Interface with Emergency Medical Services

Michael G. Tunik, MD, FAAP
George L. Foltin, MD, FAAP, FACEP

Objectives

1. Describe the components of the emergency medical services for children continuum of care.
2. Explain the differences in levels of care (basic life support and advanced life support) and providers (emergency medical technician and emergency medical technician–paramedic).
3. Discuss the physician’s role in emergency medical services and emergency medical services for children.

Chapter Outline

Introduction
Origin of EMS Systems
Federal EMSC Program
EMSC Landmarks
Physician’s Role in EMSC
Future of EMSC
Introduction

Health care professionals should have an understanding of their EMS systems because they have a critical role in the care of acutely ill and injured children.

Definitions

• EMS system—a group of emergency health care delivery organizations that, together, allow for the appropriate delivery of out-of-hospital care and transport of persons with sudden illnesses or injuries.

CASE SCENARIO

A 2-year-old girl wanders outside to the pool in her backyard. Her mother, distracted by a telephone call, rushes outside and finds her daughter floating face down in the water. She pulls her out of the pool, performs cardiopulmonary resuscitation (CPR), and calls 911.

1. What process and resources provide support for pediatric-specific training, equipment, assessment, treatment, triage, and transport in an emergency medical services (EMS) system?

2. What is the role of the physician in the EMS system’s ability to care for individuals?
• Emergency medical services for children (EMSC)—those components within the EMS system that address the needs of children. A program and philosophy that support the seamless integration of pediatric care capability.

• The EMSC continuum of care—encompasses all aspects of the care provided to an acutely ill or injured child. It begins with prevention, followed by EMS access: the recognition of an emergency, access to a telephone-activated emergency 911 system, where available, and ambulance dispatch; out-of-hospital emergency care, including triage and transport; stabilization care in an emergency department (ED); interhospital care and interfacility transport; definitive care, including inpatient care, trauma centers, and pediatric critical care networks; and rehabilitation (Figure 19.1). The continuum goes full circle when the child returns to the community and has access to a primary care physician for immunizations and illness and injury prevention.1

• Medical home and family-centered care—the combination of family and primary care physician responsible for day-to-day care of a child and integration of the services involved in the EMSC continuum of care, such as injury prevention, recognition of an emergency, and access to EMS.

• Medical oversight, direct and indirect—direct (online) medical oversight (formerly direction or control) refers to medical personnel authorized to assist out-of-hospital personnel with medical and procedural decisions via telephone or radio. Medical oversight personnel are based at a receiving facility, a central medical facility, or an EMS agency. Indirect (off-line) medical oversight refers to physicians who provide input and collaborate on writing and modifying treatment protocols, triage criteria, and equipment lists, as well as assume responsibility for quality improvement. A committee of physicians who work with the EMS medical director usually provides this input. This is an excellent forum for physicians to become involved as advocates for the special needs of children.2

• Medical oversight physician—a physician who participates in the EMS system by developing guidelines for out-of-hospital emergency care provider training, ambulance equipment, out-of-hospital care protocols, and online (direct) medical oversight.

• Primary transport—transport from the scene of an injury or illness to a hospital ED.

• Secondary transport—transport from an ED or community hospital to a specialty or definitive care center.

Figure 19.1 The emergency medical services for children (EMSC) continuum of care: Seriously ill and injured children interface with a large number of health care personnel as they move through the EMSC system.

Adapted from: Health Resources and Services Administration/Maternal and Child Health Bureau/Emergency Medical Services for Children (HRSA/MCHB/EMSC).
Epidemiology
Children account for 25% to 30% of ED visits nationally. Seriously ill children are frequently transported by their caregivers for medical evaluation. Many children, however, are assessed, treated, and transported by EMS personnel. Approximately 6% to 10% of all EMS calls are for patients younger than 19 years. Most children require transport between the hours of noon and midnight. Although most pediatric calls receive only basic life support (BLS) interventions, about one-third require advanced life support (ALS) responses. Children transported to EDs by EMS personnel are at least five times more likely to require admission than are those who arrive by other methods.

In EMS transported patients, the most common mechanisms of injury are vehicular trauma (including as a vehicle occupant or pedestrian and bicycle collisions), falls, and burns. Traumatic events predominate in children older than 2 years, with a peak in vehicular trauma among adolescents. The most common medical symptoms are seizures, respiratory distress, submersion, and poisonings. For children younger than 2 years, most calls are for medical problems. Types of illness and patterns of injury in children differ from that of adults, requiring education and treatment protocols specific to children’s needs.

Origin of EMS Systems
Trauma surgeons working in the Korean and Vietnam conflicts recognized that rapid transport and surgical repair of patients with traumatic injuries improved survival. They applied these principles to patients with traumatic injuries from motor vehicle collisions in the United States in the 1960s; previously, these patients had high mortality rates because of poor access to rapid transport to surgical care. In 1966, Pantridge and colleagues, who brought health care to chest pain patients at home in Ireland, demonstrated that early defibrillation of adults with ventricular dysrhythmias, before arrival at a hospital, improved survival.

Models of Out-of-Hospital Emergency Care
The Trauma and Medical (Cardiac) Models
Two models, the trauma model and the medical model, have influenced the approaches to out-of-hospital emergency care. Both are based on data collected on adult patients. A primary goal is providing medical (cardiac) care of the adult, in both the out-of-hospital and hospital settings, is the rapid delivery of ALS to prevent or reverse sudden cardiac death (eg, defibrillation of patients with ventricular dysrhythmias). The approach to trauma care is to maintain the airway and ventilation, provide hemorrhage control, and transport the patient rapidly to a regional trauma center for definitive care by an awaiting surgical team. Out-of-hospital interventions for trauma patients should not lengthen transport time.

The Pediatric Out-of-Hospital Emergency Care Model
Cardiac disease and cardiac arrest are uncommon out-of-hospital problems in children, whereas respiratory distress and seizures are more common in children cared for by EMS systems. Children with out-of-hospital respiratory arrest appear to have improved survival rates in an urban short transport system if airway and ventilation are provided by bag-mask ventilation. Clearly, skills in airway management and ventilation are critical for out-of-hospital emergency care providers caring for children. The pediatric out-of-hospital emergency care model should be conservative (ie, providing BLS care, focusing on airway and ventilation, and transport to pediatric-capable hospital EDs) yet permissive (ie, providing ALS care) when clear lifesaving benefits are apparent (eg, defibrillation for ventricular dysrhythmias, bronchodilators for reactive airway disease, and anticonvulsants for status epilepticus).
Certain realities affect pediatric out-of-hospital emergency care: many out-of-hospital emergency care providers had primary training that did not incorporate the pediatric educational courses and resources developed by the EMSC program, and most out-of-hospital emergency care providers will get infrequent exposure to critically ill and injured children. Therefore, there is a need for pediatric continuing medical education and frequent refreshing of critical pediatric skills, such as bag-mask ventilation.12,13

Federal EMSC Program

Origin of EMSC

The federal EMSC program was established in 1985 to help reduce childhood disability and death due to severe illness or injury. Recognition that the trauma mortality rate for children was double that of adults and that most EMS systems lacked pediatric equipment, protocols for the care of children and health care professional training in pediatrics were incentives for EMSC program development.14,15 Calvin Sia, MD, and Senator Daniel Inouye (Hawaii) set the EMSC program in motion. Senator Orrin Hatch (Utah) and Senator Lowell Weicker (Connecticut) joined Senator Inouye in authoring the first EMSC legislation (Public Law 98-555), which established a national EMSC program.6,14,15 The EMSC program is currently federally funded by the Health Resources and Services Administration Maternal and Child Health Bureau and the Department of Transportation (DOT) National Highway Traffic Safety Administration (NHTSA).

Phases of Care in EMS-EMSC Systems

The phases of care in the EMS-EMSC systems are as follows:

1. Entry phase—includes recognition of an emergency and activation of the EMS system (through a 911 call if available).

2. Response phase—immediate care by bystanders, police, appropriate prearrival instructions by EMS dispatch, dispatch priority for BLS or paramedic (ALS) ambulance.

3. Treatment and triage—care by EMS providers (first responder, emergency medical technician [EMT], EMT-paramedic [EMT-P]), including scene assessment; patient assessment (using a standard assessment approach, eg, the Pediatric Assessment Triangle); a focus on initial stabilization of airway, ventilation, and circulation; maintenance of temperature; making triage decisions (based on severity of illness or injury); and primary transport to a hospital ED, a pediatric critical care center, or trauma center. Focus on rapid transport, identification of appropriate destination, and method of transport based on severity of condition and distance from the ED.

4. Hospital phase—stabilization in a hospital ED, transfer (secondary transport) to a pediatric-capable trauma center or critical care center, and definitive care (operating room, pediatric intensive care unit, and inpatient ward).

5. Rehabilitation phase—appropriate physical or mental rehabilitation needed to allow discharge to ongoing family-centered care, preferably at home.

6. Ongoing care—prevention and care of chronic medical problems; focus on child, family, and primary care physician (Table 19-1).

Entry Phase

The entry phase requires that a problem be identified as an emergency by the patient, parent, other caregiver, or observer. Education of parents, teachers, and other caregivers is important to ensure that initial first aid or CPR can be administered when needed and that true emergencies are correctly identified. Patient education materials reviewing what defines an emergency and when to activate the EMS 911 system are available (Table 19-2).16 After an emergency is identified, the EMS system should then be activated. In many areas of
Response Phase

The EMS provider agencies have many organizational structures (volunteer, municipal, part of fire department, or separate EMS agency) but are functionally divided into those providing first responder, BLS services, ALS services, or a combination. First responders provide first aid, basic airway management such as airway clearance, CPR, newborn deliveries, basic wound care, and hemorrhage control. An EMT-basic (EMT-B) can provide all first responder skills plus patient assessment, oxygen administration, assisted ventilation (via bag-mask), splinting, spinal immobilization, patient transport, and, in some systems, assistance in administering auto-injected epinephrine (adrenaline) and inhaled bronchodilators. An EMT-B who also has training and equipment to provide automated defibrillation is known as an EMT-D. Most EMTs in the United States are now EMT-Ds. An EMT-intermediate (EMT-I), which is being phased out, is at an intermediate level of training between BLS and ALS providers. Depending on the state and the EMS system, the EMT-I is allowed to perform intubation, obtain intravenous access, and perform manual defibrillation and might be able to administer some medications. The EMT-P can obtain vascular access; deliver inhaled, intravenous, intraosseous, intramuscular, and tracheal medications; and perform endotracheal


Figure 19.2 Emergency medical services dispatch center.
TABLE 19-2 Parent and Patient Education: What is an Emergency?; When to Call 911.

**What Is an Emergency?**

- An emergency is when you believe a severe injury or illness is threatening your child’s health or might cause permanent harm.
- A child needs emergency medical treatment right away.
- Emergencies can result from medical (or psychiatric) illnesses or injuries.
- Your child could show any of the following signs:
  - Acting strangely or becoming more withdrawn and less alert
  - Less of or lack of a response when talking to the child
  - Unconsciousness or lack of response
  - Rhythmic jerking and loss of consciousness (a seizure)
  - Increasing trouble with breathing
  - Skin or lips that look blue, purple, or gray
  - Neck stiffness or rash with fever
  - Increasing or severe persistent pain
  - A cut or burn that is large, is deep, or involves the head, chest, or abdomen
  - Bleeding that does not stop after applying pressure for 5 minutes
  - A burn that is large or involves the hands, groin, or face
  - Any loss of consciousness, confusion, headache, or vomiting after a head injury
- Ask your child’s pediatrician in advance what you should do in case of an emergency.
- Call your child’s pediatrician if you think your child is ill.
- Take a basic life support course at your local hospital or school.
- Call the poison center at once if your child has swallowed a suspected poison or another person's medication, even if your child has no signs or symptoms.
- Call 911 (or your local emergency number) for help if you believe your child’s life might be in danger or that your child is seriously ill or injured.

**In Case of an Emergency:**

- Stay calm.
- Start cardiopulmonary resuscitation if your child is not breathing.
- Call 911 if you need immediate help.
- If you do not have 911 service in your area, call your local emergency ambulance service or county emergency medical service.
- Apply continuous pressure to the site of bleeding with a clean cloth.
- Place your child on the floor with his or her head turned to the side if he or she is having a seizure. Do not put anything in his or her mouth.
- Do not move your injured child unless there is immediate danger.
- Stay with your child until help arrives.
- Bring any medication your child is taking with you to the hospital.
- Bring any suspected poisons or other medications your child might have taken.
- After you arrive at the emergency department, make sure you tell the emergency staff the name of your child’s pediatrician. Your pediatrician can work closely with the emergency physicians and nurses and can provide them with more information about your child.

variability of normal pediatric vital signs and the
difficulty of accurate measurement in the field
(especially blood pressure in younger children),
it is beneficial to teach EMS providers to look
for abnormalities in mental status, respiratory
effort, and peripheral perfusion in assessing for
respiratory failure and shock. Having a readily
available reference list for normal pediatric vital
signs by age is also recommended.

**Response Phase**

First responders and EMT-Ds sometimes per-
form initial life-saving interventions, including
airway-clearing maneuvers, hemorrhage con-
trol, mouth-to-mask ventilations, compres-
sions, and defibrillation using an automated
external defibrillator. On patient contact, EMS
providers first perform a scene assessment for
safety hazards and environmental or visual in-
formation that might affect patient assessment
and care (Figure 19.3). Observation of a trauma
scene can clarify the mechanism of injury by
noting details such as the condition of a car
or bicycle or the presence of other hurt indi-
viduals and the nature of their injuries. Other
scene details can help to assess the possibility
of neglect or abuse or assist in the identification
of a poison. Bystanders might be able to pro-
vide historical information, such as initial level
of consciousness or seizure activity, as well as
treatments provided before the arrival of EMS.
Family members might not know these details.
Discussion between emergency physicians and
EMS personnel provides critical details fre-
quently unavailable from any other source.

The EMS provider then performs a rapid
patient assessment. Emphasis is placed on ear-
ly recognition of abnormalities in the airway
and breathing because most critically ill pedi-
atric patients, including serious blunt trauma
patients, have associated respiratory distress
or failure. Determination of vital signs in the
field is performed. Because of the wide range of

**Treatment and Triage Phase**

Patient assessment and treatment often occur si-
multaneously. Assessment follows an approach
that has become an integral part of many pedi-
atric resuscitation and out-of-hospital education
courses and resources. This approach is based on
the Pediatric Assessment Triangle. The Pediatric
Assessment Triangle focuses assessment on ap-
pearance, work of breathing, circulation to the
skin, and continuous reevaluation (Figure 19.4).
Treatment is protocol driven, with each EMS system having written treatment protocols for children. Model pediatric protocols have been developed and were revised in 2003\textsuperscript{19,20} (Table 19-3). Treatment focuses on airway management, assisted ventilation, oxygen administration, spinal immobilization for trauma patients, prevention of hypothermia, and rapid transport to definitive care. When necessary and when appropriate emergency care providers are available on the scene, ALS should be provided (Figure 19.5). Other treatments are frequently provided on scene or en route if there is unavoidable transport delay due to an extrication problem or anticipated prolonged transport time.

<table>
<thead>
<tr>
<th>Table 19-3 Model of Pediatric Protocols by Medical Condition</th>
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<tbody>
<tr>
<td>• General patient care</td>
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<tr>
<td>• Trauma</td>
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<tr>
<td>• Burns</td>
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<tr>
<td>• Foreign-body obstruction</td>
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<tr>
<td>• Respiratory distress, failure, or arrest</td>
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<tr>
<td>• Respiratory distress in the child with a tracheostomy</td>
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<tr>
<td>• Respiratory distress in the child receiving ventilatory support</td>
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<tr>
<td>• Bronchospasm</td>
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<tr>
<td>• Newborn resuscitation</td>
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<tr>
<td>• Bradycardia</td>
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<tr>
<td>• Tachycardia</td>
</tr>
<tr>
<td>• Nontraumatic cardiac arrest</td>
</tr>
<tr>
<td>• Ventricular fibrillation or pulseless ventricular tachycardia for basic life support providers with an automated external defibrillator</td>
</tr>
<tr>
<td>• Ventricular fibrillation or pulseless ventricular tachycardia</td>
</tr>
<tr>
<td>• Asystole and pulseless electrical activity</td>
</tr>
<tr>
<td>• Altered mental status</td>
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<tr>
<td>• Seizures</td>
</tr>
<tr>
<td>• Nontraumatic hypoperfusion (shock)</td>
</tr>
<tr>
<td>• Anaphylactic shock or allergic reaction</td>
</tr>
<tr>
<td>• Anaphylactic shock treated with an autoinjector device</td>
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<tr>
<td>• Toxic exposure</td>
</tr>
<tr>
<td>• Near-drowning</td>
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<tr>
<td>• Pain management</td>
</tr>
<tr>
<td>• Death of a child</td>
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</table>


The patient should be triaged to an appropriate destination based on age, mechanism of injury or illness, and measures of acuity. Triage and treatment decisions will be dictated by protocol or made with the assistance of direct (online) medical oversight. It is important to ensure that the physicians and nurses providing direct medical control are trained in special issues pertaining to the care of children in the field, including all pediatric treatment protocols, medication dosing, and triage decisions. There are validated pediatric trauma triage tools (eg, Pediatric Trauma Score); however, no triage tool for medical illness has been developed and validated for the out-of-hospital setting. Once treatment and triage have been initiated, emergency care providers must make transport decisions. They must decide how (eg, ground vehicle or air ambulance, ALS or BLS) and when to transport the patient. Traumatized children should be transported as soon as the airway has been stabilized and hemorrhage controlled, with other interventions performed en route. The definitive treatment for ongoing internal hemorrhage from trauma is surgical, so expeditious transport to a hospital is critical. Some patients with medical conditions receive emergency treatment in an effort to stabilize before and during transport (eg, anticonvulsants for status epilepticus, epinephrine [adrenaline] for anaphylaxis).
Frequent reassessment and ongoing treatment are continued during transport. Requirements for radio or telephone contact with the receiving facility vary, but continuous availability of direct medical oversight is optimal. A good example is contact with a poison center for directions on management of a pediatric ingestion or poisoning during transport. At the receiving hospital, the EMS providers should report the patient’s status, pertinent information from the scene, interventions performed en route, and clinical course during transport. Responsibility for patient care is then transferred to the hospital staff, which initiates the next phase in the EMSC continuum.

Safety of Children During Transport
Guidelines to make ambulance transport safe for children are being developed. A list of do’s and don’t’s is available from the EMSC program and includes the following:

- Drive cautiously at safe speeds and observe traffic laws.
- Tightly secure all monitoring devices and other equipment.
- Ensure available restraint systems are used by the out-of-hospital emergency care providers and other occupants, including the patient.
- Transport children who are not patients in a different (passenger) vehicle, and be sure that they are properly restrained whenever possible.
- Encourage use of the DOT NHTSA Emergency Vehicle Operating Course, National EMS Education Standards.

Hospital Phase
Triage and Transport to Hospitals with Pediatric Capabilities
Hospitals prepared to care for critically ill or injured children should be identified and be part of a written protocol or online medical oversight-driven triage process. Hospitals within an EMS system have varying pediatric capabilities and resources. Some EMS systems have regionalized pediatric care, whereas others have chosen to improve the pediatric capability of all hospitals in the system. Guidelines for pediatric preparedness of EDs have been developed and revised in 2009. Not all hospitals have used available guidelines. Ideally, children should be transported to the closest facility with pediatric emergency capabilities.

Rehabilitation and Ongoing Care
Although the rehabilitation phase is the last in the EMS-EMSC phases of care, an additional phase in the continuum of care is a child’s ongoing care in the community. This is actually the end and the beginning because it involves returning the child to the community and medical home. Physicians can help educate local EMS agencies about the most prevalent injuries in the community and then involve them in prevention activities. This can include bike helmet giveaways and bicycle rodeos, fire safety and smoke detector checks, or water safety and pool fencing campaigns.

Medical Home
At the center of the EMSC system, there is a primary care physician who can coordinate care for the pediatric patient (Figure 19.6). Every child should have a medical home (parent and primary physician) responsible for the following:

- Educating the family on prevention so there will be less need to use the system for the child.
- Appropriately recognizing acute illness or severe injury requiring the use of EMSC.
- Activating the EMS system and instructing the family on how and when to access EMS.

EMSC Landmarks

Institute of Medicine Report
The Institute of Medicine published a report on EMSC in 1993 that, while recognizing significant advances in EMSC, suggested improvements in several areas. These areas included communication, access to care, data collection, physician involvement, equipment, education of emergency care providers, research, and EMS system infrastructure. This led to the numerous advances that follow.
The task force also outlined essential pediatric skills for paramedics (Table 19-5). Several pioneering programs in pediatric out-of-hospital education have been developed. These include the following:

- The Center for Pediatric Emergency Medicine’s Teaching Resource for Instructors in Prehospital Pediatrics (TRIPP). The TRIPP resource is now available in BLS and paramedic versions (http://www.cpm.org).
- The Pediatric Education for Prehospital Professionals (PEPP) Course (www.PEPPsite.com). The first national course for pediatric education for out-of-hospital emergency care providers, PEPP was established by the American Academy of Pediatrics (AAP) in collaboration with Jones and Bartlett Publishers in 2000 and was revised in 2006.
- The National Association of EMTs Emergency Pediatric Care Course is designed to provide education at the EMT-I and EMT-P levels (http://www.naemt.org).

### TABLE 19-4 Paramedic Pediatric Curriculum Content

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Content</th>
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<tbody>
<tr>
<td>Patient assessment</td>
<td>Behavioral emergencies</td>
</tr>
<tr>
<td>Growth and development</td>
<td>- Suicide, aggressive behavior</td>
</tr>
<tr>
<td>Emergency medical services for children</td>
<td>Child-family communications</td>
</tr>
<tr>
<td>Illness and injury prevention</td>
<td>Critical incident stress management</td>
</tr>
<tr>
<td>Respiratory emergencies (airway and breathing problems)</td>
<td>Fever</td>
</tr>
<tr>
<td>- Respiratory distress, respiratory failure, respiratory arrest</td>
<td>Medical-legal issues</td>
</tr>
<tr>
<td>- Possible causes of respiratory emergencies:</td>
<td>- Do not resuscitate, consent, guardianship, refusal of care</td>
</tr>
<tr>
<td>* Airway obstruction (upper airway and lower airway obstruction)</td>
<td>Newborn emergencies</td>
</tr>
<tr>
<td>* Fluid in the lungs</td>
<td>Submersion</td>
</tr>
<tr>
<td>Cardiovascular or circulatory emergencies</td>
<td>Pain management</td>
</tr>
<tr>
<td>- Shock (compensated and decompensated shock)</td>
<td>Poisoning</td>
</tr>
<tr>
<td>- Rate and rhythm disturbances, cardiopulmonary arrest</td>
<td>Sudden infant death syndrome and death in the field</td>
</tr>
<tr>
<td>Altered mental status</td>
<td>Transport considerations</td>
</tr>
<tr>
<td>- Possible causes:</td>
<td>- Destination issues, methods for transport (safety seats and parental transport)</td>
</tr>
<tr>
<td>* Airway or breathing problems, shock, seizures, poisoning, metabolic, occult trauma, serious infection</td>
<td>Infants and children with special needs</td>
</tr>
<tr>
<td>Trauma</td>
<td>- Technologically assisted children</td>
</tr>
<tr>
<td>- Burns</td>
<td>- Tracheostomy care, apnea monitors, central catheters, chronic illness, gastrostomy tubes, home artificial ventilators, and shunts</td>
</tr>
<tr>
<td>Child abuse and neglect</td>
<td></td>
</tr>
</tbody>
</table>

The National Association of EMS Physicians (NAEMSP), as part of the Partnership for Children program (supported by EMSC), developed model protocols for out-of-hospital care of children. To develop these new pediatric protocols, the medical literature was evaluated to identify those out-of-hospital interventions that are evidence based, and existing protocols from many EMS systems in the United States were reviewed and collated. The topics covered by the pediatric out-of-hospital emergency protocols that were developed are listed in Table 19-3; the protocols are available from NAEMSP at www.naemsp.org.

### Table 19-5 Critical Skills for Paramedics

<table>
<thead>
<tr>
<th>Assessment of Infants and Children</th>
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<tbody>
<tr>
<td>Use of a length-based resuscitation tape</td>
</tr>
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</table>

- **Airway management**
  - Mouth-to-mouth barrier devices
  - Oropharyngeal airway
  - Nasopharyngeal airway
  - Oxygen delivery system
  - Bag-mask ventilation
  - Tracheal placement confirmation devices (carbon dioxide detection)
  - Optional: rapid sequence intubation
  - Foreign-body removal with Magill forceps
  - Needle thoracostomy
  - Nasogastric or orogastric tubes
  - Suctioning
  - Endotracheal intubation
  - Tracheostomy management

- **Monitoring**
  - Cardiorespiratory monitoring
  - Pulse oximetry
  - End-tidal carbon dioxide monitoring and/or carbon dioxide detection

- **Vascular access**
  - Intravenous catheter placement
  - Intraosseous catheter placement

- **Fluid and medication administration**
  - Tracheal
  - Intramuscular
  - Intravenous
  - Nasogastric
  - Nebulized
  - Oral
  - Rectal
  - Subcutaneous

- **Cardioversion**
- **Defibrillation**
- **Drug dosing in infants and children**
- **Stabilization and extrication**
  - Car seat extrication
  - Spinal stabilization


### Pediatric Protocols for Out-of-Hospital Emergency Care

The National Association of EMS Physicians (NAEMSP), as part of the Partnership for Children program (supported by EMSC), developed model protocols for out-of-hospital care of children. To develop these new pediatric protocols, the medical literature was evaluated to identify those out-of-hospital interventions that are evidence based, and existing protocols from many EMS systems in the United States were reviewed and collated. The topics covered by the pediatric out-of-hospital emergency protocols that were developed are listed in Table 19-3; the protocols are available from NAEMSP at www.naemsp.org.

### Care of Children in the ED: Guidelines for Preparedness

Initial efforts to develop guidelines for EDs that care for children originated in California. A few studies have suggested that some EDs are not fully prepared to care for pediatric patients; despite this finding, few of the guidelines for ED care of children have been widely adopted. The EMSC, American College of Emergency Physicians (ACEP), and AAP developed guidelines for ED pediatric preparedness. These guidelines were supported in concept by 17 professional organizations and were revised in 2009. The guidelines are available on the ACEP (http://www.acep.org) and AAP (http://www.aap.org) Web sites. Appropriate equipment for children cared for by EMTs and paramedics is necessary. Guidelines for ambulance equipment for children’s care have been developed and revised by the AAP, ACEP, and other national organizations.

### EMSC Support of National Resource Centers and a National Research Network

The EMSC program currently supports two national resource centers. The EMSC National Re-
source Center, based in Washington, DC (http://www.childrensnational.org/EMSC/), provides technical support, information dissemination, and topic-specific expertise. The National EMS Data Analysis Resource Center based in Salt Lake City, Utah (http://www.nedarc.org), provides resources on data collection, analysis, and linkages. In 2001, the EMSC program funded the Network Development Demonstration Project (NDDP). The goal of the NDDP is to develop an infrastructure for collaborative research in EMSC. Six regional research node centers, with a total of 18 hospitals, make up this Pediatric Emergency Care Applied Research Network (PECARN). Several multicenter studies have been completed by this research network.

Other EMSC-Supported Programs

Over the years, numerous programs have been funded by EMSC for state EMSC system development, regional EMSC conferences, national organizations, and research initiatives. Some of these are listed in Table 19-6.

Other EMSC Initiatives

Priorities in EMSC Research—Research Task Force

The earlier priorities for research in EMSC were revisited by PECARN in 2008. The PECARN research priorities are as follows: (1) respiratory and asthma, (2) prediction rules for high-stakes diseases, (3) medication error reduction, (4) injury prevention, (5) urgency and acuity scaling, (6) race/ethnic disparities, (7) mental health, (8) treatment of infectious disease, (9) best practice in patient care, (10) pain and anxiety management, (11) education and training outcomes, (12) development of treatment algorithms, (13) cardiac arrest, (14) practice protocols, (15) seizure management, and (16) C-spine immobilization.

Emergency Information Form

Children with special health care needs (CSHCN) bring unique problems to providers of out-of-hospital and in-hospital emergency care. The emergency information form was created to delineate in a clear and concise manner the complicated medical conditions; baseline abnormalities in mental, respiratory, and circulatory status; and baseline vital signs of a CSHCN. It helps a caregiver know what is normal for the individual child, and it helps that caregiver determine the severity of anatomical or physiologic change due to illness or injury. Frequently, CSHCN are treated by several specialists, making it difficult for emergency care providers to readily access complete information on their medical care from one source. In a collaborative effort of the EMSC program, ACEP and the AAP produced policy statements that outline the contents and format of an emergency information form. This form would

<table>
<thead>
<tr>
<th>TABLE 19-6 Emergency Medical Services for Children Supported Programs</th>
</tr>
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<tbody>
<tr>
<td>• National Resource Centers: EMSC National Resource Center and National EMS Data Analysis Resource Center</td>
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<tr>
<td>• EMSC Development Demonstration Grants (formerly state planning and implementation grants)</td>
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<td>• Network Development Demonstration Project</td>
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<td>• Pediatric Emergency Care Research Network</td>
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<td>• EMSC Partnership Demonstration Grants</td>
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<td>• Interagency Committee on EMSC Research</td>
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<td>• EMSC Regional Symposium Supplementation Grants</td>
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<td>• EMSC Targeted Issue Grants</td>
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<td>• Trauma and EMS Systems</td>
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<td>• Partnership for Children</td>
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<td>• Clinical Practice Guidelines</td>
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<td>• Enhancing Patient Safety</td>
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Abbreviations: EMS, emergency medical services; EMSC, emergency medical services for children.
Physician’s Role in EMSC

Physicians have an important role in supporting and advancing EMSC. They should be well informed about their regional EMS systems, as well as the resources, collaborative efforts, and products developed by the EMSC program. The educational programs and resources developed to educate out-of-hospital emergency care providers in the care of children should be incorporated into out-of-hospital emergency care provider training and continuing medical education. Model pediatric out-of-hospital emergency care protocols and recommended ambulance equipment lists are available to guide regional EMS systems in providing appropriate out-of-hospital emergency care for children. Individual physicians should be involved in EMS and hospital committees to ensure incorporation of these pediatric-focused resources. Guidelines for preparedness of EDs in the care of children also exist. Emergency physicians and pediatricians must take leadership roles in their EMS systems and hospital EDs to make sure that these innovative products and resources are used effectively. Some of these roles are listed in Table 19-7.

In the United States, national direction for EMS care, education, and equipment is developed through the NHTSA and various EMS-related organizations. The NHTSA publications include the EMS Agenda for the Future, which creates a vision for EMS; the National EMS Core Content, which describes the entire domain of out-of-hospital emergency care; the National EMS Scope of Practice Model, which defines the levels and performance for out-of-hospital emergency care providers; and the National EMS Education Standards, which defines the performance of out-of-hospital emergency care providers at each level of care. All of these documents can be found on the Website (http://www.ems.gov/). The National EMS Education Standards, completed in 2009, will eventually replace the current DOT National Standard Curricula. It is important for physicians with pediatric expertise to be involved and provide guidance to develop and maintain EMS systems in the United States and internationally. This will ensure that each EMS system provides the best possible care for children.

EMS Systems and EMSC Around the World

Out-of-hospital EMS systems around the world are variable in the level of development and structure. In other developed countries, ambulances can be staffed by physicians. This occurs in Austria, Canada, Germany, Greece, and the United Kingdom. On the other end of the spectrum, more than half the world’s population has no access to a formal EMS system. There is evidence that the creation of a BLS-level EMS system decreases the rate of injury-related death. The costs to train and equip BLS providers is much less than for ALS, and this is a useful and necessary first step. In early stages

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**Table 19-7 Physician Roles in EMSC**

<table>
<thead>
<tr>
<th>Role in EMSC</th>
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<td>Emphasize safety and injury prevention.</td>
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<td>Encourage parents to become certified in BLS and CPR.</td>
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<tr>
<td>Advocate for injury prevention and safety campaigns.</td>
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<td>Support and develop legislation supporting injury prevention and safety.</td>
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<td>Ensure that children are up-to-date on immunizations.</td>
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<td>Maintain office emergency preparedness and ED preparedness for children.</td>
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<td>Frequently practice pediatric resuscitation.</td>
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<td>Maintain skills in emergency pediatrics, especially airway management.</td>
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<td>Become familiar with local out-of-hospital emergency care providers, EDs, and transport services.</td>
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<td>Be available for consultation to local EDs.</td>
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<tr>
<td>Serve as medical advisers to the local EMS system.</td>
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<tr>
<td>Stay informed on issues pertaining to EMSC.</td>
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<tr>
<td>Provide expertise to national and regional EMS systems.</td>
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Abbreviations: BLS, basic life support; CPR, cardiopulmonary resuscitation; ED, emergency department; EMS, emergency medical services; EMSC, emergency medical services for children.
of development, EMS systems frequently suffer from insufficient resources, which negatively affects function (eg, response times). In developing countries, EMS systems frequently follow the historical pattern seen in the United States, where the focus of the EMS system development is on adult injuries and illness, with limited inclusion of children’s needs. In 2005, the World Health Organization published guidelines for developing out-of-hospital trauma care systems, in which children were mentioned twice (related to equipment—oral airways and intraosseous needles).

Future of EMSC
Aspects of EMSC have been integrated into the EMS systems of all 50 states. The EMSC program has accomplished much to improve the care of ill and injured children. Products associated with EMSC programs can be found by contacting the EMSC National Resource Center. Nevertheless, there are still challenges ahead. These challenges include a need for all children cared for in all EMS systems, both in the United States and internationally, to benefit from the education, training, and information developed by the EMSC program. Research studies must evaluate the national and international impact of many EMSC programs and initiatives. With continued collaboration of national, public, and government organizations and programs focused on improving the emergency care of children, the future of children cared for by EMS systems in the United States and international EMS systems is encouraging.
Check Your Knowledge

1. Which of the following problems are the most common across all pediatric age groups to be cared for by emergency medical services (EMS)?
   A. Poisoning
   B. Rashes
   C. Respiratory distress
   D. Seizures
   E. Submersion

2. Which of the following statements regarding out-of-hospital emergency care providers’ care of children is correct?
   A. They are comfortable treating critically ill children.
   B. They frequently provide assisted ventilation for a child.
   C. They frequently transport seriously ill or injured children.
   D. They require frequent refreshing of pediatric knowledge and skills.

3. All of the following treatments or services can be provided by an emergency medical technician—basic who also has training and equipment to provide automated defibrillation EXCEPT:
   A. Assisted ventilation
   B. Cardiac compressions
   C. Immobilization
   D. Manual defibrillation
   E. Patient transport

4. The role of the physician in EMS includes all of the following EXCEPT:
   A. Becoming familiar with local out-of-hospital emergency care providers, emergency departments (EDs), and transport services
   B. Emphasizing safety and injury prevention
   C. Maintaining office emergency preparedness and ED preparedness for children
   D. Providing funding for issues pertaining to EMS for children
   E. Serving as medical advisers to local EMS systems

References


A 2-year-old girl wanders outside to the pool in her backyard. Her mother, distracted by a telephone call, rushes outside and finds her daughter floating face down in the water. She pulls her out of the pool, performs cardiopulmonary resuscitation (CPR), and calls 911.

1. What processes and resources provide support for pediatric-specific training, equipment, assessment, treatment, triage, and transport in an EMS system?

2. What is the role of the physician in the EMS system’s ability to care for children?

The EMS system responds by dispatching emergency medical technician (EMT) and paramedic units. The mother’s CPR efforts combined with assisted ventilation with appropriate pediatric equipment by EMTs and paramedics resuscitate the toddler. The child is transported to a hospital with pediatric emergency and critical care staff. She is stabilized in the ED and transferred to the pediatric intensive care unit. After 2 days, she is transferred to the pediatric floor with no apparent neurologic deficits and is discharged home after 1 week of hospitalization. Her pediatrician provides her family with information on four-sided pool fencing on her next follow-up visit. The physicians and nurses at the hospital are actively lobbying their state legislators to create a law requiring four-sided fencing around all in-ground pools.

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