramedic who is treating an intoxicated driver, you may have conflicting responsibilities. However, as already noted, when you are functioning as a paramedic your priority should be the patient. Legal issues and other tasks normally addressed by police officers must be handled by other police officers on scene or dealt with after the patient has been treated and transported. Similarly, paramedics who are cross trained may learn information about a patient that is protected from disclosure by the Health Insurance Portability and Accountability Act (HIPAA) and other medical privacy laws and regulations. In a case like this, you may not be able to disclose certain information to your law enforcement colleagues despite the fact that you are also a police officer.

Laws regarding responsibilities of cross-trained individuals vary from state to state. You must be familiar with the laws of the state where you are employed. Remember: When you function as a paramedic, you must put care of the patient above all other tasks—and always remember which hat you are wearing.

used to ensure competency when the skill is needed. As a rule, the less a skill or procedure is used, the more frequent should be the review of that skill or procedure. Most quality continuing education programs acknowledge this by scheduling periodic review and practice of infrequently used skills or procedures. Professional development should be a never-ending, career-long pursuit. Additionally, you should participate in routine peer-evaluation and assume an active role in professional and community organizations (Figure 1-5).

A major step toward the development of EMS as a true health care profession has been to raise the standards of education for out-of-hospital personnel. A significant advance was the 2009 publication by the U.S. Department of Transportation of the *National Emergency Medical Services Education Standards: Paramedic Instructional Guidelines*.[4] These instructional guidelines have taken paramedic education to a much higher level and were based on a national EMS practice analysis completed by the National Registry of Emergency Medical Technicians in 2004.[5] An anatomy

(a)

(b)

FIGURE 1-5 (a and b) Public education is an important part of the paramedic's job.

and physiology course is now a prerequisite to the paramedic course. The paramedic course itself requires a far more extensive foundation of medical knowledge to underlie the required skills. In particular, the curriculum provides for an improved understanding of the pathophysiology of the various illness and injury processes paramedics encounter in their work. The materials presented in the 2009 DOT EMS Instructional Guidelines are the foundation for this textbook.

As a paramedic, you must actively participate in the design, development, evaluation, and publication of research on topics relevant to your profession. For years, paramedic practice was based on anecdotal data and tradition. Only during the past two decades did we truly begin applying the scientific method to various aspects of prehospital practice. Surprisingly, we found that there were little or no scientific data to support many of our prehospital practices. As a result of research, many traditional EMS treatments have been abandoned or refined. There are still many unanswered questions about paramedic practice, and these can be answered only by sound scientific research.

An essential aspect of a health professional is acceptance and adherence to a code of professional ethics and etiquette. Ethics are standards of right or honorable behavior, whereas etiquette refers to good manners. Both can apply to all human relationships. However, you will find that questions of ethics most often arise in relationships with patients and the public, whereas etiquette more often relates to behavior between health professionals.

The public must feel confident that, for the paramedic, the patient's and public's interests are always placed above personal, corporate, or financial interests. You must never forget that the emergency patient is your primary concern. Emergency patients are vulnerable and in need. Always keep this in mind and serve as their advocate until you turn patient care over to another health care professional.

Expanded Scope of Practice

Paramedics have a very bright future. New technologies and therapies can literally bring the emergency department to the patient. Paramedics must be willing to step up to these expanding roles, or persons from other health care disciplines will fill them.[6] There are many aspects of out-of-hospital care that can provide you with the opportunity to work in an environment other than the typical 911 response vehicle. These include:

  • Critical care transport
  • Helicopter air ambulance
  • Tactical EMS
  • Primary care
  • Industrial medicine
  • Sports medicine
  • Corrections
  • Hospital emergency departments

Paramedics are now stepping into nontraditional roles such as these because of their unique education and ability to think and work independently.

Critical Care Transport (CCT)

As a result of the specialization of health care facilities that began to occur in the 1990s, an increasing number of

FIGURE 1-6 The modern critical care transport vehicle provides virtually all the capabilities of the hospital intensive care unit.

patients are being moved from one health care facility to another for specialized care. Many of these patients are critically ill and require equipment and care more sophisticated than that available on standard ambulances. Because of this, many EMS systems have developed specialized **critical care transport** vehicles to move these patients between facilities.

These vehicles include specialized ground ambulances, fixed-wing aircraft, and helicopters. Many services have elected to use large vehicles mounted on truck chassis to provide the added space needed for critical care transport (Figure 1-6). To staff these vehicles, paramedics have been educated in various aspects of critical care medicine. These include advanced airway management, ventilator management, fluid and electrolyte therapy, advanced pharmacology, specialized monitoring, operation of intra-aortic balloon pumps, and other techniques usually found in an intensive care setting. This provides a safe and efficient way to move critical patients between facilities without compromising hospital staffing (Figure 1-7).

Helicopter Air Ambulance (HAA)

Helicopters have been a part of the EMS system for more than 30 years and play an important role—especially in

FIGURE 1-7 Critical care transport provides for the safe transfer of critically ill or injured patients between health care facilities.

(© Edward T. Dickinson, MD)

FIGURE 1-8 The helicopter has become an important part of the modern EMS system.

(© REACH Air medical Services, LLC)

rural areas. Most helicopter air ambulance (HAA) programs staff the helicopter with two medical crew members and often include paramedics. The flight paramedic typically will respond to both scene calls and interfacility transfers. The skills of the flight paramedic are very similar to those of a critical care paramedic, but must include additional education in flight physiology, aircraft operations, flight safety, and similar areas. (Figure 1-8).

Tactical EMS

Over the past decade or so there has been a trend to use EMS personnel in tactical situations. Tactical EMS is designed to enhance the safety of special operations personnel and the public. In some situations, tactical paramedics are cross trained as police officers and carry weapons. The role of the tactical paramedic is to provide life-saving care, sometimes in dangerous environments, until the patient can be safely evacuated to the general EMS system. Many of the practices and techniques of tactical EMS were drawn from experience with the military—particularly with special operations (Figure 1-9).

Mobile Integrated Health Care

Today, many patients can receive primary care outside the hospital at far less cost—for example, in physicians' offices and minor-care or outpatient clinics.[7] Additionally, many patients can be cared for at home. In certain cases, paramedics, in close contact with medical direction, can provide care at the scene without transport to the hospital (e.g., to treat simple lacerations or to change dressings or gastrostomy tubes). Several EMS systems have designated specialized crews to periodically assess and monitor high-risk patients in their community (Figure 1-10).

FIGURE 1-9 The tactical paramedic must often provide life-saving care in austere and dangerous situations.

(© Kevin Link/Science Source)

Industrial Medicine

Paramedics have long been the principal health care providers on oil rigs, movie sets, and similar industrial operations. Paramedics are specially trained for the industry in question and often assume additional responsibilities, including safety inspection, accident prevention, medical screening of employees, and vaccinations and immunizations. Many industries use paramedics to assist with sick

FIGURE 1-10 Paramedics play an important role in ensuring the health of the community they serve—especially high-risk patients.

FIGURE 1-11 The industrial paramedic provides several important services in addition to emergency care.

calls and minor medical care. Having paramedics on site allows for increased employee safety and decreased time lost from work (Figure 1-11).

Sports Medicine

Another area in the expanded scope of paramedic practice is sports medicine. Many teams, including those in professional sports, have found that paramedics complement their athletic trainers. In this role, paramedics assume considerably more responsibility for injury prevention. They are also trained to deal with injuries specific to the sport in question. For example, paramedics working with a football team will assist in pregame preparation of players. During the game, they provide any needed emergency medical care. They can also advise the staff whether an injured or ill player may return to the game. Paramedics working with hockey teams, for example, often learn to perform simple laceration repairs and provide care for orthopedic injuries to safely return the players to action as soon as possible (Figure 1-12).

Corrections Medicine

Many states and the federal government have begun to use paramedics as emergency and medical care providers in jails and prisons. In these institutions, paramedics will often do the initial prisoner medical intake assessment and oversee the medical needs of the prison population. They are also responsible for responding to emergencies within the prison. Because of this, they must also have training in correctional operations and similar issues. Paramedics also play a major role in the U.S. Department of Immigration and Customs Enforcement (ICE). Paramedics often work with Border Patrol agents and Customs agents as they endeavor to maintain homeland security (Figure 1-13).
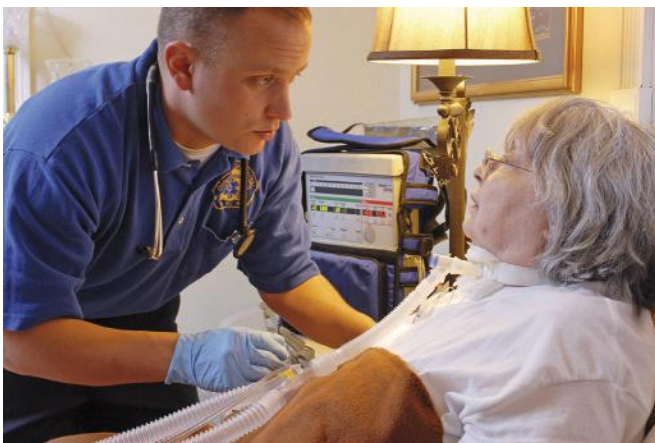
FIGURE 1-12 Injuries and medical emergencies are common at sporting events, and many teams and facilities have paramedics readily available.

(© Ray Kemp/Science Source)

Hospital Emergency Departments

Faced with a nursing shortage, many hospitals have found paramedics to be very suitable providers for emergency departments and minor care centers. The role of the paramedic in these settings varies significantly from state to state, based on local laws. In some situations, the paramedic will function in a role comparable to nursing. In others, they will work in a more technical role, assisting the

FIGURE 1-13 Paramedics often accompany U.S. Border Patrol agents and provide care to both officers and detainees.

(Photo used by permission. Courtesy of the Office of Border Patrol, Field Communications Branch)

medical and nursing staff with skills and responsibilities within the scope of paramedicine. Many paramedics enjoy the diversity and work experience of a busy emergency department (Figure 1-14).

FIGURE 1-14 Hospitals are increasingly turning to paramedics to help staff at busy emergency departments and trauma centers.

Summary

Even though it is still a young profession, EMS is now recognized as a staple in the health care system. Paramedics have been identified as underutilized medical experts and are being offered opportunities that were unheard of just a few years ago.

As the scope of practice for paramedicine continues to expand, so will the demand for skilled practitioners. It is truly an exciting time for EMS and paramedicine. The paramedic of the twenty-first century can have a more significant impact on health care than ever before. The paramedic is often the first member of the health care system with whom the patient

interacts, and the results of those interactions can affect the patient's opinion of the health care system in general.

EMS is a profession in which you can make a difference. Every call and every patient interaction has the potential to make the difference between life and death for the patient. Few professions carry such awesome responsibility.

You Make the Call

Finally, after two straight years of urban EMS work without a vacation, you and two of your best paramedic friends, Eileen and Dee Dee, are taking the trip you've been planning for some time. The small airplane grinds to a bumpy halt as you land on a tiny speck of land in the midst of a bright turquoise sea. The ride from the mainland was rough, and Eileen has thrown up. To make matters worse, two of your bags didn't make it aboard the plane. You question the ticket agent who says, "Maybe a plane come Monday. No plane Sunday." Your dream vacation is quickly turning into a nightmare.

After standing in the sun for 45 minutes waiting for a taxi, a 1995 Kia shows up. The driver tells you that your hotel is about 45 minutes away. He throws your bags into the trunk, ties the trunk shut with a piece of rope, and takes off like a dragster from the starting line. You and your friends hang on for dear life as the cab speeds through the winding streets. You try to remember whether people on this island drive on the left side or the right. You certainly can't tell based on your driver's actions. The driver seems to know everybody and honks accordingly. Loud island music crackles through the small speakers in the cab. Dee Dee, the friend who managed not to vomit on the plane, leans over to you and tells you that she thinks she needs to vomit now.

Suddenly, you see a plume of smoke billowing up on the road ahead. As the cab slows, you spot what appears to be an accident. On closer inspection, you see that another cab has plowed into a station wagon at an intersection. Several people are lying on the ground, and there is the general appearance of pandemonium. Dee Dee throws up.

The three of you, experienced paramedics, get out of the cab to take a look. The scene appears safe to approach. Unfortunately, the accident looks severe, with several persons suffering serious injuries. Bystanders begin to reach inside the station wagon and drag the occupants out to a nearby shade tree. You try to offer some advice on providing cervical spine precautions, but they aren't paying any attention to you. You cringe as you see a patient's head fall back and strike the ground.

Before long, all six victims are spread out under a large magnolia tree. A woman is crying loudly and reciting a prayer. A dog walks among the victims. One of the bystanders says that the police should be there "pretty soon." You ask if anyone has called the fire department. The bystander responds with a confused look on his face. "Why do we call the fire department?" he asks. "I do not see a fire."

One victim is obviously dead of a massive head injury. The others are alive but with various injuries. You and your friends try to provide what care you can with absolutely no medical equipment available. Before long, you hear the shrill siren of an approaching police car. The police officers get out of their vehicle and take a significant amount of time putting their hats on. One officer goes to the vehicles. The other goes to the magnolia tree, where he proceeds to get into a heated argument with one of the bystanders. Nobody is paying much attention to the victims except you and your friends.

Before long, there is some excitement as another vehicle pulls up. It seems to be some sort of ambulance. It is an old delivery van painted white with a large orange cross on the side. There are two attendants dressed in white smocks. They carry a canvas litter and, again with no spinal precautions and in no particular order, they begin to load up the victims. You and your friends try to relay the results of your assessment and care. The attendants continue with their tasks, both disinterested and unimpressed with your work. From what you can tell, absolutely no medical care is being provided.

When the last victim is loaded with the other five in the van, both attendants take their seats in the front of the van and leave for the hospital. The shrill sound of the siren slowly fades into the

distance, and you and your friends go on to the hotel. You look at the local paper each day, hoping to find out something about the crash victims, but you never find a story about the accident.

Although you are still upset about the accident and the unsophisticated level of medical care you witnessed—and after your bags finally arrive—you, Dee Dee, and Eileen have a nice vacation with no further adverse events.

1. Discuss the vast differences between EMS and paramedic care in the United States, Canada, and other economically developed nations compared with those that exist in some less developed countries of the world. How should awareness of such differences affect your attitude about your work?

See Suggested Responses at the back of this book.

Review Questions

1. Paramedics may function only under the direction and license of the EMS system's _____
   a. town council.
   c. medical director.
   b. company owner.
   d. board of directors.

2. The emerging roles and responsibilities of the paramedic include _____
   a. public education.
   b. health promotion.
   c. participation in injury and illness prevention programs.
   d. all of the above.

3. The rules, standards, and expected actions governing the activities of a group or profession are called _____
   a. ethics.
   c. manners.
   b. morals.
   d. etiquette.

4. Which of the following is an aspect of professionalism?
   a. Being well groomed
   b. Maintaining patient confidentiality
   c. Attending continuing education sessions
   d. All of the above

5. All of the following are considered new, nontraditional roles for the paramedic *except* _____
   a. primary care.
   b. sports medicine.
   c. family practitioner.
   d. industrial medicine.

See answers to Review Questions at the back of this book.

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Chapter 2
EMS Systems

Bryan Bledsoe, DO, FACEP, FAAEM

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STANDARD
Preparatory (EMS Systems)

COMPETENCY
Integrates comprehensive knowledge of EMS systems, the safety and well-being of the paramedic, and medical-legal and ethical issues, which is intended to improve the health of EMS personnel, patients, and the community.

⌄ Learning Objectives

Terminal Performance Objective: After reading this chapter you should be able to discuss the characteristics, components, and functions of emergency medicine services (EMS) systems.

Enabling Objectives: To accomplish the terminal performance objective, you should be able to:

1. Define key terms introduced in this chapter.

2. List the out-of-hospital and in-hospital components of EMS systems.

3. Link key events in the history of EMS to the development of the modern EMS system.

4. Discuss the importance of the 1966 publication *Accidental Death and Disability: The Neglected Disease of Modern Society* as it relates to the development of EMS in the United States.

5. Describe each of the ten components of EMS systems according to the Statewide EMS Technical Assessment Program.

6. Identify and discuss the vision and documents that are guiding EMS into the future.

7. Discuss the contemporary problems facing EMS as described in the Institute of Medicine document, *Emergency Medical Services: At the Crossroads*.

8. Provide examples of various configurations of EMS systems in the United States and how they integrate into the chain of survival.

9. List and describe the purposes of the national documents guiding EMS education and practice.

10. Discuss typical components that should be established for local and state-level EMS systems.

11. Describe the similarities, differences, and general purposes of the professional organizations and professional journals related to the practice of EMS.

12. Describe the intent of the General Services Administration KKK-A-1822 Federal Specifications for Ambulances.

13. Describe the purpose of categorizing receiving hospital facilities by their capabilities.

14. Explain the purpose and components of an effective continuous quality improvement program.

15. Describe how you can contribute to greater patient safety in emergency medical services.

16. Explain the role of research in EMS.

17. Discuss how evidence-based medicine is enhancing EMS.

KEY TERMS

accreditation, p. 28

bystander, p. 14

certification, p. 29

chain of survival, p. 23

clinical protocols, p. 25

Department of Homeland Security, p. 21

Emergency Medical Dispatcher (EMD), p. 27

ethics, p. 35

evidence-based medicine (EBM), p. 37

helicopter air ambulances (HAA), p. 20

interoperability, p. 27

intervener physician, p. 25

licensure, p. 29

medical director, p. 25

medical oversight, p. 25

National Highway Traffic Safety Administration (NHTSA), p. 20

National Incident Management System (NIMS), p. 21

National Transportation Safety Board (NTSB), p. 22

off-line medical oversight, p. 25

on-line medical direction, p. 25

Ontario Prehospital Advanced Life Support (OPALS) study, p. 20

peer review, p. 25

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teachable moment, p. 26

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trauma, p. 33

trauma center, p. 20

Case Study

It is a beautiful Fourth of July. You and your family are traveling down the interstate on your way to a concert and fireworks show. Just an hour from your destination, a tire blows out on the BMW ahead of you, and you see it skid into the median and crash into some pine trees. You pull onto the shoulder. As an experienced paramedic, you ensure scene safety before approaching the mangled car. You see no movement inside the passenger compartment.

Your daughter grabs her cell phone and calls 911. The dispatcher asks for the location of the crash and transfers your call to the 911 call center for that area. The emergency medical dispatcher gathers the appropriate information and dispatches the local volunteer fire service and a paramedic ambulance. While you attempt to gain access to the patients, your daughter continues to provide the dispatcher with information that he, in turn, relays to the responding units.

The local volunteer fire and rescue team arrives on scene in about 7 minutes. You provide a verbal report to the arriving rescuers. They do their own scene safety check, approach the car, and determine that there are four patients. Two are priority-1 patients (one of these is a 2-year-old child), and two are priority-3 patients. Based on the primary assessment, Rescuer Lt. C. J. Greenlee requests a medical helicopter and a second paramedic unit. Approximately 2 minutes later, a fire truck crew arrives. They reroute traffic and establish a landing zone for the helicopter.

When all EMS personnel summoned are on scene, they decide that the 2-year-old patient will be flown to Children's Hospital, a pediatric specialty center. The other

immediate patient will be transported by ground to the closest Level I trauma center. The patients with minor injuries will be taken to the local hospital by ground transport. Working as a team, the fire and ambulance personnel extricate the patients and package them for transport.

Approximately 22 minutes after the arrival of the first paramedic unit, all patients have been extricated and are en route to a receiving facility capable of providing the level of care they need. Within 15 minutes of arrival at the pediatric trauma center and just 31 minutes after the crash, the 2-year-old is moved to surgery for the repair of a ruptured liver and spleen. The other patients are being treated at their destinations as well.

Introduction

As discussed in the preceding chapter, the emergency medical services (EMS) system is a comprehensive network of personnel, equipment, and resources established to deliver aid and emergency medical care to the community. To meet the needs of the community it serves, an EMS system must function as a unified whole. In general, an EMS system is composed of both out-of-hospital and in-hospital components. The out-of-hospital component includes:

- Members of the community who are trained in first aid and CPR
- A communications system that allows public access to emergency services dispatch and allows EMS providers to communicate with one another
- EMS providers, including paramedics
- Fire/rescue and hazardous-materials services
- Law enforcement officers
- Public utilities, such as power and gas companies
- Resource centers, such as regional poison control centers

The in-hospital component includes:

- Emergency nurses
- Advanced-practice providers (physicians' assistants and advanced-practice nurses)
- Emergency physicians and specialty physicians
- Ancillary services, such as radiology and respiratory therapy
- Specialty physicians, such as trauma surgeons and cardiologists
- Social workers
- Mental health providers
- Rehabilitation services

Every EMS system must rely on the strength of its components. A weakness in one component will diminish the overall quality of patient care. For example, a typical EMS operation begins with citizen activation. That is, a **bystander**—a family member, friend, or a stranger to the patient—initiates contact with an emergency dispatch center. EMS dispatch is then responsible for collecting essential information and sending out the closest appropriately staffed and equipped unit. In many EMS systems, the dispatcher also provides prearrival instructions (discussed later in the chapter) to the patient or caller so that care may begin immediately.

Usually, the first EMS provider to respond to the scene of an emergency is a police officer, firefighter, lifeguard, teacher, or other community member who has received basic medical training in an approved Emergency Medical Responder program. That person's role is to stabilize the patient until more advanced EMS personnel arrive.

The next EMS provider likely to arrive on scene depends on the type of EMS system involved. In most areas, the dispatcher will send an EMT-level or paramedic-level ambulance. In other areas of the country, EMS uses a **tiered response**, sending multiple levels of emergency care personnel to the same incident.[1] In still other areas of the country, paramedic personnel may respond to every incident regardless of the level of care needed to treat a patient (Figure 2-1).

Once emergency care has been initiated, EMS providers must quickly decide on the medical facility to which the patient should be transported. This decision is based on the type of care needed, transport time, and local protocols. In a comprehensive EMS system in which specialty centers have been designated (such as pediatric, trauma, and burn centers), it may be necessary to transport the patient to a facility other than the closest hospital.

On arrival at the receiving medical facility, where an emergency nurse or physician assumes responsibility for the patient, the patient is assigned a priority of care. If needed, a surgeon or other specialist will be summoned.

History of EMS

The Emergency Medical Services (EMS) system, as we know it today, developed from the traditional and scientific beliefs of many cultures. To understand EMS today, it

Tiered Response

Basic life support (BLS)

Advanced life support (ALS)

Fire/rescue

Alternative Response

Basic and advanced
life support
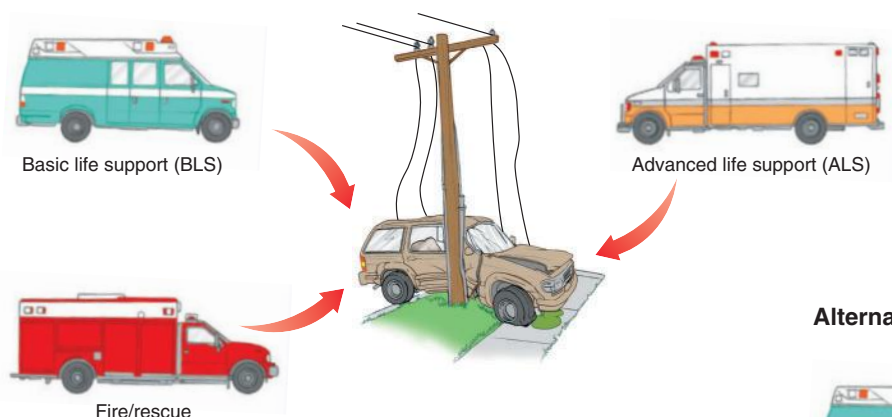
FIGURE 2-1 Some systems elect to use a tiered response whereby EMT providers provide initial on-scene care while paramedic care arrives later. Other systems send an paramedic provider to each call.
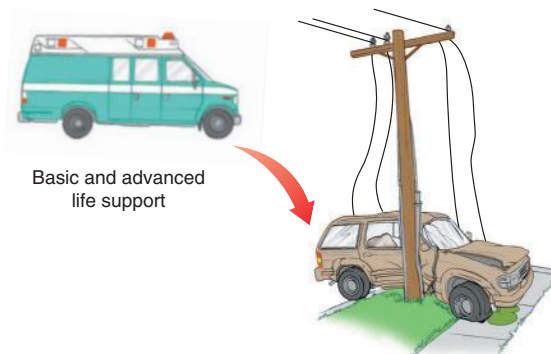
is first important to know its history. Certainly, the most significant advances in EMS have occurred during the past 50 years (see Table 2-1).

Early Development

Ancient Times

There is evidence that emergency medicine has a very long history. In fact, it may be traced back to biblical times, when it was recorded that a "good Samaritan" provided care to a wounded traveler by the side of a road.

Approximately 4,000 to 5,000 years ago, scribes in Sumer, a civilization in Mesopotamia (in southwest Asia), inscribed clay tablets with some of the earliest medical records. Similar to protocols that EMS uses today, the ancient tablets provided healers with step-by-step instructions for patient care based on the patient's description of symptoms. The tablets also included instructions on how to create the medications needed to cure the patient and explained how and when to administer them. The most striking difference between these first "protocols" and EMS today is the absence of a physical exam.

In 1862, the Egyptologist Edwin Smith purchased a papyrus scroll dating back to about 1500 B.C.E. It contained 48 medical case histories with data arranged in head-to-toe order and in order of severity, an arrangement very similar to today's patient assessment. Each case also had a particular format, including a title, specific instructions to the healer, and a projection of possible outcomes.

One section, called the "Book of Wounds," explains the treatment of injuries such as fractures and dislocations. It includes descriptions of the materials needed for making bandages and splints, as well as information about sutures and solutions that may be used to clean wounds.

At about the same time, in another civilization in the Mesopotamian region, King Hammurabi of Babylon commissioned a large painting of 282 case laws known today as the "Code of Hammurabi." That code governed criminal and civil matters, and it established strict penalties for violations, a concept called *lex talionis* or "law of the claw" (very similar to the idea of "an eye for an eye").

One section of the code was devoted to the regulation of medical fees and penalties, which were based on the social class of the patient. For example, if a surgeon operated successfully on a commoner, he would be paid only half of what his fee would be if he had operated on a rich man. Social class was also the basis for penalties. If a surgeon caused the death of a rich man, the surgeon's hand would be cut off, but if a slave died under his care, he only had to replace the slave.

EMS came from humble beginnings. Initially, out-of-hospital care involved nothing more than transport. Around 900 C.E., the Anglo-Saxons used a hammock suspended across a horse-drawn wagon. By 1100, the Normans had devised a litter that was carried between two horses to transport patients. The first recorded use of an ambulance was in the Siege of Malaga in 1487. Queen Isabella of Spain designated certain wagons for

Table 2-1 An EMS Timeline

1797	Napoleon's chief physician implements a prehospital system designed to triage and transport the injured from the field to aid stations.
1860s	Civilian ambulance services begin in Cincinnati and New York City.
1891	Dr. Friedrich Maass performs the first equivocally documented chest compression in humans.
1915	First-known air medical transport occurs during the retreat of the Serbian army from Albania.
1920	First volunteer rescue squads organize in Roanoke, Virginia, and along the New Jersey coast.
1947	Claude Beck develops first defibrillator and first human saved with defibrillation.
1958	Dr. Peter Safar demonstrates the efficacy of mouth-to-mouth ventilation.
1960	Cardiopulmonary resuscitation (CPR) is shown to be efficacious.
1965	J. Frank Pantridge converts an ambulance into a mobile coronary care unit with a portable defibrillator and recorded ten prehospital resuscitations with a 50 percent long-term survival rate.
1966	The National Academy of Sciences, National Research Council publishes *Accidental Death and Disability: The Neglected Disease of Modern Society.*
1966	Highway Safety Act of 1966 establishes the Emergency Medical Services Program in the Department of Transportation.
1967	Star of Life is patented by the American Medical Association.
1968	AT&T designates 911 as its new national emergency number.
1970	National Registry of EMTs is founded.
1970	Television show *Emergency!* debuts on NBC.
1972	Department of Health, Education, and Welfare allocates $16 million to EMS demonstration programs in five states.
1973	The Emergency Medical Services Systems (EMSS) Act provides additional federal guidelines and funding for the development of regional EMS systems; the law establishes 15 components of EMS systems.
1975	National Association of EMTs is organized.
1979	First automated external defibrillators (AEDs) become available.
1981	The Omnibus Budget Reconciliation Act consolidates EMS funding into state preventive health and health services block grants, and eliminates funding under the EMSS Act.
1981	Prehospital trauma life support (PHTLS) is developed.
1981	International trauma life support (ITLS), formerly basic trauma life support (BTLS), is developed.
1984	The EMS for Children program, under the Public Health Act, provides funds for enhancing the EMS system to better serve pediatric patients.
1985	National Research Council publishes *Injury in America: A Continuing Public Health Problem*, describing deficiencies in the progress of addressing the problem of accidental death and disability.
1988	The National Highway Traffic Safety Administration initiates the Statewide EMS Technical Assessment program based on ten key components of EMS systems.
1990	The Trauma Care Systems and Development Act encourages development of inclusive trauma systems and provides funding to states for trauma system planning, implementation, and evaluation.
1993	The Institute of Medicine publishes *Emergency Medical Services for Children*, which points out deficiencies in our health care system's ability to address the emergency medical needs of pediatric patients.
1995	Congress does not reauthorize funding under the Trauma Care Systems and Development Act.
1999	President Clinton signs bill designating 911 as national emergency number.
2003	Health Insurance Portability and Accountability Act (HIPAA) becomes effective, strictly regulating the flow of confidential information.
2006	The National Highway Traffic Safety Administration publishes *Emergency Medical Services: Agenda for the Future* to guide the development of EMS in the United States in the twenty-first century.

the transport of injured soldiers. Her grandson, King Charles V, reportedly again used field ambulances in 1553 in the Siege of Metz.

The Napoleonic Wars

In the wars between Napoleon's French Empire and other European countries from 1803 to 1815, ambulances were often used to evacuate the wounded. Military surgeon Dominique-Jean Larrey, one of Napoleon's chief surgeons, devised this idea. Larrey became distressed to see that many of the wounded were neglected for a long period of time and that most died before reaching a hospital. He subsequently developed a light carriage that allowed the movement of injured soldiers from the battlefield. These carriages came to be called *ambulances volantes*, or "Larrey's Flying Ambulances," because they were positioned with the French "flying artillery" on the battlefield. Even though the *ambulance volante* was little more than a covered horse-drawn cart, Larrey is credited with the development of the first prehospital system that used both triage and transport. Larrey was also credited with being the first to place a medical attendant in an ambulance.[2]

Although the first use of aircraft for medical evacuation is lost to history, there are records of hot air balloons being used to evacuate wounded from the Prussian Siege of Paris in 1870. During the retreat of the Serbian Army from Albania in 1915, unmodified French fighter aircraft were used to ferry the injured.

The United States in the Nineteenth Century

The development of ambulances in the United States occurred in the first part of the nineteenth century. In 1861, during the Civil War, surgeon Jonathan Letterman reorganized battlefield medical care and initiated the use of ambulances for the evacuation of battlefield casualties. In 1864, President Abraham Lincoln signed into law an act that firmly established a uniform army ambulance plan. This act separated ambulance transport from all other transport services in the Army and placed it under the medical command.

Between 1861 and 1865, a nurse named Clara Barton coordinated care for the sick and injured at Civil War battlefield sites along the East Coast. Defying army leaders, she persisted in going to the front, where wounded men suffered and often died from lack of the simplest medical attention. She continued the concept of the *ambulance volante* by organizing the triage and transport of injured soldiers to improvised hospitals in nearby houses, barns, and churches away from the battlefield.[3]

Following the success of ambulances in the Civil War, several communities and hospitals began to develop civilian ambulance services. The first civilian ambulance was established in 1860 (before the Civil War) in Cincinnati,

Ohio, by Commercial Hospital. In 1869, Bellevue Hospital, on the island of Manhattan in New York City, began to operate an ambulance service. The ambulances of both services were specially designed horse-drawn carts that were staffed with physician interns from the various hospital wards. By 1899, Michael Reese Hospital in Chicago began to operate a motorized ambulance.[4]

The Twentieth Century

From World War I to World War II

During World War I, a high mortality rate of soldiers was associated with an average evacuation time of 18 hours. As a result, in World War II a system of transportation to increasing echelons (levels) of care was created. Battlefield ambulance corps transported wounded soldiers from the front lines to the echelons of care. However, many of the echelons were so far from the battlefield and from each other that there were huge delays in patient care. In many cases, it was often days from the injury itself to definitive surgery.

There were some developments in American civilian ambulance services after World War I. Some hospitals experimented with placing physician interns on ambulances. In 1926, the Phoenix Fire Department began providing "inhalator" service and officially entered into the realm of medical care. In 1928, the first bona fide rescue squad, called the Roanoke Life Saving Crew, was started in Roanoke, Virginia. However, in 1929, the United States entered the severe economic crisis known as the Great Depression, which lasted until the start of American involvement in World War II in 1941. Little changed in the civilian ambulance service during this period.

Effects of World War II

Following the bombing of Pearl Harbor on December 7, 1941, the United States entered World War II. Because of the demands of war, many hospital-based ambulance services shut down. Many city governments turned ambulance services over to local police and fire departments. Unfortunately, there were no requirements for minimal training or care. In fact, ambulance work was often seen as a punishment, and many departments were quick to eliminate ambulance service as soon as they could.

Post-World War II

The end of World War II brought prosperity to the United States. Several medical advances occurred subsequently, improving the lives of the public. Not long after World War II, however, the United States found itself at war again—this time on the Korean peninsula.

The 1950s

Korea is a mountainous country that lacked an organized system of highways and roads. Because of this, the U.S. Army began using helicopters to move the injured from

the front lines to mobile army surgical hospitals (MASHs) located fairly close to the front lines. Thus, injured soldiers were being promptly evacuated to a surgical center and were receiving emergency care and surgery shortly after their injury. This practice resulted in significant improvements in battlefield mortality.[5]

Similarly, in the late 1950s the United States entered the Vietnam War. This time, the battles took place in the jungles of Southeast Asia. As in Korea, there were few roads, and jungles slowed movement of the injured. Again, helicopters were called on to evacuate the wounded to forward-placed surgical hospitals. In Vietnam, in many cases, evacuation occurred within 10 to 20 minutes of injury (Figure 2-2). Once stabilized and able to be moved (generally within 24 to 48 hours), the patients would be flown by jet to Clark Air Force Base in the Philippines, where they would receive any necessary further treatment. The decrease in the amount of time to definitive care plus advances in medical procedures significantly reduced mortality rates. This strategy also set the stage for trauma system development in the United States.[6]

Several significant medical developments occurred in the 1950s. In 1956, physicians Peter Safar and James Elam pioneered the use of mouth-to-mouth resuscitation. In 1959, the first portable defibrillator was used at Johns Hopkins Hospital in Baltimore.[7] In 1960, cardiopulmonary resuscitation (CPR) was refined and deemed to be effective for human resuscitation.[8]

The 1960s

Throughout history, significant advances in trauma care occurred during wartime. However, until the late 1960s,
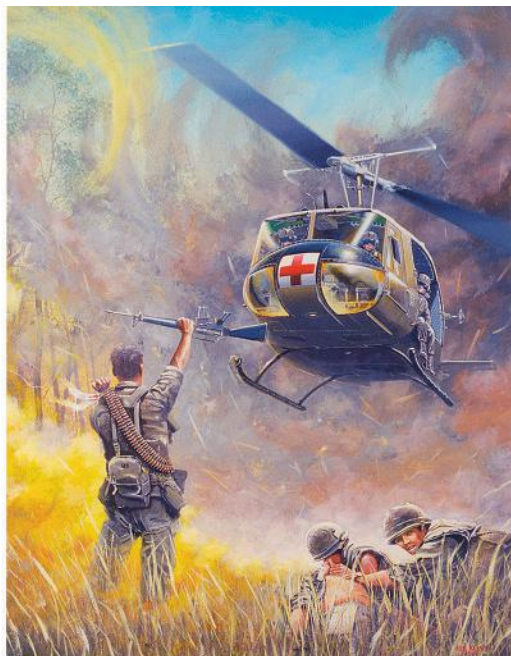
FIGURE 2-2 Medical evacuation helicopters, colloquially called "Dustoff," saved many lives during the Vietnam War.

(Dust off © Joe Kline Aviation Art)

few areas of the United States provided adequate civilian prehospital emergency care similar to what was provided to soldiers and sailors during war. The prevailing thought was that medical care began in the hospital emergency department. Rescue techniques were crude, ambulance attendants poorly educated, and equipment minimal. Police, fire, and EMS personnel often had no radio communication. Proper medical direction was not available, and the only interaction between physicians and EMS personnel was at the receiving facility.

Eventually, as costs and demand for additional services forced many rural mortician-operated ambulances to withdraw, local police and fire departments found that they had to provide the ambulance service. In many areas, volunteer ambulance services made up of local, independent EMS provider agencies proliferated. In urban settings, the increased demand on hospital-based EMS systems resulted in the development of municipal services, which were operated on city, county, or regional levels. However, because they could not communicate with one another, it was impossible to coordinate a response to any but the simplest local calls.

In 1966, the publication of *Accidental Death and Disability: The Neglected Disease of Modern Society* by the National Academy of Sciences, National Research Council, focused attention on the problem. The "White Paper," as the report was called, spelled out the deficiencies in prehospital emergency care.[9] It suggested guidelines for the development of EMS systems, the training of prehospital emergency medical providers, and the upgrading of ambulances and their equipment. The problems identified in the study included:

- Lack of uniform laws and standards for prehospital care
- Poorly equipped ambulances
- Poor-quality ambulances
- Lack of communications between the ambulance and the hospital
- Inadequate training of ambulance personnel
- Inadequate physician and nursing staffing of hospital emergency departments

CONTENT REVIEW

➤ 1973 EMSS Act: Fifteen Components of EMS Systems
- Manpower
- Training
- Communications
- Transportation
- Emergency facilities
- Critical care units
- Public safety agencies
- Consumer participation
- Access to care
- Patient transfer
- Standardized record keeping
- Public information and education
- System review and evaluation
- Disaster management plans
- Mutual aid

Civilian EMS, as we know it today, started to evolve significantly in the 1960s. In 1960, the Los Angeles Fire Department placed medical personnel with every engine, ladder, and rescue company. It was one of the first large fire departments to embrace the concept of emergency medical care.

In 1966, the Highway Safety Act promulgated initial EMS guidelines for the United States. The same year, Dr. J. Frank Pantridge developed a mobile coronary response unit in Belfast, Northern Ireland. Using a portable defibrillator, he treated ten cardiac arrest patients, five of whom enjoyed long-term survival.[10] In 1969, the first paramedic program began in Miami, Florida, by Dr. Eugene Nagel.[11]

The 1970s

The 1970s were the decade when EMS truly came into its own. The National Registry of Emergency Medical Technicians was established in 1970. Interestingly, EMS got one of its biggest boosts from Hollywood. On January 15, 1972, the television show *Emergency!* made its debut on NBC. The show, produced by Hollywood legend Jack Webb, featured two Los Angeles County Fire Department paramedics and the new paramedic program in southern California (Figure 2-3). The show brought public attention to the concept of prehospital care and provided considerable encouragement for development of the modern EMS system.[12]

Then, in 1973, Congress passed the Emergency Medical Services Systems Act, which provided funding for a series of projects related to the delivery of trauma care.

FIGURE 2-3 The television show *Emergency!* played a major role in bringing the world of EMS into the public spotlight.

(Larry Barbier/NBCU Photo Bank via AP Images)

This enabled the development of regional EMS systems that took place from 1974 through 1981. A total of $300 million was allocated to study the feasibility of EMS planning, operations, expansion, and research.[13]

To be eligible for this funding, an EMS system had to include the following 15 components: manpower, training, communications, transportation, emergency facilities, critical care units, public safety agencies, consumer participation, access to care, patient transfer, standardized record keeping, public information and education, system review and evaluation, disaster management plans, and mutual aid. As farsighted as these criteria were, the designers of the legislation unfortunately omitted two key components: system financing and medical direction.

When federal funding was significantly reduced in the early 1980s, many EMS systems faced economic disaster. Subsequently, the Emergency Medical Services Systems Act was amended in 1976 and again in 1979, and a total of $215 million was appropriated over a seven-year period toward the establishment of regional EMS systems. However, many systems were still operating without medical direction.

The 1980s

In 1981, the passage of the Consolidated Omnibus Budget Reconciliation Act (COBRA) essentially wiped out federal funding for EMS. The small amount of funding that remained was placed into state preventive-health and health-services block grants. The National Highway Traffic Safety Administration (NHTSA) attempted to sustain the efforts of the Department of Health and Human Services, but with its other EMS responsibilities and no additional funding, the momentum for continued development was lost.

In 1988, the Statewide EMS Technical Assessment Program was established by the NHTSA. It defines elements necessary to all EMS systems. Briefly, they are:

- ***Regulation and policy.*** Each state must have laws, regulations, policies, and procedures that govern its EMS system. It also is required to provide leadership to local jurisdictions.

- ***Resources management.*** Each state must have central control of EMS resources so all patients have equal access to acceptable emergency care.

- ***Human resources and training.*** Qualified instructors should teach a standardized EMS curriculum, and all

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CONTENT REVIEW

➤ 1988 NHTSA: Ten System Elements
- Regulation and policy
- Resources management
- Human resources and training
- Transportation
- Facilities
- Communications
- Trauma systems
- Public information and education
- Medical direction
- Evaluation

personnel who transport patients in the prehospital setting should be adequately trained.

- *Transportation.* Patients must be safely and reliably transported by ground or air ambulance.

- *Facilities.* Every seriously ill or injured patient must be delivered in a timely manner to an appropriate medical facility.

- *Communications.* A system for public access to the EMS system must be in place. Communication among dispatchers, the ambulance crew, and hospital personnel must also be possible.

- *Trauma systems.* Each state should develop a system of specialized care for trauma patients, including one or more **trauma centers** and rehabilitation programs. It also must develop systems for assigning and transporting patients to those facilities.

- *Public information and education.* EMS personnel should participate in programs designed to educate the public. The programs are to focus on the prevention of injuries and how to properly access the EMS system.

- *Medical direction.* Each EMS system must have a physician as its medical director. This physician delegates medical practice to nonphysician caregivers and oversees all aspects of patient care.

- *Evaluation.* Each state must have a **quality improvement (QI)** system in place for continuing evaluation and upgrading of its EMS system.

Helicopter air ambulances (HAA) began to develop in the early 1980s. A hospital or consortium of hospitals operated most helicopter programs. These services initially used all-nurse crews. However, as the operations matured, a paramedic was often used in place of one of the nurses on the flight. HAA is primarily used for both scene-to-hospital and interhospital transfer of critically ill or injured patients.

The 1990s

Further improvements were made to EMS during the 1990s. In 1990, Congress passed the Trauma Care Systems and Development Act. This Act provided funding to states for trauma system planning, development, implementation, and evaluation.

In 1993, the Institute of Medicine published *Emergency Medical Services for Children*. This document pointed out the deficiencies in pediatric emergency care in the United States. A small amount of federal funding subsequently financed the Emergency Medical Services for Children (EMSC) program.

In 1995, Congress did not reauthorize the Trauma Care Systems and Development Act, and the funding for trauma systems fell back on the states. This resulted in significant variability in trauma system care across the United States.

By the late 1990s, EMS systems and EMS practice had started to mature. It was at this point that self-assessment of EMS began to occur. Researchers and systems began to link patient outcomes (morbidity and mortality—illness and death) with various EMS practices. Surprisingly, some practices that had seemed intuitive did not hold up to the test of science. One of the largest studies of prehospital practices and outcomes was the **Ontario Prehospital Advanced Life Support (OPALS) study** that was conducted in various regions of the province of Ontario, Canada. The study has provided significant information about early defibrillation, response times, advanced life support procedures, and much more.[14]

EMS Agenda for the Future

The **National Highway Traffic Safety Administration (NHTSA)** published the *EMS Agenda for the Future* in 1996.[15] This document examined what had been learned during the prior three decades of EMS and endeavored to create a vision for the future of EMS in the United States. It was published at an important time, when those agencies, organizations, and individuals that affect EMS were evaluating their respective roles in the context of a rapidly evolving health care system—a process of evaluation that is ongoing.

NHTSA is a division of the U.S. Department of Transportation (DOT) and the Health Resources and Services Administration (HRSA), Maternal and Child Health Bureau. *The EMS Agenda for the Future* focused on aspects of EMS related to emergency care outside traditional health care facilities. It recognized the changes that occurred in the health care system of which EMS is a part. The document recommended that EMS of the future would be a community-based health management system that would be fully integrated into the overall health care system. EMS of the future would have the ability to identify and modify illness and injury risks, provide acute illness and injury care and follow-up, and contribute to the treatment of chronic conditions and to community health monitoring. EMS would be integrated with other health care providers and public health and public safety agencies in the effort to improve community health, which would result in more appropriate use of acute health care resources. Overall, EMS would remain the public's emergency medical safety net.

To realize this vision, *The EMS Agenda for the Future* proposed continued development of 14 core EMS attributes. They were:

- Integration of health services

- EMS research

- Legislation and regulation

- System finance

- Human resources

- Medical direction
- Education systems
- Public education
- Prevention
- Public access
- Communication systems
- Clinical care
- Information systems
- Evaluation

Although many of the recommendations proposed by the *EMS Agenda for the Future* have been realized, many have not. Despite this, this document continues to serve as a guide for EMS providers, health care organizations and institutions, governmental agencies, and policy makers who must be committed to improving the health of their communities and to ensuring that EMS efficiently contributes to that goal. They must invest the resources necessary to provide the nation's population with emergency health care that is reliably accessible, effective, subject to continuous evaluation, and integrated with the remainder of the health care system.

The Twenty-First Century

The United States has changed significantly following the terrorist attacks of September 11, 2001 (Figure 2-4). Among other things that occurred as a result of 9/11, review of the public safety system found numerous flaws. President George W. Bush established the **Department of Homeland Security** to coordinate the various agencies responsible for protecting the country. With this came the **National Incident Management System (NIMS)** and other strategies to prepare the country for terrorist attacks and other threats.[16]

FIGURE 2-4 The attacks on New York City and Washington on September 11, 2001, forever changed the face of EMS.

(© Reuters)

In 2005, two devastating hurricanes (Katrina and Rita) hit several Gulf Coast states, causing massive damage and loss of life. The emergency response, in some cases, was less than ideal. Additional changes were made to improve the Federal Emergency Management Agency (FEMA) and other governmental agencies following these disasters. A significant economic downturn in 2008 forced many cities to cut back on EMS and fire operations. As in most times of economic distress, EMS and hospital emergency departments were faced with less funding and more patients.

In the 2010s, EMS began to fill nontraditional roles, including some primary care roles, through community paramedicine and mobile integrated health care programs. The driving forces for these endeavors vary. In some communities, primary care is limited, so EMS providers have stepped up and assumed part of the role. In other communities, building codes and fire prevention strategies have significantly reduced the incidence of fires. Because of this, some fire departments have looked to expand their services beyond traditional firefighting roles. Community paramedicine has seemed to be a natural fit.

EMS at the Crossroads

In 2006, the National Academies Institute of Medicine published another evaluation of the status of emergency services in the United States. This document, titled *Emergency Medical Services: At the Crossroads,* was critical of many EMS practices. The study found that there were significant problems at the federal level. Despite the advances made in EMS, sizable challenges remained. At the federal policy level, government leadership in emergency care was found to be fragmented and inconsistent. As it is currently organized, responsibility for prehospital and hospital-based emergency and trauma care is scattered across multiple agencies and departments. Similar divisions are evident at the state and local levels. In addition, the current delivery system suffers in a number of key areas:

- *Insufficient coordination.* EMS care is highly fragmented, and often uncoordinated among providers. Multiple EMS agencies serving within a single population center do not operate cohesively. Agencies in adjacent jurisdictions often are unable to communicate with one another. In many cases, EMS and other public safety agencies cannot talk to one another because they operate with incompatible communications equipment or on different frequencies.

- *Coordination of transport within regions is limited.* The management of the regional flow of patients is poor, and patients may not be transported to facilities that are optimal and ready to receive them. Communications and hand-offs between EMS and hospital personnel are frequently ineffective and often omit important clinical information.

- *Disparities in response times.* The speed with which ambulances respond to emergency calls is highly variable. In some cases, this variability is related to geography. In dense population centers, for example, the distances ambulances must travel are small, but traffic and other problems can cause delays. In contrast, rural areas involve longer travel times, sometimes over difficult terrain. This is further worsened by problems in the organization and management of EMS services, the communications and coordination between 911 dispatch and EMS responders, and the priority placed on response time given the resources available.

- *Uncertain quality of care.* Very little is known about the quality of care delivered by EMS services in the United States because there are no standardized measures of EMS quality, no nationwide standards for the training and certification of EMS personnel, no accreditation of institutions that educate EMS personnel, and virtually no accountability for the performance of EMS systems. Even though most Americans assume that their communities are served by competent EMS services, the public has no idea whether this is true, and no way to know.

- *Lack of readiness for disasters.* Although EMS personnel are among the first to respond in the event of a disaster, they are the least prepared component of community response teams. Most EMS personnel have received little or no disaster response training for terrorist attacks, natural disasters, or other public health emergencies. Despite the massive amounts of federal funding directed to homeland security, only a tiny proportion of those funds have been directed to medical response. Furthermore, EMS representation in disaster planning at the federal level has been highly limited.

- *Divided professional identity.* EMS is a unique profession, one that straddles both medical care and public safety. Among public safety agencies, however, EMS is often regarded as a secondary service, with police and fire taking more prominent roles; within medicine, EMS personnel often lack the respect afforded to other professionals, such as physicians and nurses. Despite significant investments in education and training, salaries for EMS personnel are often well below those for comparable positions, such as police officers, firefighters, and nurses. In addition, there is a cultural divide among EMS, public safety, and medical care workers that contributes to the fragmentation of these services.

- *Limited evidence base.* The evidence base for many practices routinely used in EMS is limited. Strategies for EMS have often been adapted from settings that differ substantially from the prehospital environment and, consequently, their value in the field is questionable, and some may even be harmful. For example, field intubation of children, still widely practiced, has been found to do more harm than good in many situations.[17] Although some recent research has added to the EMS evidence base, a host of critical clinical questions remain unanswered because of limited federal research support, as well as inherent difficulties associated with prehospital research due to its sporadic nature and the difficulty of obtaining informed consent for the research.[18]

National Report Card on the State of Emergency Medicine

The American College of Emergency Physicians (ACEP) in 2006 published a study similar to EMS at the Crossroads. The paper, *The National Report Card on the State of Emergency Medicine: Evaluating the Environment of Emergency Care Systems State by State,* pointed out the significant problems that existed in all aspects of emergency care.[19] This paper primarily addressed problems in hospital emergency departments but also addressed EMS issues. Overall, the report detailed that emergency services in the United States are so overstressed that the quality of care has been compromised. Multiple causes were indentified and included such things as inadequate funding, patient overcrowding, lack of alternate care facilities, problems with medical liability, the effect of illegal immigration, and many other factors. Each state was given a letter grade that reflected the reported standard of emergency care in that state.

Helicopter Air Ambulance Recommended Improvements

In 2001, federal reimbursement for medical helicopters improved, and the national medical helicopter fleet expanded from 300 aircraft to almost 900 in a matter of years. With the increase in helicopters came an increase in accidents and overutilization. In 2008, there were a record number of helicopter air ambulance crashes with related fatalities. As a result, the **National Transportation Safety Board (NTSB)** held hearings in 2009 and later recommended sweeping improvements for the helicopter air ambulance industry.

Today's EMS Systems

The EMS system of today remains a mixture of various types of operations. The modern EMS system is now fairly well integrated with the health care system and, to a lesser degree, with the public safety system. Despite some federal

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CONTENT REVIEW

➤ Types of EMS Services
  - Fire-based
  - Third service
  - Private
  - Hospital-based
  - Volunteer
➤ Regardless of the delivery type, all emergency operations must be closely integrated and work together.

oversight, the provision of EMS is still primarily a local government responsibility. Because of the differences among localities, there are significantly different approaches to the provision of EMS across the United States. Government entities have elected to operate various service types of EMS. These include:

- Fire-based
- Third service
- Private (profit or nonprofit)
- Hospital-based
- Volunteer
- Hybrid (combination of any of these)

Regardless of the delivery type, the lessons of 9/11 have shown that all emergency operations must be closely integrated and able to work together. The rapid development of EMS technology is making this possible and has simplified many aspects of EMS.

Chain of Survival

Traditionally, emergency health care was considered to begin at the time of the emergency. More recently, however, it has been shown that emergency health care may actually begin long before an emergency occurs. In this regard, EMS and emergency medicine practitioners are embracing preventive health care measures that may help to reduce emergency illnesses and accidents. It also now includes such innovative measures as EMS personnel periodically visiting high-risk and homebound citizens and assessing their health status and needs.

Aside from such preventive activities, the EMS system is part of a continuum of care that begins once an emergency occurs and ends when the patient completes care and returns to his normal activities of daily living. This continuum is often referred to as the **chain of survival**. As defined by the American Heart Association (AHA), the chain of survival consists of the five most important factors affecting survival of a cardiac arrest patient: (1) immediate recognition and activation of EMS; (2) early CPR; (3) rapid defibrillation; (4) effective advanced life support; and (5) integrated post-cardiac arrest care. A similar continuum of events, essential to the optimal care of any emergency patient, might include, but would not be limited to, the following:

- Bystander care
- Dispatch
- Response
- Prehospital care

- Transportation
- Emergency department care
- Definitive care
- Rehabilitation

To achieve this continuum, several components of the EMS system must be in place.

Essential Components for Continuum of Care
Health Care System Integration

It is now recognized that EMS is a major component of the modern health care system. Interestingly, the original purpose of EMS was to address cardiac emergencies—particularly cardiac arrest. Now, almost forty years later, there is renewed emphasis of the roles and responsibilities of the EMS system in all types of cardiac emergencies. These responsibilities begin with the public service access points (PSAPs) that are typically the 911 call centers. PSAPs are now the primary interface between the EMS system and the communities it serves. Now, dispatchers can give basic first aid and emergency care instructions, including CPR instructions, to the caller until the EMS providers arrive (Figure 2-5).

The role of the EMS system is now extremely important in the identification of acute coronary syndrome and
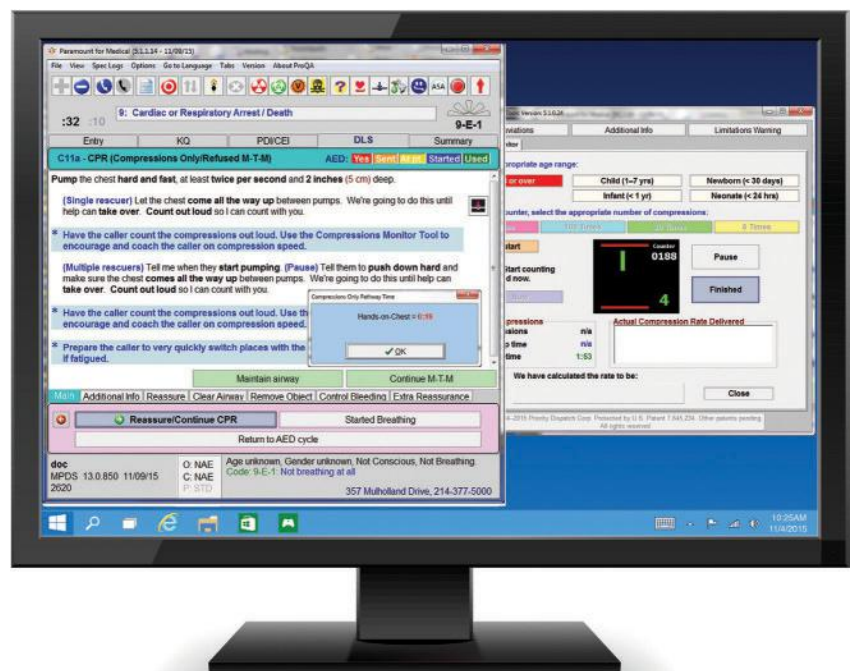
FIGURE 2-5 Emergency Medical Dispatchers can give prearrival instructions to a caller, including how to perform CPR.

(From Advanced MPDS v13.0 © 1979-2015 International Academies of Emergency Dispatch and ProQA Paramount v5.1 © 2007–2015 Priority Dispatch Corp. All Rights Reserved. Used by permission.)

ST-segment elevation myocardial infarction (STEMI). The standard of care has quickly shifted—now, in many cases, paramedics make the decision to activate a cardiac catheterization team based on their interpretation of a prehospital ECG. This has significantly decreased the time from onset of symptoms to primary percutaneous coronary intervention (PPCI). Evidence is beginning to show that many cardiac arrest patients may benefit from PPCI, and certain health care facilities are now devoting resources to the specific care of cardiac arrest that may include PPCI.

Finally, EMS is stepping up and assuming an important role as the initial component and gatekeeper of the modern health care system.

Levels of Licensure/Certification

As noted in the preceding chapter, the *National EMS Scope of Practice Model* defines and describes four levels of EMS licensure:

- Emergency Medical Responder (EMR)
- Emergency Medical Technician (EMT)
- Advanced EMT (AEMT)
- Paramedic

Each level represents a unique role, set of skills, and knowledge base.[20] In 2009,*National EMS Education Instructional Guidelines* were developed and published for each of these four levels.[21] These instructional guidelines replace the various curricula that had been previously published to guide EMS education. The use of instructional guidelines, as opposed to a rote curriculum, allows EMS educators to adapt their educational strategies to the specific student population they serve. When used in conjunction with the *National EMS Core Content*, national EMS certification, and National EMS Education program accreditation, the *National EMS Scope of Practice Model* and the *National EMS Education Standards* create a strong and interdependent system that provides the foundation to ensure the competency of out-of-hospital emergency medical personnel throughout the United States.

Quality of Education

One of the fundamental principles of quality EMS is a solid education program for providers. EMS education has evolved significantly in the past two decades. Now, there are more educators with advanced degrees and EMS is being recognized in the academic community. Despite the advances, however, there remains considerable variation in EMS educational programs across the country.

In response to *The EMS Agenda for the Future*, several documents have been prepared to guide EMS education. The first of these was the *National EMS Core Content*, published by NHTSA in 2005.[22] This document defined the body of knowledge, skills, and abilities desired in EMS personnel. It was followed shortly thereafter by *The National EMS Scope of Practice,* also published in 2005, which helped to define the future roles of EMS providers. This consensus document supported a system of EMS personnel licensure that was common in other allied health professions and was designed to serve as a guide for states and territories in developing their **scope of practice** legislation, rules, and regulations. States following the *National EMS Scope of Practice* model as closely as possible would increase the consistency of the nomenclature and competencies of EMS personnel nationwide, facilitate reciprocity, improve professional mobility, and enhance the name recognition and public understanding of EMS. Some states have adopted the *National EMS Scope of Practice* model in its entirety, whereas others have adopted only parts of it.

Oversight by Local- and State-Level Agencies

The efficient delivery of emergency medical care requires a systematic approach and team effort to make the best use of existing resources. That means each community must develop an EMS system that best meets its needs. Although EMS systems across the country and the world will vary, certain elements are essential to ensure the best possible patient care.

At the municipal and regional levels, the first step in developing a comprehensive EMS system is to establish an administrative oversight agency. This agency is responsible for managing the local system's resources, developing operational protocols, and establishing standards and guidelines. Within the agency, a planning board is often formed. The planning board should be composed of community representatives, including emergency physicians, the emergency nurse association, the firefighter association, state and local police, and consumers. The planning board develops a budget and selects a qualified administrative staff capable of managing an EMS agency.

Once established, the agency designates who may function within the system and develops policies consistent with existing state requirements. It also creates a quality assurance or quality improvement program to evaluate the system's effectiveness and to ensure that the best interests of the patient are always a top priority. State EMS agencies are typically responsible for allocating funds to local systems, enacting legislation concerning the out-of-hospital practice of medicine, licensing and certification of field providers, enforcing all state EMS regulations, and appointing regional advisory councils.

In essence, EMS is made up of a series of systems within a system. The integration of these systems and the cooperation of all participants help to result in the best quality of emergency care.

Medical Oversight

An EMS system must retain a **medical director**—a physician who is legally responsible for all clinical and patient-care aspects of the system. The medical director serves as the de facto conscience of the EMS system and must first be an advocate for quality patient care. Prehospital medical care provided by nonphysicians is considered a delegated practice of the system medical director; that is, prehospital care providers are the medical director's designated agents, regardless of who their employers may be.

The medical director's roles in an EMS system are to:

- Educate and train personnel
- Participate in personnel and equipment selection
- Develop clinical protocols in cooperation with expert EMS personnel
- Participate in quality improvement and problem resolution
- Provide direct input into patient care
- Interface between the EMS system and other health care agencies
- Advocate within the medical community
- Serve as the "medical conscience" of the EMS system, including advocating for quality patient care

In addition to the responsibilities just listed, the medical director is the ultimate authority for all medical issues within the system. Traditionally, **medical oversight** has been divided into an on-line (direct) component and an off-line (indirect) component. The trend has been to decrease on-line activities and to bolster the off-line component.[23]

On-Line Medical Direction

On-line medical direction occurs when a qualified physician gives direct orders to a prehospital care provider by either radio or telephone (Figure 2-6). Medical direction may be delegated to a mobile intensive care nurse (MICN),

FIGURE 2-6 The medical director can provide on-line guidance to EMS personnel in the field.
(© Dr. Bryan E. Bledsoe)

advanced practice practitioner, or paramedic. In all circumstances, ultimate on-line responsibility remains with the medical director.

On-line medical direction offers several benefits to the patient. It gives the EMS provider direct and immediate access to medical consultation for specific patient care. It also allows for the transmission of essential data, such as 12-lead ECGs. The transmission of physiologic data provides the on-line physician with diagnostic information that can be used to make critical decisions while the patient is still on scene or en route. Most EMS systems have the equipment to record on-line consultations. Those recordings can then be used for **peer review** and other continuous quality improvement activities.

When at the scene of an emergency, the health care provider with the most knowledge and experience in the delivery of prehospital emergency care should be in charge. When a nonaffiliated physician or **intervener physician** is on scene and on-line medical direction may not exist, the paramedic should relinquish responsibility to the physician. However, the intervener physician must first identify himself, demonstrate a willingness to accept responsibility, and document the intervention as required by the local EMS system. If the treatment differs from established protocols, the intervener physician must accompany the patient in the ambulance to the hospital.

If an intervener physician is on scene and on-line medical direction does exist, the on-line physician is ultimately responsible. In case of a disagreement, the paramedic must take orders from the on-line physician.

Off-Line Medical Oversight

Off-line medical oversight refers to medical policies, procedures, and practices that a system medical director has established in advance of a call. It includes **prospective medical oversight** such as guidelines on the selection of personnel and supplies, training and education, and protocol development. An important part of medical oversight is participation in the selection of medical equipment. Off-line medical oversight also includes **retrospective medical oversight**, such as auditing, peer review, conflict resolution, and other quality assurance processes.

Clinical protocols are the policies and procedures of all medical components of an EMS system and are the responsibility of the medical director. Many EMS systems use committees, often made up of physicians within the community, to develop medical treatment protocols. EMS protocols provide a standardized approach to common patient problems and a consistent level of medical care, as well as a standard for accountability. When treatment is undertaken based on such protocols, the on-line physician, if needed,

can assist prehospital personnel in interpreting the patient's complaint, understanding the findings of their evaluations, and providing the appropriate treatment.[24] Protocols are designed around the four "Ts" of emergency care:

- *Triage.* Guidelines that address patient flow through an EMS system, including how system resources are allocated to meet the needs of patients.
- *Treatment.* Guidelines that identify procedures to be performed on direct order from medical direction and procedures that are preauthorized protocols called **standing orders**.
- *Transport.* Guidelines that address the mode of travel (air vs. ground) based on the nature of the patient's injury or illness, the condition of the patient, the level of care required, and estimated transport time.
- *Transfer.* Guidelines that address receiving facilities to ensure that the patient is admitted to the one most appropriate for definitive care.

Protocols also are established for special circumstances, such as the proper handling of "Do Not Resuscitate" orders, patients who refuse treatment, sexual abuse, abuse of children or elderly people, termination of CPR, and intervener physicians. Although protocols standardize field procedures, they should allow the paramedic the flexibility necessary to improvise and adapt to special circumstances.

Public Information and Education

The public is an essential, yet often overlooked, component of an EMS system. EMS should have a plan to educate the public on recognizing an emergency, accessing the system, and initiating basic life support procedures. Because of this, public education has become an increasingly important role for EMS. As already noted, patient education can occur before the emergency occurs (prevention) through activities such as bicycle safety programs, infant car seat programs, and similar strategies (Figure 2-7). In addition, it has been found that patients are more likely to listen to advice and consider lifestyle changes following an emergency. This is often referred to as a **teachable moment**. A teachable moment is an unplanned opportunity to present information when the circumstances are such that a person is likely to understand and accept the information. EMS public education can take several forms, including role modeling, community involvement, leadership, and prevention.

One of the most fundamental components of EMS public education is to help members of the public to recognize an emergency when it occurs and to learn how to access the EMS system. Prompt recognition of an emergency can save lives. For example, the American Heart Association (AHA) estimates that more than 300,000 cardiac arrests per year occur before the patient reaches the
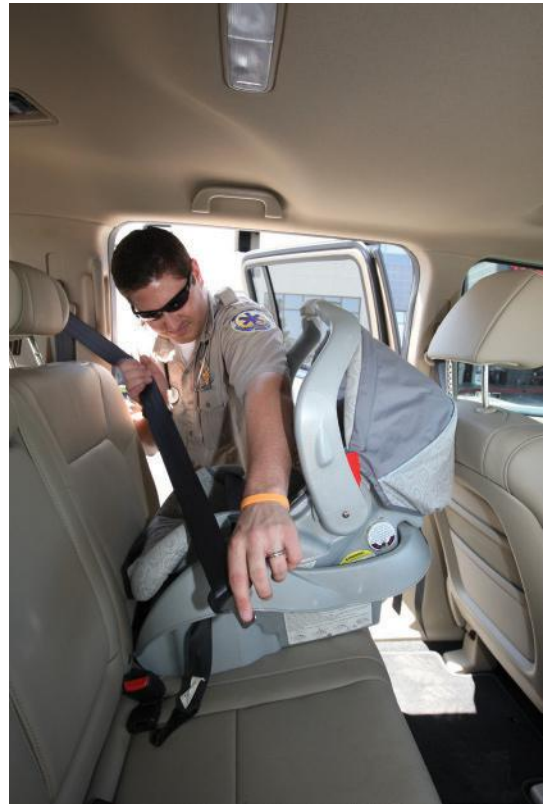
FIGURE 2-7 Providing disease and injury prevention education to the public has become an important role of EMS in the twenty-first century. *(© Dr. Bryan E. Bledsoe)*

hospital. Such arrests are called "sudden death" because most happen within 2 hours of the onset of cardiac symptoms. Many patients delay calling for help when symptoms occur. If the patient and bystanders are taught to recognize the emergency and call for help in time, many cases of sudden death could be prevented.

The second aspect of public education is system access. Citizens must know how to activate EMS in an emergency to prevent life-threatening delays. Whether access is by way of 911 or a local seven-digit phone number, the number should be well publicized, and citizens should be taught how to give the necessary information to the emergency medical dispatcher.

Finally, after recognizing an emergency and activating EMS, citizens must know how to provide basic life support assistance, such as cardiopulmonary resuscitation (CPR) and bleeding control after major trauma. Abundant research indicates that a relationship exists between rapid emergency care and mortality (death) rates of patients—especially with cardiac arrest. Communities have proven that when many citizens are trained in basic life support and early defibrillation—and there is a rapid paramedic response—a larger number of patients can be successfully resuscitated. The AHA estimates that thousands of lives could be saved each year with implementation of bystander CPR programs and rapid paramedic response. Because of

the widespread availability of auto-mated external defibrillators (AEDs) in private homes and public places, early defibrillation has become more commonplace and more successful. Cardiac arrest sur-vival takes a fully engaged public and an effective EMS system.

Effective Communications

The communications network is the heart of a regional EMS system (Figure 2-8). Coordinating the com-ponents into an organized response to urgent medical situations requires a comprehensive, flexible communi-cations plan. Such a plan should include the following:

FIGURE 2-8 The EMS communications center is truly the heart of the modern EMS system.

- *Citizen access.* A well-publicized universal number, such as 911, provides direct citizen access to emer-gency services. Multiple community numbers only add life-threatening minutes to emergency response times. Enhanced 911, or E-911, gives automatic loca-tion of the caller, instant routing of the call to the appropriate emergency service (fire, police, or EMS), and instant callback capability. The proliferation of cell telephone and Internet-based phone lines (voice over Internet protocol, or VOIP) has made caller location more difficult, although strategies have been devel-oped to address these issues.

- *Single control center.* One control center that can com-municate with and direct all emergency vehicles within a large geographical area is best. Ideally, all public service agencies should be dispatched from the same communications center to ensure the best use of resources in an emergency response.

- *Operational communications capabilities.* With these, EMS dispatch can manage all aspects of system response and assess the system's readiness for the next response. Emergency units can communicate with one another and with other agencies during mutual aid and disaster operations. Hospitals also can communi-cate with other hospitals in the region to assess spe-cialty capabilities.

- *Medical communications capabilities.* EMS providers can communicate with the receiving facility and, in many areas, transmit ECG and other patient informa-tion to the hospital or a physician's office. Newer tech-nologies can send patient information to designated sites at the same time the information is obtained. The growth in communications technology has been one of the biggest advances in EMS in recent years.

- *Communications hardware.* The North American communications infrastructure has changed drasti-cally. The utility of the Internet has changed the way we send and receive information. The massive devel-opment of the cell telephone network has affected this as well. EMS communications uses all these technolo-gies as well as more typical radio communications sys-tems. Most ambulances now have notebook computers and global positioning system (GPS) and vehicle track-ing system capabilities. As a result of the terrorist attacks of 2001, there has been considerable federal emphasis on updating and improving the national emergency and public safety communications system. An important related directive has been to ensure **interoperability**—a feature that allows personnel from different jurisdictions and systems to communicate with one another effectively.

- *Communications software.* This includes the radio frequencies needed for in-system communication and, in many systems, the satellite and high-tech com-puter programs that track ambulances. Radio proce-dures, policies consistent with FCC standards and local protocols, and backup communication plans for disaster operations are essential to the modern EMS operation.

An EMS system must have an effective and efficient com-munications network in place. Because no single design will meet the needs of all communities, each system should design a network that is simple, flexible, and practical.

Emergency Medical Dispatcher

The activities of the **Emergency Medical Dispatcher (EMD)** are crucial to the efficient operation of EMS (Figure 2-9). EMDs not only send ambulances to the scene, but they also make sure that system resources are in constant readiness
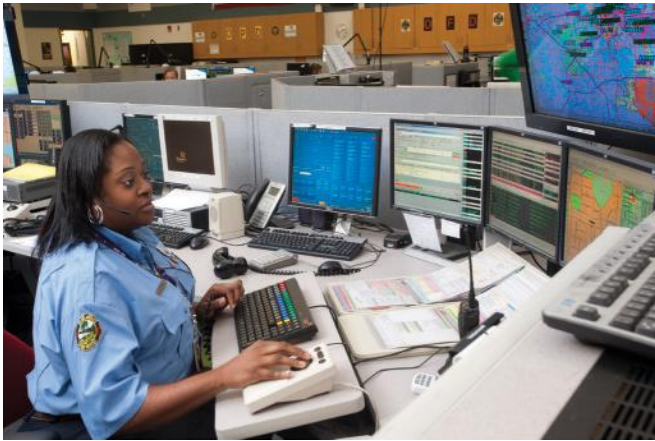
FIGURE 2-9 The modern EMS dispatcher plays a major role in EMS system operations and can affect the quality of emergency care provided.

to respond. EMDs must be both medically and technically trained. Their training should cover basic telecommunication skills, medical interrogation (questioning), giving prearrival instructions, and dispatch prioritization. The course should be standardized, and it should include certification by a government agency.

EMS Dispatch

Emergency medical dispatching is the nerve center of an EMS system. It is the means of assigning and directing appropriate medical care to patients and should be under the full control of the medical director and the EMS agency. An emergency medical dispatch plan should include interrogation protocols, response configurations, system status management, and prearrival caller instructions.

Another management method is called "priority dispatching," which was first used by the Salt Lake City Fire Department. Using a set of medically approved protocols, EMDs are trained to medically interrogate a distressed caller, prioritize symptoms, select an appropriate response, and give life-saving prearrival instructions.[25]

In 1974, the Phoenix Fire Department introduced a **prearrival instruction** program developed by medically trained dispatchers. In that program, callers initiate life-saving first aid with the dispatcher's help while they wait for emergency units to arrive on scene. In 1985, the Seattle EMS system initiated a successful program of instructing callers in CPR. Critics point out that prearrival instruction programs may result in increased liability. Even so, the increased liability of *not* providing such a service may far outweigh the risk of providing it.

An effective EMS dispatch system places the first responding units on scene within minutes of the onset of the emergency. The American Heart Association reports that brain resuscitation will not be successful if response time exceeds 4 minutes unless there was proper basic life support (BLS) intervention (CPR). Many studies have shown that defibrillation is most effective when delivered in 4 minutes or less after patient collapse. If EMS responders arrive more than 4 minutes after patient collapse, patient outcomes are better if the patient receives at least 90 seconds of CPR prior to defibrillation. For many years, the desired EMS response time was established at 8 minutes, but recent studies have shown that a response time of 8 minutes has not been associated with improved outcomes. A response time of 4 minutes or less has been highly associated with improved outcomes in cardiac arrest. However, few EMS systems can routinely deliver response times of 4 minutes or less. Further research is needed to determine the best desired response times for a specific EMS system[26,27] and how to achieve them.

Initial and Continuing Education Programs

The two kinds of EMS education programs for EMS personnel are initial education and continuing education. *Initial education* programs are the original courses for prehospital providers. They involve the completion of a standardized course that meets or exceeds recommended standards. (As noted earlier, instead of various curricula for the various levels of EMS, the *National EMS Instructional Guidelines* now allow instructors more latitude in instructional strategies.) *Continuing education* programs include refresher courses for recertification and periodic in-service training sessions. All education programs should have medical oversight and a medical director who is involved in the process. The EMS agency is responsible for ensuring funding for its education programs.

Initial Education

A paramedic's initial education is accomplished by successfully completing a course following the most recent *National EMS Education Instructional Guidelines* published by the U.S. DOT. The guidelines establish the minimum content for the course and set a standard for paramedic programs across the country. The Instructional Guidelines offer guidance of three specific learning domains:

- *Cognitive,* which consists of facts, or information knowledge
- *Affective*, which requires students to assign emotions, values, and attitudes to that information
- *Psychomotor,* which consists of hands-on skills students learn while in laboratory and clinical settings

There is a national effort to have all paramedic education programs accredited. The **accreditation** process ensures that all paramedic education programs meet minimal guidelines in regard to faculty, facilities, equipment, medical oversight, clinical affiliations, and financial stability.[28] The primary accrediting organization in EMS is the

Committee on Accreditation of Educational Programs for the Emergency Medical Services Professions (CoAEMSP), an entity of the Commission on Accreditation of Allied Health Programs (CAAHEP). Some states have their own program accreditation processes.

Continuing Education

Once a paramedic has completed the initial education program, he must remain current on changes in EMS care. To achieve this, a continuing education program is essential. Various methods are available for a paramedic to attain the necessary continuing education. These include traditional lectures and prepackaged programs but also include innovative strategies such as web-based programs, podcasts, videos, and similar alternative delivery models. Most continuing education programs must be accredited or approved by an oversight body. The *Continuing Education Coordinating Board for Emergency Medical Services (CECBEMS)* is a national continuing education certifying body, although some states provide their own continuing education certifying process.

Continuing education is mandatory and is just as important as the initial paramedic education program. EMS is a relatively young **profession** and information and technology changes rapidly. More important, continuing education allows you to stay abreast of the changes in emergency care procedures to ensure that you are providing the best patient care possible. The best paramedics are those who seek and complete quality continuing education.

Licensure, Certification, Registration, and Reciprocity

Once initial education is completed, the paramedic will become either certified or licensed, depending on the laws governing EMS in the particular state.

Licensure is a process of occupational regulation. Through licensure, a governmental agency (usually a state agency) grants permission to engage in a given trade or profession to an applicant who has attained the degree of competency required to ensure the public's protection. Some states choose to license paramedics instead of certifying them. (There is an unfounded general belief that a licensed professional has greater status than one who is certified or registered. However, a certification granted by a state, conferring a right to engage in a trade or profession, is, in fact, a license.)

Regardless of what it is called, the paramedic must realize that the authority granted to him by the state is a privilege and his personal responsibility. He must take a proactive role in maintaining his good standing through continuing education, conduct his practice in a manner to uphold the public trust he has been given, and protect this privilege. The paramedic should never assume that anyone else would take over this responsibility for him.

Certification is the process by which an agency or association grants recognition to an individual who has met its qualifications. Many states certify paramedics. After attaining state certification, paramedics are permitted to work within an established EMS system under the direct supervision of a physician medical director.

Registration is accomplished by entering one's name and essential information within a particular record. Paramedics are registered so the state can verify the provider's initial certification and monitor recertification. Almost every state has an EMS office that tracks the registration of emergency care providers. Whereas some states track only paramedic providers, others maintain registers on the certifications of Emergency Medical Responders, EMTs, Advanced EMTs, and Paramedics.

Reciprocity is the process by which an agency grants automatic certification or licensure to an individual who has comparable certification or licensure from another agency. For example, some states grant reciprocity to paramedics who are certified in another state. In some states, certification or licensure is not automatic. In these cases, the state may grant certification or licensure through *equivalence* or *legal recognition*, under which the state determines that the out-of-state paramedic's initial education meets the requirements of the state, and the paramedic is then allowed to participate in a licensure examination or other activity to gain licensure or certification.

National Registry of EMTs

The National Registry of Emergency Medical Technicians (NREMT) is a nonprofit entity based in Columbus, Ohio. It prepares and administers standardized tests for the various EMS provider levels. The National Registry establishes the qualifications for registration and biennial reregistration and serves as a vehicle for establishing a national minimum standard of competency. Through these services, the National Registry serves as a major tool for reciprocity by providing a process for paramedics to become certified when moving from one state to another. The National Registry also supports the development and evaluation of EMS education programs with the goal of developing nationwide professional standards for EMS providers.

Currently, in the majority of states, National Registry examinations are being used at some level by EMS regulators. Several states offer locally developed examinations because their levels of certification or licensure differ from those recognized by the National Registry. The states that use the National Registry examinations benefit from savings that result from spreading exam development costs over a large user base as well as from the assurance that the examinations are widely recognized as providing a national standard.

Staying Abreast

In EMS, it is important to stay abreast of new developments and information. Professional organizations, professional publications, and the Internet provide opportunities to keep yourself professionally up to date.

Professional Organizations

The public image of EMS is often shaped by the professional organizations that represent that profession. Membership in professional organizations is a great way to stay abreast of changes in the profession and to interact with members from other parts of the country. It also provides an excellent opportunity to share ideas. National EMS organizations include the following:

- National Association of Emergency Medical Technicians (NAEMT)
- National Association of Search and Rescue (NASAR)
- National Association of EMS Educators (NAEMSE)
- National Association of EMS Physicians (NAEMSP)
- International Flight Paramedics Association (IFPA)
- National EMS Management Association (NEMSMA)
- National Council of State EMS Training Coordinators (NCSEMSTC)

In addition to these, most states have EMS organizations that provide information and assistance at a state or local level.

These are just some examples of organizations through which paramedics, emergency physicians, and nurses can enrich themselves and pursue their particular interests. Such organizations assist in the development of educational programs, operational policies and procedures, and the implementation of EMS. They establish guidelines with input from the public and the profession, which ensure that the public interest is served in the delivery of emergency medical services. They also provide a means to promote and enhance the status of EMS within the health care community, and their efforts help to create a unified voice for EMS providers.

Professional Journals and Magazines

A variety of journals are available to keep the paramedic aware of the latest developments in this ever-changing industry. These journals provide an abundant source of continuing-education material, as well as an excellent opportunity for EMS professionals to write and publish articles. The following is just a partial list of journals that routinely publish articles relating to the medical care of patients in EMS:

- *Academic Emergency Medicine*
- *American Journal of Emergency Medicine*
- *Annals of Emergency Medicine*
- *Emergency Medical Services*
- *Journal of Emergency Medical Services (JEMS)*
- *Journal of Pediatric Emergency Medicine*
- *Journal of Trauma: Injury, Infection and Critical Care*
- *Prehospital Emergency Care*

The Internet

The Internet has changed the world and certainly has changed EMS. There are now numerous websites designed for EMS providers. Many trade magazines and similar entities offer websites with constantly updated content and news. There are numerous websites that provide quality, accredited continuing education programs. There has been a similar trend in placing much of the didactic portion of initial EMS education on the Internet. This allows students to receive initial and continuing education in their local communities. Interestingly, several EMS-oriented social communities have been developed. These have allowed international EMS discussions and networking and have a considerable following among EMS providers (Figure 2-10).

Effective Patient Transportation

Patients who are transported under the direction of an EMS system should be taken to the nearest appropriate medical facility whenever possible. Medical oversight should designate that facility, based on the needs of the patient and the availability of services. In some cases, the patient's need for special services (such as care for burns) means designating a facility that is not nearby. At other times, the closest facility will be designated for stabilization of the patient while transfer is arranged. The ultimate authority for this decision remains with on-line medical direction.

Air Transport

Patients may be transported by ground or air (Figure 2-11). As noted earlier, use of helicopters for medical transport was introduced during the Korean War and expanded in

FIGURE 2-10 The Internet has allowed paramedics, regardless of their location, to obtain quality continuing education.

FIGURE 2-11 Patients may be transported by ground or air. Medical helicopter transport was introduced in the 1950s during the Korean War.
(© Ed Effron)

Vietnam, and success of military evacuation procedures led to their use in civilian ambulance systems. In 1970, the Military Assistance to Safety and Traffic (MAST) program was established. This demonstration project set up 35 helicopter transportation programs nationwide to test the feasibility of using military helicopters and paramedics in civilian medical emergencies.[29]

Today, trauma care systems use law enforcement, municipal, hospital-based, private, and military helicopter transport services to transfer patients. Fixed-wing aircraft also are used when patients must be transported long distances, usually more than 200 miles (Figure 2-12).

Ambulance Standards

All transport vehicles must be licensed and meet local and state EMS requirements. Equipment lists should be consistent with systemwide standards. There are various national and regional standards regarding what equipment and technologies should be available on both emergency and nonemergency ambulances. Regional standardization of equipment and supplies is most effective in facilitating interagency efforts during disaster operations.

FIGURE 2-12 Fixed-wing aircraft, as well as helicopters, have become an important part of patient transport in the modern EMS system.
(© REACH Air Medical Services)

In 1974, in response to a request from the DOT, the General Services Administration (GSA) developed the "KKK-A-1822 Federal Specifications for Ambulances." This was the first attempt at standardizing ambulance design to permit intensive life support for patients en route to a definitive care facility. The act defined the following basic types of ambulance:

- *Type I (Figure 2-13).* This is a conventional cab and chassis on which a module ambulance body is mounted, with no passageway between the driver's and patient's compartments.
- *Type II (Figure 2-14).* A standard van, body, and cab form an integral unit. Most have a raised roof.

FIGURE 2-13 Type I ambulance.

FIGURE 2-14 Type II ambulance.

FIGURE 2-15 Type III ambulance.

- *Type III (Figure 2-15).* This is a specialty van with forward cab and integral body. It has a passageway from the driver's compartment to the patient's compartment.

Only these certified ambulances may display the registered "Star of Life" symbol as defined by the National Highway Traffic Safety Administration (NHTSA). The word *ambulance* should appear in mirror image on the front of the vehicle so that other drivers can identify the ambulance in their rear-view mirrors.

Many services now place a variety of specialized equipment on board ambulances, including specialty rescue, hazardous materials (hazmat), and additional advanced life support equipment. This has often meant exceeding the gross vehicle weight and has resulted in introduction of a medium-duty truck chassis built for rugged durability and large storage and work areas (Figure 2-16). Another newer type of ambulance, developed for fuel economy and enhanced safety, is the diesel ambulance (Figure 2-17). Ambulance standards will continue to evolve. Concerns about the future of the environment have

FIGURE 2-16 Some EMS systems have elected to use medium-duty ambulances that are built on a commercial truck chassis.

(© Pat Songer)

FIGURE 2-17 The diesel, unibody ambulance is becoming increasingly popular because of cost, fuel economy, and safety.

(© Acadian Ambulance Services)

led to a trend to consider vehicle emissions (exhaust and carbon footprint) in ambulance design.

In 1980, the revision "KKK-A-1822A" aimed at improving ambulance electrical systems by designing a low-amp lighting system to replace antiquated light bars and beacons. This standard helped to reduce electrical system overloads. In 1985, another revision, "KKK-A-1822B," specified changes based on the National Institute for Occupational Safety and Health (NIOSH) standards. These include reduced internal siren noise, high engine temperatures, and exhaust emissions; safer cot-retention systems; wider axles; handheld spotlights; battery conditioners for longer life; and venting systems for oxygen compartments. In 2002, revision "KKK-A-1822E" provided guidelines to improve occupant protection in the patient compartment, including additional occupant restraints, more rounded interior corners, and more secure locations of the sharps container for needles and other potentially dangerous items. Revision "KKK-A-1822F" was published in 2007 and primarily addressed electrical systems, signage, and safety.[30]

All ambulances purchased with federal funds during the 1970s were required to comply with the KKK criteria. Since then, however, some states have adopted their own criteria.

Appropriate Receiving Facilities

Not all hospitals are equal in emergency and support service capabilities. So how do you get the right patient to the right facility in an appropriate amount of time? EMS systems organize hospitals into categories that identify the readiness and capability of each hospital and its staff to receive and effectively treat emergency patients. EMS coordinators can use these categories to quickly recognize the most appropriate medical facility for definitive treatment or life-saving stabilization.