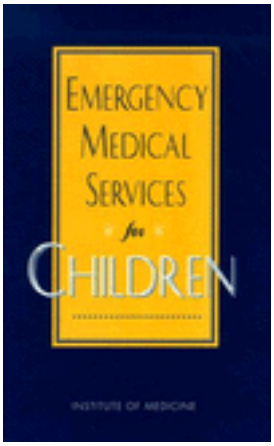

Emergency Medical Services for Children

Jane S. Durch and Kathleen N. Lohr, Editors;
Committee on Pediatric Emergency Medical Services,
Institute of Medicine

ISBN: 0-309-58544-9, 416 pages, 6 x 9, (1993)

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Committee on Pediatric Emergency Medical Services

Jane S. Durch Kathleen N. Lohr, *Editors*

Division of Health Care Services
INSTITUTE OF MEDICINE

NATIONAL ACADEMY PRESS
Washington, D.C. 1993

NATIONAL ACADEMY PRESS 2101 Constitution Avenue, N.W. Washington, D.C. 20418

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Support for this project was provided by the Maternal and Child Health Bureau of the Health Resources and Services Administration, U.S. Department of Health and Human Services, under Grant No. MCJ-117025-02. The views presented are those of the Institute of Medicine Committee on Pediatric Emergency Medical Services and are not necessarily those of the funding organization.

Library of Congress Cataloging-in-Publication Data

Emergency medical services for children / Jane S. Durch and Kathleen N. Lohr, editors
p. cm.
"Committee on Pediatric Emergency Medical Services, Division of Health Care Services, Institute of Medicine."
Includes bibliographical references and index.

ISBN 0-309-04888-5

1. Pediatric emergency services—United States—Planning. I. Durch, Jane S. II. Lohr, Kathleen N., 1941-. III. Institute of Medicine (U.S.). Committee on Pediatric Emergency Medical Services.
[DNLM: 1. Emergencies—in infancy & childhood. 2. Emergency Medical Services. WS 200 E5273 1993]
RJ370.E433 1993
362.1'8'083—dc20
DNLM/DLC
for Library of Congress 93-8084
CIP

Additional copies of this book are available from the National Academy Press, 2101 Constitution Avenue, N.W., Box 285, Washington, D.C. 20055. Call 800-624-6242 or 202-334-3313 (in the Washington Metropolitan Area).

Printed in the United States of America

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Preface

The problem of childhood injuries and illnesses and the emergency care they require is immense and its consequences tragic. If the recent past is an indication of the immediate future, then more than 20,000 children under 19 years of age will die this year in the United States as a result of injury. An additional 30,000 will have a permanent disability as a result of brain injury. As disturbing as these data are, they are but the top of a huge pyramid; for each death of a child due to injury in this country, as many as 42 children are hospitalized and 1,120 children visit an emergency room. Moreover, emergency room visits by children as a result of injury are only one-third of the total number of visits by children to emergency rooms. The other two-thirds of those visits are due to illnesses, many of which are serious; these include debilitating asthma and life-threatening meningitis.

One cannot be aware of these data and not want to reduce their number and their impact. That goal can be achieved. The rates of death and disability in the United States exceed the comparable rates in Canada, France, the former Federal Republic of Germany, and Great Britain. If this country would energetically pursue preventive health measures, including the establishment of continuous, family-oriented, community-based primary care for all children, there is no reasonable doubt but that the number of injuries and episodes of illness—and their consequences—could be significantly reduced. Moreover, if that were accomplished, the savings would be enormous in economic as well as humanitarian terms.

The charge to this Institute of Medicine committee, however, was not to design the ideal medical home (primary care) for children, nor was it to develop strategies for the development and implementation of effective injury prevention measures. It was to review the nature and extent of pediatric emergencies and the emergency care available to children and to define

the characteristics of an emergency medical services system for children (EMS-C system), the elements of a data system needed for planning and evaluation, and the role of government in that system. In developing its response to this charge, the committee utilized fully the remarkable diversity in expertise and background of its multidisciplinary membership and prepared a report that is scholarly and detailed. It identified the essential components of an EMS-C system. It considered how best to ensure access to that EMS-C system. It recognized the very special needs of children in terms of anatomy, physiology, and psychology, and underscored how these must be met by EMS-C programs and personnel. Thus, there must be different and special equipment, different-sized instruments, different doses of different drugs, and different approaches to the psychological support and remedial care to be given to the ill or injured child. Guidelines by which personnel essential for the provision of emergency care for infants and children are to be trained, educated, and re-trained and re-educated must take into account these factors. Thus, the committee called attention to the importance of fully developing and organizing in a *system* all those special emergency services that children must have.

The committee believed that it was of critical importance to develop an initial uniform data set about these services in order to begin to obtain information that would be used to assess the system and its effectiveness. Mindful of the tragic toll of injury and illness emergencies, the committee further recognized the great importance of obtaining data needed for developing prevention strategies as well as for improving the EMS-C system as a whole.

The recommendations that reflect these matters are directed at all levels of government, many different health care professionals, and a wide range of voluntary groups. Some recommendations are directed to the whole of emergency medical services (EMS), for example, the need to develop an expanded 9-1-1 system nationally to provide access to EMS. Some are aimed at subtle modifications or minor (but significant) improvements in the existing system. Others require putting what now exists in some places into those places where no EMS now exists. All do, as they must, take into account the local and regional diversity of this country.

In recommending these special services for children, the committee concluded that the EMS-C must not be separate from, but instead should be an integrated part of, the entire emergency medical system. At the same time, the committee recognized how very important it will be to make sure that the needs of children will not be lost again in the continuing development of that larger emergency medical system. To ensure that, the committee has recommended the creation of specific agencies and defined specific roles for them in both state and federal governments. These public agencies must be effectively linked with the private sector.

The committee recognized the extremely important role that effective rehabilitation services can and must play in this matter. Nonetheless, just as it was not the committee's charge to design the ideal medical home for children, it was not the committee's charge to design rehabilitation services. Instead this was addressed by stressing the need for extremely effective linkages between EMS-C and rehabilitation.

Thus, throughout its deliberations, the committee recognized the very great importance of establishing effective communication systems and of developing an information system that could obtain data to be used to assess the effectiveness of the system (and improve it continually) and to provide information useful in developing the means to prevent emergencies. If there were but one thing that this author would stress, it would be that.

In this time of national economic duress, the committee was cognizant that the matter of costs and benefits would be raised. Obtaining accurate and comprehensive data on the cost or the benefits of emergency medical systems is extremely difficult. The direct and immediate health care costs of nonfatal injuries in children are estimated to be in excess of $5 billion a year, and the indirect costs, including the loss of productive life, greatly exceed those direct costs of caring for injured children. Available estimates indicate that the implementation of comprehensive and effectively linked services for emergency medical care does ensure better outcomes and that the economic benefits of an emergency medical system for children would be very large. Therefore, the committee believes that the cost of developing an effective EMS-C would be well worth it.

The committee is aware that great thought, effort, and time will be required to develop the EMS-C that our children need and deserve. These efforts can build on the accomplishments of many groups during the past quarter-century since the landmark NRC report *Accidental Death and Disability: The Neglected Disease of Modern Society*. The committee believes that this is an opportune time to develop EMS-C since the country seems to be on the threshold of significant health care reform. Therefore, we hope this report will stimulate increased attention to and development of these urgently needed emergency medical services in the context of an effective system of primary care for children.

In closing, I wish to express my great appreciation and admiration to the committee and to the IOM staff for their commitment, energy, and expertise, all of which were provided ceaselessly and patiently and, most important, very productively. I have not listed them here because they are listed elsewhere, but that must not detract from the debt I owe or the admiration I have for them.

Donald N. Medearis, Jr., M.D.
Chair

Acknowledgments

The Committee on Pediatric Emergency Medical Services would like to acknowledge the assistance that they and the study staff received from several individuals and groups during this study.

The study conducted by this committee was funded by the Maternal and Child Health Bureau (MCHB) of the Health Resources and Services Administration (HRSA) through the Emergency Medical Services for Children (EMS-C) Demonstration Grant Program. MCHB staff members—David Heppel, M.D., Director of the Division of Maternal, Infant, Child, and Adolescent Health; Peter Conway, the study's project officer; and Jean Athey, Ph.D., Director of the EMS-C and Injury Prevention Programs—helped keep the committee and staff informed of relevant activities and provided access to useful background material on the demonstration grant awards. Also generous with their assistance were members of the staff of the Emergency Medical Services Division of the National Highway Traffic Safety Administration at the Department of Transportation: Susan Ryan, M.S., chief of the division, and Highway Safety Specialists Gary Criddle, R.N., Thomas Dolan, and Charles Glass.

The committee benefited from presentations by guests invited to two meetings. In December 1991, the committee was joined by Paul Anderson, Chief of the Idaho Emergency Medical Services Bureau, Wade Spruill, Jr., Director of Emergency Medical Services for Mississippi, and Javier Gonzalez del Rey, M.D., from the staff of the Shenandoah Community Clinic in Martinsburg, West Virginia, to discuss emergency medical care in nonmetropolitan and rural areas. In March 1992, George Foltin, M.D., Director of Pediatric Emergency Medical Services, Bellevue Hospital Center, New York City, spoke with the committee on behalf of the National Association of Emergency Medical Services Physicians regarding medical control of prehospital

care. Laurie Flaherty, R.N., chair of the pediatric committee of the California chapter of the Emergency Nurses Association, addressed nursing issues for the committee.

Members of the committee and staff were able to attend conferences in June 1991 and February 1992 that were held as part of the EMS-C demonstration grant program. The conferences gave the committee members an opportunity to meet grantees from some 30 EMS-C projects, to learn about their activities and experiences, and to gain insight into the issues in this field. The two EMS-C resource centers have been especially helpful to the study staff; in particular, the committee thanks Jane Ball, R.N., Dr.P.H., and Bryna Helfer of the EMS-C National Resource Center in Washington, D.C., and Deborah Henderson, R.N., M.A., of the National EMS-C Resource Alliance in Torrance, California.

The committee appreciates the willingness of individuals from a variety of organizations to speak with members of the study staff and to provide background materials: Albert N. Brasile, Centers for Disease Control and Prevention; Donald C. Bross, J.D., Ph.D., C. Henry Kempe National Center for the Prevention and Treatment of Child Abuse and Neglect; Douglas E. Brown, EMS Data Systems, Inc.; Ceil M. Hendrickson, R.N., Children's National Medical Center; Ronald Kropp, M.H.S., Maryland Institute for Emergency Medical Services Systems; David Lloyd, National Center on Child Abuse and Neglect; Susan Mackenzie, Ph.D., Health and Welfare Canada, Laboratory Center for Disease Control; Stephen Mawn, American Society for Testing and Materials; Meri McCoy-Thompson, M.A.L.D., National Center for Education in Maternal and Child Health; Greg McDonald, Arrowhead (Minnesota) EMS System; Mary McDonald, R.N., M.S.P.H., National Heart, Lung, and Blood Institute; Deborah Nadzam, Ph.D., R.N., Joint Commission on Accreditation of Healthcare Organizations; Mary Overpeck, National Institute of Child Health and Human Development; I. Barry Pless, M.D., Montreal Children's Hospital; and William E. Stanton, National Emergency Number Association.

The committee also received helpful contributions from Joanne Lukomnik, M.D., a consultant to the committee. Jennifer McGrady, a student intern at the Institute of Medicine (IOM), helped prepare for the first committee meeting and began the task of assembling background materials. Greg Pearson, a free-lance writer, produced the earliest draft of some of the material for the report. The report has benefited from the useful (anonymous) critiques received as a result of the formal review that must be conducted before the release of any IOM report.

Finally, the committee expresses its considerable appreciation to members of the IOM staff whose efforts have ensured the successful completion of the study and this report. Donna Thompson, Administrative Assistant, provided essential secretarial support. Other members of the IOM staff

contributing to this project include Holly Dawkins, Research Assistant; Jo Harris-Wehling, Program Officer; and Nina Spruill, Financial Associate. The study began under the direction of Michael Millman, who did much to assist the committee in organizing its approach to the study and in formulating the recommendations reflected in the report. Finally, throughout the study, Karl Yordy, Director of the Division of Health Care Services, provided invaluable guidance and support.

Contents

TABLES

Emergency Medical Services for Children

Summary

Emergency care for children's serious illnesses and injuries is a part of the health care system that parents hope never to need. Unfortunately, many families will need such care for their children, and they will want the best care possible. Life-threatening emergencies arise in many forms—motor vehicle crashes, drownings, poisonings, burns, pneumonia, meningitis, and asthma only begin a long list. Each year, injury alone claims more lives of children between the ages of 1 and 19 than do all forms of illness. Most admissions to pediatric intensive care units, however, are due to acute illness. Overall, some 21,000 children and young people under the age of 20 died from injuries in 1988. Nearly 21,000 more deaths occurred because of illness and other disorders (excluding congenital anomalies and birth-related conditions). Thousands more children were hospitalized and millions more were treated in emergency departments (EDs).

Clearly, preventing emergencies is the best "cure" and must be a high priority, but as yet, prevention is far from foolproof. When prevention fails, families should have access to timely care by trained personnel within a well-organized emergency medical services (EMS) system. Services should encompass prevention, prehospital care and transport, ED and inpatient care at local hospitals and specialty centers, and assistance in gaining access to appropriate follow-up care including rehabilitation services.

For too many children and their families, however, these resources have not been available when they were needed. Although EMS systems and hospital EDs are widely assumed to be equally capable of caring for children and adults, this is not true. In many EMS systems, children's needs

have been overlooked as services developed for adult trauma and cardiac patients. Progress has been made in recent years to improve emergency care for children, but much work remains to be done. This report identifies essential steps to be taken to make available to children the high quality emergency care they need and deserve.

RECOGNIZING A NEED FOR EMERGENCY MEDICAL SERVICES FOR CHILDREN

Origins of the Study and Report

In 1984, Congress approved a demonstration grant program to expand access to and improve the quality of emergency medical services for children (EMS-C) available through existing EMS systems and to generate knowledge and experience that other states and localities could draw on in their efforts to enhance EMS-C capabilities. This ongoing program is operated by the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (DHHS).

In response to continuing congressional interest, HRSA requested that the Institute of Medicine (IOM) undertake a study of pediatric emergency medical services to look at the issues more broadly than individual demonstration projects could. The IOM study was guided by a 19-member committee with expertise in pediatrics, emergency medicine, trauma, nursing, prehospital emergency services, injury prevention, hospital administration, public policy, and local government (see roster), and it benefited from the contributions of others who met with the committee.

The committee's report examines the nature and extent of acute illness and injury among children, reviews the origins and organization of EMS systems, describes the current state of effective care, addresses data and standards needed for surveillance and evaluation of services and outcomes, and recommends policy mechanisms to promote development of better systems of care. The committee took into account system components needed to reduce the negative consequences of pediatric emergencies, the full spectrum of facilities involved in pediatric emergencies, particular problems and capabilities of urban and rural settings, and experience gained from the demonstration projects.

The report is addressed to a wide audience: health policymakers; health professionals, including physicians in pediatrics, family practice, surgery, and emergency medicine, nurses in emergency, critical care, and pediatric settings, and prehospital care providers at all levels; hospital administrators; members of voluntary organizations concerned with public safety; parents and the concerned public; and the officials responsible for organizing and operating EMS systems at the national, state, and local levels.

A Vision of Emergency Medical Services for Children

Public policies and programs for children are often fragmented, with special initiatives devised *ad hoc* or *de novo* to meet special needs. The committee finds this unacceptable for EMS-C. It adopted a broad vision of an ideal EMS-C system as part of overall EMS and as part of a comprehensive and coherent approach to children's health care (which should include a "medical home" for routine care). The connections between primary care, emergency care, tertiary (i.e., specialty) care, and rehabilitation should be as seamless as possible.

EMS-C systems must be prepared to care for *all* children: regardless of age (infants, toddlers, schoolchildren, or adolescents); condition (ill, injured, or with special health care needs); or economic resources (insured, uninsured, or in a public assistance program). The committee also emphasizes that EMS systems should view ensuring high quality emergency care for children as a further step in the same process that has led them to develop increasingly sophisticated care for adults.

The committee concluded that, if children's needs in emergency care are to be met, EMS-C must establish three important linkages. First, the separate components of EMS-C must be connected to form a system. Second, EMS-C must be integrated into the larger EMS system. Third, EMS-C must develop strong ties to the broader elements of child health care. Two approaches are needed to fashion these linkages. First, a "top down" approach—reflected in recommendations for federal and state action—is essential to ensure that the needs of all children are addressed in a comprehensive, efficient, and equitable manner. Second, a "bottom up" approach, which depends on the efforts of concerned and committed individuals and communities, is a vital element in making sure that EMS-C is recognized as a priority and receives the attention it requires at the local level. The committee's examination of EMS-C issues proceeds from the position that both approaches are essential.

Children and Why They Need Special Attention

Because no consensus exists regarding the age at which childhood ends and adulthood begins, the committee declined to fix a specific age range to define the "children" to be served by EMS-C. Instead, the committee emphasizes its concern for the entire span of childhood: infants, toddlers and preschoolers, schoolchildren, and adolescents. The one exclusion deemed appropriate for this report is newborns and the intensive care that they may require immediately after birth.

Care for seriously ill and injured children cannot presume that they are simply "little adults." It can, in fact, be more difficult to assess the severity

of illness or injury in children than in adults. Important anatomic, physiologic, and developmental differences exist between children and adults: children are smaller and proportioned differently; normal respiratory rates, heart rates, and blood pressure differ; characteristic changes in vital signs that signal deterioration in adults may not occur in children; and stages in children's physiologic, emotional, and behavioral development affect their responses to medical care and their risk of injury and illness.

Epidemiological Considerations

Limited data make it difficult to determine in detail how many children need emergency care, the kinds of illness and injury they experience, and the nature and outcome of the care they receive. What is clear is that injury is the leading cause of death among children over the age of 1 year. Overall, injuries associated with motor vehicles account for the largest number of deaths. Drowning, burns, and fire-related injuries are significant contributors to deaths, especially among younger children. Among adolescents, many deaths are due to homicide and suicide. In anatomic terms, brain injuries (caused directly by trauma or as a secondary result of illness or other injury) contribute to many deaths and long-term impairments for survivors.

Fewer children die from acute illnesses than from injuries, but many more are hospitalized. In 1990, for example, children experienced about 266,000 hospitalizations principally for injury and 701,000 for respiratory conditions (which represents nearly a third of all hospitalizations among children less than 15 years old). Respiratory, circulatory, or neurologic crises, which can have a variety of causes, characterize many illness-related emergencies. With no commonly accepted set of diagnoses defining illness-related emergencies, however, determining specific numbers of cases from available mortality and hospitalization data is difficult. Some deaths attributed to sudden infant death syndrome, the second leading cause of death among infants, may be due to child abuse or inadvertent suffocation.

Children with chronic illnesses or other special health care needs are especially vulnerable to serious injury and illness. They are likely to need specialized emergency care, to need care more frequently than other children, and to need care for complaints that would be less serious in fundamentally healthy children.

Several other factors are also of special concern. Adolescent girls may require emergency care for pregnancy-related problems, including premature labor. Children experiencing psychiatric or behavioral emergencies require care from mental health professionals as well as from medical and surgical providers. Violence, in the form of homicide, suicide, assault, and child abuse, is a special threat to children's physical and emotional well-being.

Increasingly, firearms are used in homicide and suicide among children.

Data on ED visits and prehospital care, for injury or illness, are especially weak. Estimates are that children account for 25 to 35 percent of all ED visits (about 30 million in 1990) and appear to make up about 10 percent of patients receiving prehospital services. The most seriously ill and injured children may require care in pediatric specialty centers and access to rehabilitation services.

Demands on EMS-C are being increased by factors other than simply the frequency of illness and injury among children: inadequate access to (or use of) primary care; increased survival and home care of children who have chronic illnesses or are technology-dependent; and staff, facility, and other resource limitations. Office-based physicians encounter children requiring emergency care, but many offices may not be adequately prepared to provide the immediate treatment that those children need.

Lifetime costs associated with injury have been estimated at $13.8 billion for children under age 15 and $39.1 billion for 15- to 24-year-olds. Asthma is one of the few major illnesses for which costs have been estimated: annual direct and indirect costs for children under age 18, excluding medications, amounted to $1.3 billion. Both injury and illness carry nonmonetary costs in pain and distress for children and their families.

Key Historical Developments

Two developments in the mid-1960s brought EMS to the attention of federal, state, and local governments and the medical community. First, the landmark report *Accidental Death and Disability: The Neglected Disease of Modern Society*, published in 1966, highlighted the need for better trauma care. Second, work by physicians in Ireland demonstrated that rapid treatment of cardiac emergencies could improve survival. Trauma and emergency cardiac care continue to be significant priorities for EMS systems.

Federal funding was first made available to support development of EMS systems through the National Highway Traffic Safety Administration of the Department of Transportation and through the Department of Health, Education, and Welfare (now DHHS) under the 1973 Emergency Medical Services Systems (EMSS) Act. A grant program underwritten by the Robert Wood Johnson Foundation provided further resources at this important developmental stage. The DHHS role decreased in 1981 when EMS funding was folded into a block grant program that allowed states to decide how to distribute funds among seven preventive health and health services programs. EMS was allocated substantially less support, but over time, many states and localities increased their own funding for EMS.

Resources for emergency care were developing within the health care

community, including training programs for physicians, nurses, and prehospital providers (i.e., emergency medical technicians [EMTs] and paramedics) and specialized trauma units. During the 1970s, however, pediatricians and pediatric surgeons recognized that children's emergency care needs were not receiving adequate attention. To correct this oversight, they began working with hospitals, EMS agencies, their colleagues, and their communities to improve the ability of EMS systems to care for children.

Early successes such as creation of a regional pediatric trauma center as part of Maryland's statewide EMS system and the Los Angeles program to identify EDs qualifying as "emergency departments approved for pediatrics" or "pediatric critical care centers" have served as models for similar efforts elsewhere. Training in pediatric emergency care became available through locally developed programs and nationally recognized courses (e.g., Pediatric Emergency Medical Services Training Program, Pediatric Advanced Life Support [PALS], and Advanced Pediatric Life Support [APLS]).

Awareness of EMS-C issues increased with the start of the EMS-C demonstration grant program in HRSA. Since it began, the program has supported 20 demonstration projects, 11 implementation programs, and 5 special projects. Grantees have created a variety of products including training materials, treatment protocols, and system guidelines. Two EMS-C resource centers have also been established to assist grantees and others interested in emergency care for children.

PRIORITY ISSUES IN IMPROVING EMERGENCY MEDICAL SERVICES FOR CHILDREN

The EMSS Act did much to shape the development of EMS systems by specifying 15 essential functions, including training, communications, transportation, critical care facilities, and standard record keeping. For EMS-C, this committee sees seven essential areas of system responsibility: identifying emergencies; ensuring access to the services of the system (e.g., through 9-1-1 telephone service) with dispatch of equipment and personnel; providing appropriate prehospital care; transporting patients; providing definitive medical care; communicating among emergency care providers and with others, including parents and primary care providers; and using information systems and feedback to assess and improve patient care, to enhance system performance, and to identify injury prevention needs.

Achieving these goals involves medical and administrative considerations and requires the participation and cooperation of a variety of individuals and institutions. No one agency or institution has authority over all the elements involved. Thus, efforts to address the EMS needs of *children* must consider all the elements that constitute EMS systems, understand the specific channels through which change can be implemented, and make

EMS-C a genuine priority with decisionmakers in a position to influence the future direction of emergency medical care. With this report, the committee identifies issues of special concern for EMS-C and presents recommendations for specific actions that should be taken.

Education and Training

Because many aspects of emergency care are different for children than for adults, health care professionals and others with responsibility for children must have the specific knowledge, understanding, and skills necessary to provide appropriate care. The committee's review of desirable elements of such educational efforts led to seven formal recommendations, which promote its view that better education and training are essential for achieving larger goals for EMS-C.

Programs for the Public

Parents, as well as others with routine responsibility for the well-being of children (e.g., teachers, school nurses, day-care providers, coaches, lifeguards and other camp and recreation personnel, and scouting and other youth group leaders), play a vital role in three areas: preventing illness and injury, recognizing (when prevention has failed) that urgent medical care is needed, and gaining access to such care. Evidence suggests that parents are not always aware of the greatest risks to their children, and they can, therefore, be poorly prepared to prevent them. Parents and the public must also understand when and how to use the EMS system. Needed emergency care may be delayed if the seriousness of a child's condition is not recognized. In other cases, unnecessary use of EMS resources can impair the system's ability to provide care for true emergencies. Public information and education programs on EMS-C should ultimately reach the entire population, including children themselves, but they should be aimed first at parents and adults who are involved most directly in the care, education, and oversight of children.

The committee concluded that public education efforts should focus on three areas: prevention and safety; basic first aid and cardiopulmonary resuscitation (CPR); and when and how to use the EMS system. Programs should include a core of universally appropriate material plus issues of specifically local concern. Guidance in using the EMS system, for example, must always take into account specific local mechanisms for requesting assistance, and prevention messages should target particular risks for illness and injury that children in that community face.

Opportunities for training include health care visits, schools, day-care, recreation, and community programs. A child's primary care provider should

play an important role in ongoing education of parents. Public education programs need to be a continuing activity rather than a special project and must be reviewed periodically to ensure that their content is consistent with current medical practice guidelines.

To address these issues, **the committee recommends that:**

- **states and localities develop and sustain programs to provide to the general public of all ages adequate and age-appropriate levels of education and training in safety and prevention, in first aid and cardiopulmonary resuscitation, and in when and how to use the emergency medical services system appropriately for children. It recommends further that:**

— **the content of such programs reflect the particular needs of each community;**
— **the content of such programs reflect the special medical, developmental, and social needs of children;**
— **parents and other adults who are responsible for the care and education of children (e.g., day-care workers, teachers, coaches) receive highest priority in such programs; and**
— **adolescents also be a high priority in this endeavor.**

- **states and localities develop and maintain specific guidelines or criteria to ensure basic consistency and quality of educational programs across communities and populations reached, including specific content elements that those education programs should cover.**

Programs for Health Care Professionals

Until very recently, curricula in emergency care have included little pediatric content and pediatrics curricula have given little attention to emergency care. The committee endorses efforts to incorporate essential elements of pediatric emergency care into the initial and continuing training of all health care providers who care for children. Some material should be included in training programs for all providers; other training needs are specific to particular kinds of providers.

General education and training needs include recognizing characteristic signs of serious illness or injury in children of all ages, rendering essential care for all pediatric patients, and addressing psychosocial aspects of pediatric emergency care. Underlying these should be adequate training in pediatric anatomy, physiology, and pathophysiology. In addition to clinical training, emergency care providers must learn about the organization and operation of EMS systems, particularly local and regional services, and about the importance of data collection and analysis.

Ensuring adequate training for all practitioners will require attention to initial qualifying training for prehospital providers, to beginning years of education for other health professionals, to graduate and residency training programs for nurses and physicians, and to continuing education courses. **The committee specifically recommends that:**

- **organizations that accredit training programs for prehospital care providers require that the curricula for EMT-Basic, EMT-Intermediate, and EMT-Paramedic provide training in pediatric basic life support; in the medical, developmental, and social needs of all children; and in caring for children with special health care needs.**
- **accreditation organizations require that curricula for EMT-Paramedic programs include training in advanced life support for children.**
- **appropriate accrediting organizations require that the primary curricula for all health care professionals include training in basic resuscitation skills and the use of the emergency medical services system. These curricula must give specific attention to the unique medical, developmental, and social needs of children.**
- **appropriate accrediting organizations ensure that graduate nursing programs in emergency, pediatric, and family practice nursing include training in emergency care for children, including advanced resuscitation.**
- **the Accreditation Council for Graduate Medical Education ensure that residency programs for emergency medicine, family medicine, pediatrics, and surgery include training in emergency care for children, including advanced resuscitation.**

Continuing education courses (e.g., PALS, APLS) are currently a major source of training in pediatric emergency care for existing practitioners. Although such courses are not sufficient by themselves as a long-term approach to providing needed training, they are an essential component of an overall program of EMS-C training. Because most providers will have limited opportunities to apply their knowledge and skills, they need training resources that will enable them to refresh their skills and to learn about current practice guidelines.

All parties involved with EMS-C should address certain other education and training issues as well. These include making appropriate training available and affordable, particularly to volunteers and to providers in rural areas; evaluating education and training efforts with special attention to the problem of poor retention of CPR and other skills (by members of the public and by health care providers); establishing a central source of information on EMS-C education and training materials; and financing education and training.

Putting Essential Tools in Place

Emergency care providers must have system resources available that enable them to use their training and skills successfully. Despite impressive progress in recent years, EMS systems must improve their ability to meet the needs of pediatric patients in five major areas. Equipment and supplies (including medications) necessary for treating children are often unavailable. Protocols—standardized sets of procedures or decision algorithms that are developed to guide patient care—have not been developed for pediatric emergency care. Medical control, which entails physician oversight of care provided by prehospital personnel and input into broader planning efforts, lacks sufficient pediatric expertise. Categorization of the pediatric emergency care capabilities of hospitals and other facilities has not been extensive enough. Finally, regionalization of care—deliberate efforts to establish relationships between a specialty center and the communities and community hospitals in a natural (geographic) referral area—has been stymied in many areas by administrative, economic, and political obstacles.

More investment in supplies and equipment appropriate for children (across the entire pediatric age range) would be a significant and cost-effective improvement in the capacity of EMS systems to discharge their responsibilities to children, in part because the marginal cost (to EMS systems) of having durable and disposable materials and supplies suitable for pediatric cases is quite low. The committee calls for each health care provider or agency to define the emergencies that occur in the patient populations that they serve and to ensure that the necessary and proper equipment is available to treat critically ill and injured neonates, infants, children, and adolescents. To this end, **the committee recommends that all state regulatory agencies with jurisdiction over hospitals and emergency medical services systems require that hospital emergency departments and emergency response and transport vehicles have available and maintain equipment and supplies appropriate for the emergency care of children**. The objectives are to ensure that all hospital EDs and EMS systems maintain at least a minimal level of essential equipment and that consistency in these requirements is appropriately balanced with the flexibility needed in special circumstances. If these materials are used infrequently, they must be monitored on a regular basis so that they do not deteriorate or become outmoded.

Protocols have a role to play in every phase of the EMS system. They help direct decisions about when and where care should be given as well as guide what care is rendered and how. Each phase of care needs specific kinds of guidance. Protocols have a solid place already in many areas of health care, including EMS for adults. What is required now is more systematic development, dissemination, application, and evaluation of guidelines

and protocols with tested pediatric elements and components for the full range of EMS-C activities—dispatch, prehospital care, transport, ED services, hospital inpatient care, and emergency care in outpatient settings.

Medical control operates in two ways. *On-line* medical control implies real-time direction by designated medical personnel of prehospital care for seriously injured or ill children; services may include authorization for advanced life support procedures, triage and destination assignment, and management of patients who refuse care. *Off-line* medical control operates through policymaking activities, training programs, quality assurance efforts, and the like. In comparison with on-line medical control, these efforts are likely to be broader in scope and setting and to relate more to the long-term development of guidelines and protocols. Both on-line and off-line medical control require active participation, leadership, and commitment from health care professionals (particularly physicians) with experience and training in caring for infants, children, and adolescents.

Categorization of institutions and regionalization of services, often associated conceptually and practically, demand stronger involvement and investment than has been true heretofore. Categorization is an effort to identify the readiness and capability of a health care facility (usually a hospital) and its staff to provide optimal emergency care. Once criteria for classifying capabilities are available, implementation mechanisms can range from entirely voluntary to government designation. Regionalization (e.g., of ground and air transport systems, intensive care units, trauma centers, or burn centers) is often a more formal effort by outside agencies to specify particular centers or institutions that can offer complex, sophisticated services in a particular geographic area. It also can involve initiatives to develop formal arrangements between those facilities and less specialized ones regarding patient referral so as to promote optimal allocation of health care resources. Such arrangements may need to span state boundaries to bring services to those states, or parts of states, that lack specialty centers of their own.

If categorization and regionalization are pursued collaboratively, they can make EMS-C, as part of larger EMS systems, both more efficient and more effective. The range of interested parties—professional groups, individual practitioners and institutional providers, public and patient advocacy groups, local and state governments—creates special complexities. To improve chances for accurately categorizing facilities and designating regional referral centers for pediatric care, the committee generally prefers "local" as contrasted with "national" decisionmaking and solutions. Nevertheless, it sees some need for guidance at the national and state level to foster appropriate identification and classification of referral centers and to overcome difficult inter- and intrastate questions of legal and regulatory matters, transfer policies, and reimbursement. Specifically, **the committee recommends that all state regulatory agencies with jurisdiction over hospitals and EMS**

systems address the issues of categorization and regionalization in overseeing the development of EMS-C and its integration into state and regional EMS systems.

Communication

Communication is a critical, but complex, element in the successful operation of *systems* of emergency medical care. Context plays a strong role: actually delivering services to specific individuals raises communication issues different from those related to planning and exchanging information independent of patient care. Special questions about technology and equipment must be addressed. Participants in the communication process are obviously important factors, because patients and their families (or other bystanders), providers, and administrators all interact in various combinations and for various purposes, often under stressful circumstances. Better communication among all the providers who care for a patient calls for particular attention to follow-up on patient outcomes and further care and for feedback from other providers.

Public Access to Emergency Services

Easy public access to the EMS system is essential and can be facilitated with a universal emergency access number—9-1-1 and enhanced 9-1-1 (E9-1-1) emergency response systems. The latter typically draw on computerized databases to identify automatically the telephone number and location of the caller; this, in turn, means that the EMS system can route calls to appropriate jurisdictions and send assistance even if callers cannot communicate effectively because of their condition, language barriers, or other reasons. All these factors mean that response times can be reduced, with presumably more effective intervention and, ultimately, improved patient outcomes.

Movement toward universal adoption of 9-1-1 or E9-1-1 systems is regarded as so significant that **the committee recommends that all states ensure that 9-1-1 systems are implemented. The 9-1-1 system must be universally accessible and effectively linked to the emergency medical services system. Communities with 9-1-1 systems in place should move toward enhanced 9-1-1 capabilities. Communities with no 9-1-1 system should move directly to an enhanced 9-1-1 system.**

Communication Within EMS Systems

Sometimes, communication takes the form of obtaining accurate and timely advice rather than summoning an EMS response. Poison control

centers, especially those certified by the American Association of Poison Control Centers, can give the public and emergency care providers specialized guidance via telephone for managing the care of children exposed to potentially toxic materials. Parents also seek telephone advice from hospital EDs. This service can yield benefits, especially if given by well-trained staff with adequate guidance, but it also poses risks because no direct assessment of a child's condition can be made. The committee strongly advocates appropriate training, clear protocols, careful documentation, and routine monitoring in ED programs offering telephone advice.

Communication is a key component in prehospital services, using technologies that range from quite commonplace to rather sophisticated (e.g., standard telephone links, radio systems, microwave networks, and satellite links). On-line medical control requires good communications systems to link prehospital personnel with designated medical personnel (e.g., at a base hospital, which can be quite distant). When EMS systems develop on-line medical control, they must consider factors such as the availability and cost of base hospital staff, the level of care that prehospital providers are authorized to deliver, and the perceived need for direct medical oversight of prehospital care. In rural areas, where ED personnel and expertise in emergency medicine are limited, on-line medical direction may depend on communications systems that permit contact with more distant hospitals.

Good communication in hospital care is also crucial. ED personnel consult with "local" experts and a child's primary care physician, as well as with regional and national experts through poison control centers, pediatric referral centers, and telephone hot lines. Facsimile communication can be a valuable adjunct for long-distance and local consultation. When children must be transferred to referral centers, clear communication between hospitals and health care providers involved is essential to ensure that vital clinical and administrative information is exchanged. Here the committee believes that written transfer agreements between hospitals speed the transfer process by settling many procedural and administrative matters in advance. Development of centralized communication services also may ease transfer arrangements and help make efficient use of regional resources.

Communication plays an important role in ensuring that an ill or injured child obtains the full range of services, from prevention to acute care and on to rehabilitation, that comprise EMS-C. The committee thus argues that EMS-C systems must give special attention to follow-up in three areas: primary care, post-ED care, and rehabilitation. In addition, more and better feedback regarding patient care and system performance is needed throughout EMS and EMS-C systems; it promotes optimal patient care and effective linkages between system components. Feedback needs to reach individual providers as well as managers and administrators and may require systematic data collection.

Communication About EMS-C

Important communication *about* EMS-C should occur independently of the delivery of care to children. Providers with pediatric expertise must be active in organizing and operating EMS and EMS-C systems. Public education should be an integral part of these systems; injury prevention is an especially high priority. Opportunities for valuable communication among providers exist through various professional activities, including those related to the EMS-C demonstration grant program. Public safety organizations should be viewed as useful partners in communications about EMS and EMS-C. Building on these activities argues for a national EMS-C center or clearinghouse activity that can collect and evaluate EMS-C materials and serve as a focal point for information exchange.

Planning, Evaluation, and Research

Are children getting the EMS care they need, when and where they need it? Today, we cannot really answer this question in any systematic way. To answer it, three activities must receive attention: planning, evaluation, and research.

Meeting Data Needs for Planning and Evaluation

Most of the committee's attention to planning and evaluation centered on routine data collection efforts at the institutional, system, local, state, and national levels. These tasks require access to data, analytical resources to transform those data into meaningful information, and ways to use and disseminate the information to improve the care that children receive and to target prevention efforts. Four central points guided the committee's thinking about EMS-C data: (1) information on structural aspects of care, processes of care, and outcomes of care is essential; (2) individual components of an EMS system as well as the system as a whole must be examined; hence, information on individual patients needs to be linked across settings and providers; (3) analyses must be conducted at the local, state, and national levels; specific data needed at each level may vary, but in all cases, data collected for one level (e.g., nationally) should be useful at every level below that (e.g., states and localities); and (4) routine information gathering is a prerequisite for planning and evaluation purposes; such information may be useful for research, but additional primary, targeted data collection and analysis will often be required.

In principle, data on emergency care for children and the systems through which it is provided are available from an assortment of sources: prehospital services, hospital EDs, inpatient services in hospitals, trauma registries,

death records, health insurance claims forms, poison control centers, injury surveillance systems, and tracking and reporting systems for motor vehicle crashes. The EMS-C demonstration projects have also been a significant source of detailed information on EMS-C matters. Each of these data systems has different advantages and disadvantages; in no case, however, can one source provide the full range of information needed for planning, evaluation, or research.

The committee identified several problems warranting special attention and offered specific recommendations to address them. First, the lack of uniformity and consensus about data elements has led to a patchwork of information about EMS-C and little possibility of comparing or aggregating data across systems. Second, the inability to link and aggregate data, in particular to link information on individuals for episodes of care and to aggregate data across systems, makes it difficult to assess the effectiveness of emergency care.

Third, use of diagnostic coding for cause of injury must be expanded. The ICD-9-CM (International Classification of Diseases, ninth edition, clinical modification) external cause-of-injury codes, or E-codes (which classify the mechanism of injury), are available and in use in some settings. This information is valuable in identifying specific risk factors, setting targets for injury prevention programs, monitoring the effectiveness of prevention efforts, and assessing the cost of care for specific kinds of injuries. These points were regarded as sufficiently persuasive that **the committee recommends that states and other relevant bodies adopt requirements that ICD-9-CM E-codes be reported for all injury diagnoses reported for hospital and ED discharges**.

Fourth, valid data and performance indicators must be available. Diagnosis and measures of acuity or severity of illness and injury require particular attention. Fifth, knowledge of patient outcomes is essential for determining whether children are receiving good emergency care, but three fundamental concerns remain unresolved: what outcomes to measure, when to assess them, and how. The committee endorses the view of other IOM committees that many outcomes other than death must be considered: presence or absence of disease, various types of impairments, functional limitations, disabilities that interfere with age-appropriate activities, and core domains of health status (physical mobility and functioning, social and role functioning, and emotional and mental well-being).

More comprehensive information about the nature and outcome of emergency care for children is essential. Therefore, developing better and more extensive data collection and analysis programs, with a common core of basic descriptive data, must be a high priority for EMS-C systems across the country. Data are needed from all phases of care for emergencies, including prehospital, ED, inpatient and critical care, and rehabilitation. To

promote progress in this area, **the committee recommends that states implement a program to collect, analyze, and report data on EMS; those data should include all of the elements of a national uniform data set and describe the nature of emergency medical services provided to children. Furthermore, it recommends that mechanisms be developed to link all data on a specific case, where those data are generated by separate parts of the EMS system**.

The committee believes that data collection must get under way. It suggests an initial set of data elements for prehospital and ED services that should become part of a broader uniform national data set for EMS-C. Finally, the committee advises that EMS-C agencies in federal and state government (proposed below) assume responsibility for determining how these activities should be organized and supported; at the federal level, **the committee recommends that the federal center responsible for EMS-C develop guidelines for a national uniform data set on emergency medical services for children**.

Research

Research is needed to validate the clinical merit of care that is given, to identify better kinds of care, to devise better ways to deliver that care, and to understand the costs and benefits of the EMS and EMS-C systems now in place and toward which the nation should move. **The committee recommends that research in emergency medical services for children be expanded and that priority attention be given to seven areas: clinical aspects of emergencies and emergency care; indices of severity of injury and, especially, severity of illness; patient outcomes and outcome measures; costs; system organization, configuration, and operation; effective approaches to education and training, including retraining and skill retention; and prevention** . Other areas that warrant targeted research efforts include epidemiology of illness and injury, skills needed in prehospital care, and rehabilitation services. As with the earlier data-related recommendations, the committee believes that the proposed federal center must play a prominent role in supporting a comprehensive research agenda for EMS-C.

Leadership at the Federal and State Levels

The committee has by now clearly set forth its support for two goals: ensuring the development of high quality EMS-C as an integral component of existing EMS systems and ensuring strong links to providers of child health services. Although the committee's charge addresses only emergency care, its positions rest on the belief that society has a special obligation

to attend to the health care needs of children. They depend on others for their care and have no independent political voice through which they can make their needs known. Children's issues have been overlooked in this field, and the committee wishes to see that oversight corrected.

Agencies and Advisory Councils

To provide leadership in efforts to improve EMS-C, the committee sets forth two pairs of recommendations regarding the establishment of EMS-C centers or agencies at the federal and state levels.[1] Ensuring that children's emergency care needs receive adequate attention calls for action at the highest levels of federal and state government—by the Secretary of DHHS and by the governors. Specifically, **the committee recommends that:**

- Congress direct the Secretary of DHHS to establish a federal center or office to conduct, oversee, and coordinate activities related to planning and evaluation, research, and technical assistance in EMS-C;
- **Congress direct the Secretary to establish a national advisory council for this center; members should include representatives of relevant federal agencies, state and local governments, the health care community, and the public at large;**
- **states establish a lead agency to identify specific needs in emergency medical services for children and to address the mechanisms appropriate to meeting those needs; and**
- **state advisory councils be established for these agencies; members should include representatives of relevant state and local agencies, the health care community, and the public at large.**

The committee argues the case for these federal and state centers and advisory councils for EMS-C on six key grounds: (1) advancing an ethical imperative; (2) counterbalancing the weakness of children as a political force; (3) providing visibility for an important health service; (4) strengthening partnerships across federal, state, and local levels of government; (5) improving organizational efficiency; and (6) improving economic efficiency and countering economic losses.

The committee also concludes that the arguments for and strengths of these types of entities outweigh the drawbacks—both in general and for EMS and EMS-C in particular. Because past experience suggests that children's

[1] In discussions about states, the committee assumes a total of 54 "state" entities—namely, the 50 existing states, the District of Columbia, Puerto Rico, the Virgin Islands, and a combined area of American Samoa, Guam, and the Commonwealth of the Marianas. It uses the term "state" for simplicity of presentation.

requirements will not be adequately represented without an identifiable institutional voice, alternatives to establishing a center for EMS-C were deemed inadequate. The committee is confident that by starting at the highest levels with a public-private sector approach (which is inherent in the proposed advisory councils), efforts to ensure that children's emergency care needs are met will, at last, receive adequate attention.

The committee's charge to the proposed federal EMS-C center (presented in some detail in Chapter 8) covers 11 elements that were judged to be critical to progress in this field: developing a national strategy for EMS-C, coordinating efforts throughout the federal government, disseminating information and providing for a clearinghouse function, improving access to care, underscoring medical illness as a special concern in EMS-C, assisting education and training efforts, collecting and analyzing data, supporting enhanced research efforts, creating incentives for state action, providing technical assistance, and encouraging regional coordination. The first eight elements presuppose a national perspective; the last three aim to foster state and local efforts.

At the federal level, Congress and the Secretary of DHHS could assign responsibility for EMS-C to an existing agency or choose to give it to a newly created entity. Several models could be examined in drawing up plans for a federal EMS-C center. The committee recommends a fairly traditional federal agency arrangement, coupled with a national advisory council, but a hybrid approach to organizational structure and governance might be considered. Among the possible models are DHHS agencies for disease prevention and health promotion and for minority health, the two resource centers for EMS-C now supported by HRSA, two centers concerned with child abuse and neglect (one in DHHS, one in a state university), and an office concerned with juvenile justice in the Department of Justice.

At the state level, eight matters are paramount: planning state programs; enhancing education and training; strengthening structural elements of the EMS-C system; collecting and analyzing data; improving access to care; broadening interstate cooperation; ensuring public accountability; and, in terms of implementation broadly conceived, taking political considerations and fiscal constraints into account. Each state will have a unique mix of opportunities and constraints—based on factors such as population, geography, culture, political system, economics, and health care policies and resources—and each state agency must formulate programs suited to its specific circumstances. Thus, although the committee believes that lead agencies for the states are key to integrating EMS-C into EMS and in improving the outcomes of EMS-C, it does not present a single model for them.

Advisory councils proposed by the committee offer the opportunity for

a broad range of parties to participate in the development of EMS-C. The state bodies in particular should be able to accommodate the very diverse needs, resources, and organizational characteristics of individual states. The agenda for the advisory councils should include immediate concerns such as funding priorities as well as longer-term issues such as health care reform. Public accountability is essential and can be encouraged by requirements such as publication of annual reports that are widely disseminated.

Funding

To underwrite these efforts initially, **the committee further recommends that Congress appropriate $30 million each year for five-years (for a total of $150 million over the period) to support activities of the federal center and the state agencies related to EMS-C**. An illustrative allocation of the $30 million per year might be: $1.5 million for direct operation of the federal center in DHHS; $1 million for data collection, analysis, and minimum data set activities; $1.5 million for technical assistance and clearinghouse tasks; and $2.5 million for extramural research. The remaining $23.5 million might be allocated to the 54 "states" according to some formula based partly on fixed costs and partly on population factors. States and localities (e.g., counties, metropolitan areas), as well as organizations in the private sector, would be eligible to apply for federal funds for technical assistance, clearinghouse activities, research, and similar functions financed directly through the national center. State agencies could establish policies for making some portion of their own federal dollars available to local communities or in state private sector entities (in addition to whatever state funds such agencies might have available for these purposes).

The committee sees the recommended level of support as the absolute minimum for development of an effective program. A token, underfunded EMS-C program cannot discharge its responsibilities satisfactorily; it might, instead, waste the resources that are provided, lead to a false sense of security about the state of EMS-C today and tomorrow, and be unable to demonstrate any meaningful effect on the planning and delivery of emergency care for children. A funding recommendation must, for the sake of concreteness and face validity, be specific. The committee recognizes, however, that on the typically rocky road of implementation, some details and desirable (or not so desirable) aspects will emerge only as the program progresses. Thus, the recommended dollar figures above might well be revised, either upward or downward, over the proposed five-year funding period. Although to some these recommendations may seem costly in the face of stringent budget constraints at the federal and state levels, clearly in *absolute* terms this level of spending is not excessive for the goals set forth.

LOOKING TO THE FUTURE

Other important issues affecting EMS-C, including many of the concerns endemic to the entire health care sector in this country, remain unaddressed by this committee. For example, a systematic assessment of benefits and costs of EMS-C is needed, but serious conceptual and practical questions remain unanswered. Matters of health care reform, access to primary care, and pressures on emergency care facilities and providers are of considerable significance for EMS-C but lie beyond the scope of this committee's charge. Nevertheless, these issues form the backdrop against which the committee's recommendations will have to be played out and should not be overlooked.

Issues of Benefits and Costs

In an era of severe budget constraints at the national, state, county, and municipality levels, the difficulties of paying for programs such as EMS and EMS-C loom large. If such groups are to be persuaded to find the necessary funds, estimates of the costs of programs and the benefits expected from them ought to be generated. The current dearth of information about the benefits, in terms of health outcomes, of EMS-C programs *per se* clearly hinders the development of quantitative estimates of cost-benefit or cost-effectiveness ratios.

Costs and financing issues rank in significance with patient outcomes and benefits. Neither the public nor the private sector can be expected to handle the burden of rising costs alone. Hence, a partnership between the public and private sectors (such as the agency-plus-advisory-council structure recommended by the committee) will be required. The committee believes that national and state advisory councils may well want to place cost issues high on their respective agendas—especially because reallocations of health sector dollars among competing needs may be likely in the near term.

A Changing Health Care Environment

The health care system within which EMS-C exists faces significant questions regarding its future shape and structure. Although EMS-C concerns are not likely to determine the answers to these questions, EMS-C will certainly be affected in important ways by the decisions that are made.

Health Care Reform

The growing move toward health care reform will generate intense debates about rising rates of expenditures and inadequate access to health care for millions. Significant reform efforts will require painful choices for

many parties and trade-offs among several desirable objectives. It will also demand that a considerable array of difficult topics be competently addressed: for example, who pays; what are the covered benefits; how universal are coverage and access; how best should we reach special populations in need; how will we contain costs; how can we maintain and enhance the infrastructure for health care (e.g., the information and knowledge base, health personnel and facilities); and how can we maintain, if not improve, the quality of health care and the value received for our health care dollar.

This committee takes the position that parties responsible for the future of EMS and EMS-C must become knowledgeable about technical aspects of health care reform proposals. The proposed national and state advisory councils might well be expected to monitor how the interests of EMS-C and EMS more generally are reflected in reform proposals. How (and how well) proposals attend to broader issues of health care for children must be of special concern for those interested in EMS-C.

Special Challenges to EMS and EMS-C

Regardless of the outcome of the health care reform process, EMS-C must contend with more immediate challenges that arise out of problems facing EMS and the larger health care community. EMS systems, particularly in major urban areas, face increasing demand for their services, often in circumstances in which emergency care resources are scarce or overburdened. In rural areas, many small hospitals have closed (200 between 1980 and 1988 alone), and prehospital providers face serving large regions with limited staff and equipment.

Emergency care providers themselves are among the scarce resources in EMS. The loss of volunteer EMTs and paramedics, who are the only providers of prehospital care in some localities, is a special concern for some EMS systems. Nursing shortages can contribute to problems in EDs and elsewhere in the continuum of care. Tensions associated with the demands of emergency care exacerbate the loss of providers of all types and the difficulties in replacing them.

Hospitals, EDs, and EMS systems are facing concerns over the impact of statutory requirements for minimum levels of care and appropriateness of transfers of patients between facilities (the "anti-dumping" provisions of recent legislation). These legal standards have created various uncertainties, such as the level of service required before a patient can be discharged or transferred. For hospitals with comparatively minimal EDs or extremely overcrowded EDs, pressures for staffing and equipment (and consequent costs) may be intense. Thus, the net effect may prove to be a reduction in the health care resources available to the very patients whom the "anti-dumping" legislation was intended to help.

Questions about the future of hospital EDs and the availability of primary care for children are closely linked and of special concern for EMS-C. Because many children, particularly those from disadvantaged families but increasingly middle-class children, lack adequate access to primary care and preventive services, EDs are called on more and more to provide those services. The committee did not attempt to reach a consensus on whether EDs should assume wider responsibility for primary care, but it did agree on two points. First, ED caseloads are directly affected by practice patterns in primary care, so the future role of EDs cannot be determined in isolation. Second, a clear dilemma exists: In some locales, primary care provided in hospital EDs may permit EMS-C interests to thrive; in others, primary care may swamp ED resources and erode capacity to meet true emergency needs.

In the short-term at least, expanding the primary care system quickly or broadly enough to relieve burdens on hospital EDs will not be possible, and those EDs now under stress will doubtless continue to experience problems. Thus, the role of the ED in health care delivery in general and the implications of that role for delivery of genuine emergency care should be addressed explicitly in studies that may be done on the future of primary care, case management and managed care programs, trauma systems, and the American hospital. Moreover, as the role of EDs evolves, the ramifications for education and training of professionals who staff EDs will need to be better understood.

FINAL THOUGHTS

Attempts to ensure that children receive adequate emergency medical care are a recent development in the field of EMS. This committee has adopted the position that EMS-C efforts in the future must consider all the elements that constitute good emergency care *and* good health care generally, working through channels in both the public and private sector. The needs of children must be more widely recognized and made a genuine priority for policymakers at national, state, and local levels, particularly those in a position to influence the future directions of EMS and EMS-C. The conclusions and recommendations of this IOM study committee are intended to foster increased public attention and action at the highest levels toward an EMS-C system for the 21st century in which all parties can be confident and all can be proud.

SUMMARY OF RECOMMENDATIONS OF THE COMMITTEE ON PEDIATRIC EMERGENCY MEDICAL SERVICES

The committee recommends that:

Education and Training

- states and localities develop and sustain programs to provide to the general public of all ages adequate and age-appropriate levels of education and training in safety and prevention, in first aid and cardiopulmonary resuscitation, and in when and how to use the emergency medical services system appropriately for children. It recommends further that:
  - the content of such programs reflect the particular needs of each community;
  - the content of such programs reflect the special medical, developmental, and social needs of children;
  - parents and other adults who are responsible for the care and education of children (e.g., day-care workers, teachers, coaches) receive highest priority in such programs; and
  - adolescents also be a high priority in this endeavor.
- states and localities develop and maintain specific guidelines or criteria to ensure basic consistency and quality of educational programs across communities and populations reached, including specific content elements that those education programs should cover.
- organizations that accredit training programs for prehospital care providers require that the curricula for EMT-Basic, EMT-Intermediate, and EMT-Paramedic provide training in pediatric basic life support; in the medical, developmental, and social needs of all children; and in caring for children with special health care needs.
- accreditation organizations require that curricula for EMT-Paramedic programs include training in advanced life support for children.
- appropriate accrediting organizations require that the primary curricula for all health care professionals include training in basic resuscitation skills and the use of the emergency medical services system. These curricula must give specific attention to the unique medical, developmental, and social needs of children.
- appropriate accrediting organizations ensure that graduate nursing programs in emergency, pediatric, and family practice nursing include training in emergency care for children, including advanced resuscitation.
- the Accreditation Council for Graduate Medical Education ensure that residency programs for emergency medicine, family medicine, pediatrics, and surgery include training in emergency care for children, including advanced resuscitation.

Putting Essential Tools in Place

- all state regulatory agencies with jurisdiction over hospitals and emergency medical services systems require that hospital emergency departments

Summary of Recommendations-*continued*

and emergency response and transport vehicles have available and maintain equipment and supplies appropriate for the emergency care of children.

- all state regulatory agencies with jurisdiction over hospitals and emergency medical services systems address the issues of categorization and regionalization in overseeing the development of EMS-C and its integration into state and regional EMS systems.

Communication and 9-1-1 Systems

- all states ensure that 9-1-1 systems are implemented. The 9-1-1 system must be universally accessible and effectively linked to the emergency medical services system. Communities with 9-1-1 systems in place should move toward enhanced 9-1-1 capabilities. Communities with no 9-1-1 system should move directly to an enhanced 9-1-1 system.

Planning, Evaluation, and Research

- states and other relevant bodies adopt requirements that ICD-9-CM E-codes be reported for all injury diagnoses for hospital and emergency department discharges.
- states implement a program to collect, analyze, and report data on emergency medical services; those data should include all of the elements of a national uniform data set and describe the nature of emergency medical services provided to children.
- mechanisms be developed to link all data on a specific case, where those data are generated by separate parts of the emergency medical services system.
- the federal center responsible for emergency medical services for children develop guidelines for a national uniform data set on emergency medical services for children.
- research in emergency medical services for children be expanded and that priority attention be given to seven areas: clinical aspects of emergencies and emergency care; indices of severity of injury and, especially, severity of illness; patient outcomes and outcome measures; costs; system organization, configuration, and operation; effective approaches to education and training, including retraining and skill retention; and prevention.

Federal and State Agencies and Funding

- Congress direct the Secretary of the Department of Health and Human Services to establish a federal center or office to conduct, oversee, and coordinate activities related to planning and evaluation, research, and technical assistance in emergency medical services for children.
- Congress direct the Secretary to establish a national advisory council for this center; members should include representatives of relevant federal agencies, state and local governments, the health care community, and the public at large.

- states establish a lead agency to identify specific needs in emergency medical services for children and to address the mechanisms appropriate to meeting those needs.
- state advisory councils be established for these agencies; members should include representatives of relevant state and local agencies, the health care community, and the public at large.
- Congress appropriate $30 million each year for five-years—a total of $150 million over the period—to support activities of the federal center and the state agencies related to emergency medical services for children.

1

Introduction

Emergency care for children's serious illnesses and injuries is a part of the health care system that parents hope never to need. Unfortunately, many families will need such care for their children, and when they do, they will want the best care possible. Life-threatening emergencies arise in many forms—motor vehicle crashes, drownings, poisonings, burns, pneumonia, meningitis, and asthma only begin a long list. Each year, injury alone claims the lives of more children and young people between the ages of 1 and 19 than do all forms of illness. Acute illness, even though it leads to fewer deaths than injury, is responsible for most of the admissions to pediatric intensive care units (PICUs) and a large proportion of emergency department (ED) visits.

Limited national data make it difficult to determine with any precision how many children require emergency care. What is known is that in 1988, some 21,000 children and young people under the age of 20 died from injury, and additional deaths occurred because of acute illness (NCHS, 1992b). Beyond these deaths are many more children who survive but must be hospitalized or treated in EDs and other outpatient settings. In 1990, children experienced about 266,000 hospitalizations principally for injury and another 701,000 just for respiratory conditions (NCHS, 1992a). Data on ED visits are especially weak, but estimates are that children account for about 30 million of the total (i.e., about one-third of a reported total of 92 million in 1990) (ACEP, 1990d; American Hospital Association, 1991). Children in certain vulnerable populations, such as those with special health care needs or without adequate primary care, are likely to require emergency services even more than many other children.

Clearly, preventing emergencies is the best "cure" and must be a high priority, but as yet, prevention is far from foolproof. When prevention fails, families should have access to timely care by trained personnel within a well-organized system of emergency medical care. Services should encompass prevention, prehospital care and transport, ED and inpatient care at local hospitals and at specialty centers, and assistance in gaining access to appropriate follow-up care including rehabilitation services. However, for too many children and their families, those resources are not available when they are needed. This committee believes that efforts must be made to change that situation; in this report it outlines the steps it judges should be taken to make that change.

THE ISSUE: ENSURING EMERGENCY MEDICAL CARE FOR CHILDREN WHO NEED IT

Historically, the needs of children have largely been overlooked as emergency medical services (EMS) have developed in this country. The original efforts in EMS to institute more effective trauma and cardiac care were led by physicians trained in adult medicine, many of whom had little experience with pediatric patients and the unique features of pediatric care. Even the development of neonatal intensive care programs brought little attention to the needs of older infants, children, and adolescents.

In the early 1980s, growing numbers of pediatric specialists and professional societies began to participate in EMS system development; only then was attention focused on the need for specialized training programs and practice guidelines for pediatric emergency care. Efforts to introduce appropriate pediatric care brought changes in some EMS systems. Early successes such as Maryland's pediatric trauma system and the Los Angeles program to identify EDs qualifying as "emergency departments approved for pediatrics" or "pediatric critical care centers" have served as models for similar efforts elsewhere. Specialized training, which has become available through locally developed programs and nationally recognized courses, has helped emergency care providers acquire the knowledge and skills to improve their care of children.

Efforts to improve emergency medical services for children (EMS-C) have had to contend with a daunting array of targets. EMS systems have rarely developed as comprehensive and coordinated programs. Often, the various elements of an EMS system—state and local government agencies, prehospital providers and their agencies, hospital staff and ED and inpatient services, specialized referral centers, and so on—operate under differing authorities and with differing perspectives. Trying to ensure that the emergency care needs of children are met has required working with each separate system element and through a variety of channels to implement changes.

Furthermore, this committee and many other observers are persuaded that improving EMS-C requires attention to broader aspects of child health care.

Emergency medical care is caught up in many of the concerns endemic to the entire health care sector in this country: for example, complexities of the organization, delivery, and financing of health care; financial, insurance, and other barriers to access to appropriate care; inadequate numbers of health care personnel and perverse patterns of specialization and geographic location; and great variations in use of services and questions about the appropriateness and quality of health care (NRC/IOM, 1992a,b). Liability concerns are complicated by questions of consent for treatment when parents are unavailable or adolescents seek care on their own. What needs to be understood is that these matters are more vexing for children than they are for adults.

In the past, much of the public has assumed that EDs and emergency care providers were adequately prepared to treat any patient. In fact, their ability to care for children has been limited, and the public is becoming increasingly aware of the need for attention to EMS-C concerns. In January 1992, a *U.S. News and World Report* cover story highlighted both the general lack of readiness in many EMS systems to care for children and the successful work that has been done in some cities and states to change that (Buckley, 1992). The committee intends for its report to build on this increasing attention to EMS-C—and to broader child health issues—among public officials, professional communities, parents, and the general public.

THE INSTITUTE OF MEDICINE STUDY

Origins of the Study

The efforts of the pediatric community to improve emergency care for children received a substantial boost in 1984 with the passage of federal legislation (Public Law 98-555) authorizing a demonstration grant program on EMS-C. This program is administered by the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services. Since the first four grant awards in early 1986, projects in 31 states have led to the development and dissemination of new training programs and approaches to organizing services. Beginning with grants in 1991, the emphasis of the program shifted to implementation of EMS-C programs and to further work in specific areas through "targeted issues" grants. At the suggestion of Congress, HRSA requested that the Institute of Medicine (IOM) undertake a study to assess the need for and effectiveness of pediatric EMS. The IOM was expected to draw on the experiences of the demonstration grant projects but to look at the issues more broadly than these individual projects could.

The current study is, in fact, a logical extension of previous work by the National Academy of Sciences (NAS) and the IOM. In 1966, an NAS conference formulated recommendations regarding techniques and training in cardiopulmonary resuscitation (NAS/NRC, 1967). Also in 1966, the NRC issued the landmark report *Accidental Death and Disability: The Neglected Disease of Modern Society* (NAS/NRC, 1970a), which helped focus attention on the lack of adequate trauma care throughout most of the country. Subsequent reports on various aspects of EMS have also had a major impact in shaping the development of EMS systems around the nation (NAS/NRC, 1968, 1970b,c, 1972, 1978a,b, 1980). More recent studies on injury and disability have also emphasized the need for skilled emergency care to limit the adverse consequences of injury and illness (NRC/IOM, 1985; IOM, 1991b).

None of these reports gave much specific attention to pediatric care. With the current report, therefore, the IOM welcomes the opportunity to bring to EMS-C the kind of visibility that the NAS was able to bring to adult emergency care more than 25 years ago.

Conduct of the Study

In June 1991, a 19-member committee, chaired by Donald N. Medearis, Jr., M.D., was formally constituted by the IOM to conduct the requested study of pediatric EMS. Members of the committee were chosen so as to bring to the study a broad range of expertise and perspectives, including pediatrics, emergency medicine, trauma, nursing, prehospital emergency services, injury prevention, hospital administration, public policy, and local government, not to mention the personal perspective of parents concerned about the well-being of their children. Six members of the committee have participated in EMS-C demonstration grant projects.[1]

The charge to this committee included the following tasks:

- estimate the nature and extent of the problems of mortality, morbidity, disability, and other negative consequences associated with emergency, out-of-hospital pediatric trauma and critical illness;
- estimate the adequacy of current efforts to reduce the negative consequences of these emergencies, including attention to the linkages between acute services, prevention, and rehabilitation;
- define the desirable characteristics of systems of services that could achieve the above effectively and efficiently, and specify the ways that existing EMS systems must change if the desired pediatric capacity is to be achieved;
- develop criteria and data requirements for surveillance of emergencies and their negative outcomes, their determinants and contributing factors,

and the evaluation of service systems dealing with pediatric emergencies and related prevention and rehabilitation; and

- consider means by which the federal government could encourage better systems for reducing pediatric emergencies and their negative consequences in the states and localities, including appropriate roles for the private sector.

In responding to this charge, the committee specifically took into account (1) actions by EMS system components needed to reduce the negative consequences of pediatric emergencies; (2) the full spectrum of facilities involved in responding to pediatric emergencies; (3) particular problems and capabilities of urban and rural settings; and (4) experience gained from the EMS-C demonstration projects.

Between June 1991 and December 1992, the committee held six meetings at which it identified critical issues, explored committee members' views, sought additional information on specific concerns, formulated recommendations, and refined drafts of this report. At two of those meetings, the committee was joined by invited guests who could speak directly to experiences and concerns not otherwise represented among committee members. Members of the committee also had an opportunity to talk with EMS-C grantees at two conferences held in connection with the HRSA demonstration grant program.

A VISION OF THE IDEAL SYSTEM: ESTABLISHING CRITICAL LINKAGES

In too many spheres, public policies and programs for children seem to be fragmented, with special policies devised *ad hoc* or *de novo* to meet special needs (NRC, 1982; Harvey, 1990). The committee found this unacceptable for EMS-C. In responding to its charge and conducting study activities, therefore, the panel adopted a broad vision of an ideal system for EMS-C, one that can contribute to a comprehensive and coherent approach to the care of children.

The committee emphasizes that children must not be seen as a "special-interest group" in pursuit of appropriate emergency medical care. Instead, ensuring high quality care for children should be viewed as a further step in the process that has led EMS systems to develop increasingly sophisticated care for adults suffering heart attacks or injured in automobile crashes. Furthermore, emergency medical care cannot be treated as a process unrelated to a child's routine health care needs. The connections between primary care, emergency care, tertiary (i.e., specialty) care, and rehabilitation should be as seamless as possible. Furthermore, EMS-C systems need to be prepared to care for *all* children: regardless of age (infants, toddlers, schoolchildren,

or adolescents); condition (ill, injured, or with special health care needs); or economic resources (insured, uninsured, or in a public assistance program).

These concerns led the committee to conclude that, if children's needs in emergency care are to be met, EMS-C must establish three important linkages. First, the separate components of EMS-C must be linked to form a system. Second, EMS-C must be linked to the larger EMS system. Third, EMS-C must be linked to the broader elements of child health care.

Linking Components of EMS-C

A diverse array of people, functions, and facilities are required for EMS-C. In the view of this committee, essential elements include community education, prevention programs, a means of requesting assistance (e.g., a 9-1-1 telephone system), skilled prehospital care, transport for ill and injured children, EDs prepared to offer basic emergency care to children, referral centers able to provide advanced emergency care and timely access to pediatric specialists, PICUs, other inpatient services, and access to further care such as pediatric rehabilitation programs. EMS-C must also include planning for the care of children in disaster and mass casualty situations. Basic services should be available in every community, but specialty care should be treated as a regional resource.

The committee agrees fully with the many others who believe that these elements produce the most effective care when they are explicitly linked in an EMS-C system (e.g., AAP, 1988b, 1992e; Haller, 1989b, 1990; Ramenofsky, 1989a; ACEP, 1990d; Ludwig and Selbst, 1990; Seidel and Henderson, 1991; Dieckmann, 1992a). A system should provide a degree of planning and coordination that operates beyond the scope of any single component. No single system configuration will be appropriate for every community; local conditions, needs, and resources will shape how systems develop. Communities should not, however, be willing to rely on a "system" that is simply the independent activities of various individual and institutional health care providers.

This committee is also firmly committed to the position that care for pediatric trauma and illness should be provided under a single EMS-C umbrella. The efforts to develop trauma systems, including special pediatric trauma centers, have provided valuable experience in systems development, but they also have encouraged people to think about trauma separately from illness. As others have noted, the resources needed for trauma care and for illness care are more similar than different (Haller, 1987, 1992; Ludwig, 1989; Ramenofsky, 1989b; Weinberg, 1989). Surgical and medical specialists each have contributions to make to the care of seriously ill or injured children.

Linking Children to EMS

The efforts to further the development of EMS-C must not lose sight of the broader EMS picture. Because only limited numbers of pediatric specialists and pediatric specialty hospitals are available across the country to care for ill and injured children, EMS-C needs to be able to rely on the services of the many EMS systems already in place. That means working with them rather than attempting to duplicate their substantial resources in personnel, training, equipment, and experience (Haller, 1987; ACEP, 1990d; Dieckmann, 1992a). In any case, much as with care for trauma and illness, the line between caring for children and caring for adults is not always sharp (e.g., in obstetrical and perinatal care or care for adolescents and young adults [Haller, 1987]). EMS-C should also be coordinated with other related programs such as poison control centers and neonatal intensive care units.

Just as the impulse to create a freestanding EMS-C system must be overcome, so must reluctance on the part of EMS systems to accept the obligation to prepare adequately for pediatric care (Foltin et al., 1990; Thomas, 1991b). EMS systems have traditionally been built around adult care by health care providers with little experience in caring for children. Some may not recognize the distinctive aspects of pediatric care; others may recognize only that they are unsure what the appropriate care is. To change this situation, the pediatric community has begun and must continue to contribute its expertise to EMS systems; its primary responsibilities here are to ensure that children's needs are recognized and that resources needed to care appropriately for children (such as training, equipment, and guidelines for treatment) are available.

Linking Emergency Care to Children's Health Care

Skilled emergency care is an important element of a comprehensive system of health care for children, but it is only one of many kinds of care that children need. Reliable access to primary care that can emphasize prevention and address, on a continuing basis, all aspects of children's health and development—a concept described as a "medical home"—should be the background against which EMS-C operates (Sia and Peter, 1988; Sia and Stewart, 1989; Haller, 1990; Seidel and Henderson, 1991; AAP, 1992a,e). The American Academy of Pediatrics (AAP, 1992a) describes the medical home as care for infants, children, and adolescents that is

- "accessible, continuous, comprehensive, family-centered, coordinated, and compassionate" and
- "delivered or directed by well-trained physicians who are able to manage or facilitate essentially all aspects of pediatric care" and who "should

> be known to the child and family and able to develop a relationship of mutual responsibility and trust with them" (p. 251).

The committee supports a medical home that offers financially and geographically accessible care that is available around the clock and over time to provide continuity. With an emphasis on prevention and early intervention, a medical home can provide the kind of comprehensive, family-centered care that can avert some emergencies and coordinate care when it is needed. The committee also recognizes that this kind of care is an ideal that is far from the reality of care available to many children. They believe, however, that EMS-C can promote better care for children by emphasizing the value of such a source of comprehensive and continuing care.

Primary care providers have important contributions to make to EMS-C (AAP, 1988b, 1992e; Ludwig and Selbst, 1990; Seidel and Henderson, 1991). They are principal agents for prevention of serious illness and injury by providing children with immunizations and other clinical preventive services, by treating children in early stages of illness that otherwise might worsen, and by counseling parents and children about avoidable risks for illness and injury (e.g., proper use of child safety seats or maximum water heater temperatures). They also should be able to inform parents about when and how to seek emergency care and be prepared themselves to treat emergency conditions encountered in the office setting. Further, they should help develop and support adequate EMS-C resources in the community.

When emergency care is needed, a child's primary care provider should, at a minimum, be informed of the care the child received. When children need hospitalization (for stabilization, definitive care, and perhaps transport between facilities), as well as rehabilitation and follow-up care, the primary care provider should play a major role in coordinating that care. Involving the medical home in emergency care is especially important for children with special health care needs, whose treatment may differ from what other children might generally receive.

GUIDING PRINCIPLES

To this vision of EMS-C as a system of care that should operate as an integral element of the broader realms of EMS and child health, the committee added other guiding principles. A fundamental position is that society has a special obligation to address the needs of children because they must depend on others for the protection of their health and safety and have no political voice of their own. EMS-C must be recognized as a public responsibility; the "market" cannot be relied on to produce the kind of planning and cooperation required to make services available to all who need them. The committee shares the view of the AAP (1992d) that children's

access to optimal emergency care should not be affected by socioeconomic status.

Action on EMS-C is needed at the highest levels of federal and state governments to ensure that adequate resources are devoted to children's needs in this area. Legislative and regulatory authority can be used to create requirements and incentives to provide necessary EMS-C resources. Governmental action should not, however, be the only means by which advances in EMS-C are achieved. Community efforts by individuals and voluntary organizations and steps by health care or public safety professionals can be vital to the initiation and success of EMS-C programs.

Major societal issues are affecting EMS-C by increasing the need for emergency care and by altering the ways in which that care is delivered. Although this committee is not in a position to address these issues in a comprehensive manner, it underscores their significance and calls for appropriate efforts by other groups and by society at large to work toward solutions. In recent years, urban violence associated with easy access to guns and illegal drugs has become a particular threat to the physical and psychological health of inner-city youth, creating a tragic increase in the need for emergency care. New products and technologies, despite efforts to reduce risks, can expose children to new hazards such as toxic substances or recreational injuries. For poor or uninsured children, inadequate access to primary care contributes to a greater need for truly urgent care because conditions remain untreated. It also leads to otherwise unnecessary use of the ED for basic care of minor illnesses and injuries. The continuing loss of health care services in rural areas and the increasingly desperate financial position of many states and localities impose constraints not only on resources available to support emergency care but also on all publicly funded health care programs. The committee believes that problems such as these demand urgent attention. Addressing the current needs in EMS-C will not resolve these larger issues, but it can help ensure that high quality emergency care will be available to children who require it.

ORGANIZATION OF THE REPORT

This report reflects the broad scope of the committee's concerns and discussions. It presents those matters that the committee sees as especially important for EMS-C and explains the basis for the committee's formal recommendations. The next two chapters provide background regarding emergency medical care for children and introduce many of the issues that subsequent chapters address in greater detail. Chapter 2 describes differences between children and adults that account for differences in the care they need and examines the epidemiology of serious illness and injury in children. Chapter 3 presents a history of EMS and EMS-C and reviews the

organization and operation of EMS systems and their components. *Note* : Readers familiar with EMS and EMS-C may wish to go directly to the subsequent chapters that address specific issues and recommendations.

Chapter 4 examines education and training for both health care providers and the public. The committee's recommendations target curriculum changes and other improvements in education programs for health care providers that will better prepare them to deliver emergency care to children. The committee also addresses preparing primary care providers, parents, and other adults responsible for the care of children (e.g., teachers, day-care providers, coaches) to recognize the need for emergency care, to obtain that care, and to offer basic first aid and resuscitation to children until professional care is available.

Chapter 5 turns to those tools that health care providers and that emergency care systems must have to deliver good emergency care to children: appropriate equipment; sound guidelines for pediatric care; pediatric expertise in medical direction for prehospital care and system planning; a clear indication of the pediatric care capabilities of area hospitals; and a regional approach to emergency care to help make efficient and effective use of limited pediatric specialty resources.

Chapter 6 takes up formal and informal communication resources needed in EMS-C. The committee emphasizes the need for public access to emergency assistance through 9-1-1 and enhanced 9-1-1 telephone systems. It also addresses communication needs within EMS-C systems, including technical aspects of communication and the role of communication in coordinating patient care; arranging expeditious transfers to other sites for more specialized care; and generally for planning, operating, and evaluating EMS and EMS-C activities.

Chapter 7 emphasizes the need to develop on a nationwide basis good information resources in EMS-C for planning system operations and evaluating performance and care. Recommended steps include identification of a uniform core of essential data elements and their use in systematic data collection. Use of existing diagnostic codes to identify external causes of injury (known as E-codes) is also recommended as a source of valuable information on injury risks. In addition, Chapter 7 presents a wide-ranging research agenda emphasizing questions on clinical aspects of care, measuring severity and outcome of illness and injury, costs, optimal system configuration and operation, effective approaches to education and training, and prevention.

In Chapter 8, the committee makes its final recommendations, which call for establishing identifiable leadership in EMS-C at the federal and state levels through federal and state agencies, with the assistance and oversight of advisory councils. The committee recommends modest amounts of federal funding to implement new programs, to support research activities,

to create an information center, and to promote the development of EMS-C programs and resources and their integration into wider EMS systems at the local, regional, and state levels. The chapter also discusses the roles of local or county health agencies, state and local professional groups, community groups, and concerned individuals.

Chapter 9 concludes the report with a brief examination of some of the problems facing EMS and EMS-C today and possible implications for EMS-C of some of the important issues facing the larger health care community.

AUDIENCE FOR THIS REPORT

The committee intends for this report to speak to a broad audience among public officials, the health care community, parents, and the general public. Some portions will be of greater interest and relevance than others to specific readers. Nevertheless, if the recommendations set forth are to be followed, many groups and individuals will have roles to play.

Federal, state, and local officials and legislators can give valuable leadership in efforts to ensure that EMS systems are prepared to provide the care that children need. In both the policies they implement and the resources they make available, officials at all levels of government will do much to determine the progress that is made. This report offers a guide to those matters that warrant the highest priority.

The committee hopes that this report will help make a broad range of health professionals aware of the need for action to ensure that clinicians are adequately trained, necessary resources (e.g., equipment, practice guidelines, and medical direction) are available in identifiable facilities, communication technologies and practices support optimal care, information systems and data are available to contribute to planning and evaluating care, and essential research is undertaken. Among those whom the committee wishes to reach are physicians in pediatrics, family practice, surgery, and emergency medicine; nurses in general and specialty-care settings; emergency medical technicians at all levels; hospital administrators; and medical professionals responsible for organizing and operating EMS systems.

Parents are a crucial part of the audience for this report. The committee wants to encourage parents and other responsible adults to become aware of their community's EMS-C resources and how to use them. Individuals and organizations within a community can become strong and effective advocates for high quality emergency care resources for their children.

THE COMMITTEE'S GOAL

The "top down" approach to implementing EMS-C, which is embodied in the proposals for federal and state agencies and advisory groups, is essential

to ensure that the needs of *all* children are addressed in a comprehensive and efficient manner. A "bottom up" approach, which depends on the efforts of concerned and committed individuals and communities, is a vital element in making sure that EMS-C is recognized as a priority and receives the attention it requires. The committee's vision of the future of EMS-C—as an integral element of comprehensive, high quality EMS systems and firmly linked to the idea of a medical home for health care for children—holds both of these approaches to be critical to success.

Thus, the challenges that lie ahead are formidable. The committee's goal for this report is to clarify those challenges and to identify the ways they can be successfully and expeditiously met. Further, it aims to intensify the focus on emergency care of children and, indeed, to make it a genuine priority with decisionmakers who are in a position to influence the future direction of emergency medical care and care for children generally.

NOTE

1. The six committee members who participated in EMS-C demonstration grant projects are Martin R. Eichelberger, M.D.; J. Alex Haller, Jr., M.D.; Patricia A. Murrin, R.N., M.P.H.; James S. Seidel, M.D., Ph.D.; Calvin C.J. Sia, M.D.; and Joseph J. Tepas III, M.D.

2

Risking Our Children's Health: A Need for Emergency Care

In 1988, about 21,000 children under the age of 20 died from injuries; additional deaths occurred as a result of acute illness. Hundreds of thousands more children were hospitalized, and millions visited emergency departments (EDs). Tragically, the care that has been available to these children has not always been adequate. Children have unique clinical needs that cannot always be met by care designed for adults. Until recently, however, important differences between children and adults in anatomy, physiology, pathology, and psychology have received relatively limited attention from EMS systems (Seidel et al., 1984; Seidel, 1986a). Furthermore, limited data make it difficult to determine in sufficient detail how many children need emergency care, the kinds of illnesses and injuries they experience, and the nature and outcome of the care they receive.

The data that are available provide at least a partial picture of the emergency care that children need. In the broadest terms, injury presents the greatest threat to children's lives and takes an especially heavy toll among adolescents and young adults. Infants and very young children are more susceptible to serious illness than older children are, and until children approach adolescence, respiratory diseases lead to more hospitalizations than do injuries.

This chapter discusses differences between children and adults and the need for special attention to those differences in emergency care. It also reviews available information on the numbers of children and the kinds of conditions that require emergency care.

DEFINITIONS

Children

Childhood begins at birth, but there is no single, universally recognized age at which childhood ends and adulthood begins. It is possible, for example, to register to vote at age 18 but not to be able legally to consume or purchase alcoholic beverages until age 21. Adolescents are biologically capable of becoming parents as early as 11 or 12 years old but cannot get a driver's license until they are 16 or 17. Even though markers such as these may draw the boundary between children and adults at different ages, the fact that there is a boundary to define demonstrates a need to distinguish children from adults.

The American Academy of Pediatrics (AAP, 1988a) has set an upper age of 21 to define the patient population that falls under its purview, but various factors play a role in determining the age range used in specific settings. The special demands of chronic illness may, for example, call for continued care beyond the age of 21 by pediatric specialists (AAP, 1988a), and a conference on childhood injury research recommended including individuals up to age 24 (NICHD, 1992).

Hospitals and EMS systems often use younger ages to define the pediatric population. A survey of state EMS agencies found that only 12 set a specific age limit: five states used age 14; two, age 16; three, age 18; and, of the remaining two, one used age 19 and the other age 21 (Seidel, 1991). Some states had no policy and others relied on case-specific factors to make a determination. Studies that the committee drew on throughout this report used a variety of ages to define pediatric populations.

In situations where a specific age is set for adult patients, children may be defined by default. The survey of state EMS agencies found that 19 of 27 states that specified a minimum age to define adult patients use age 18 (Seidel, 1991). For its new indicators of the quality of trauma care, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO, 1991) also defines adults as patients age 18 and older.

Because older adolescents are much more similar anatomically and physiologically to adults than younger children are, they can often be treated successfully by health care providers without specialized pediatric training. Hospitals may also find that specific circumstances, such as injuries from assaults or gun shots, make it appropriate to separate care for younger children from that for older adolescents (Barlow, 1989; Haller, 1989a). Nevertheless, adolescents, who are not yet adults and who have characteristic psychosocial needs, may make a better recovery if they can receive care from providers with specific training in pediatric and adolescent medicine.

The committee declined to fix a specific age range to define "children,"

preferring instead to emphasize that its concern encompasses the entire span of childhood: infants, toddlers and preschoolers, schoolchildren, and adolescents. Its view also covers the emergency care needs of all children regardless of basic health status—those who have been healthy before the onset of an emergency condition and those with chronic illnesses or other special health care needs. The one exclusion deemed appropriate for purposes of this report is newborns and the intensive care that they may require immediately after birth.

Emergency Medical Services

The committee views emergency medical services for children (EMS-C) as specialized care, provided by physicians, nurses, paramedics, emergency medical technicians, allied health personnel (e.g., respiratory therapists, physical therapists), and others, that covers a wide range of services including prevention, prehospital care, stabilization and definitive care in various inpatient settings, and rehabilitation. As is stressed throughout this report, EMS-C should operate against a broader background of child health and emergency medical care; links with the primary care environment are critical.

The usage of "EMS" in this report should be made clear. "EMS system" refers to services organized on state, regional, and local levels to meet the emergency care needs of the community. "EMS agency" is used in two ways: (1) as the state government office responsible for regulating or administering emergency care services, particularly prehospital services; and (2) as the local or regional organization (which may be public, private, or volunteer) that provides prehospital services directly to patients. Where EMS is used alone, its context should indicate whether it refers only to prehospital matters or to the broader EMS system.

Although the specific care that children should receive from the EMS system depends on the nature of the emergency and factors such as the training and resources available to emergency care providers, the elements of basic life support (BLS) and advanced life support (ALS) form a common core of emergency care. BLS encompasses first aid and basic cardiopulmonary resuscitation (CPR) aimed at stabilizing a patient until more advanced care is available. Important skills include patient assessment and care aimed at ensuring an open airway and adequate breathing, controlling bleeding, and immobilizing the spine or other skeletal injuries. ALS includes more extensive stabilization and resuscitative care with additional, often invasive, procedures such as endotracheal intubation to provide an airway and promote breathing, intravenous (or intraosseous) administration of fluids and medications, or use of equipment such as defibrillators. BLS training is available to parents and other members of the public as well as health care professionals.

In addition to "care for emergencies," health care providers and organizations are also faced with the need to provide "care in emergency settings" to children who are not seriously ill or injured but have limited access to other care. Chapter 3 discusses the history and structural components of emergency care and EMS systems in this country.

WHY CHILDREN NEED SPECIAL ATTENTION

Children Differ from Adults

Emergency care for children must take into account important differences between adults and children and among children of varying ages. Characteristics of anatomy, physiology, and psychological development differ as do the kinds of injury and illness that they experience. These factors all affect children's risks for and responses to injury and illness as well as their treatment.

Anatomy and Physiology

Anatomically, children are smaller and proportioned differently than adults. Smaller body size results in greater surface area relative to body volume, which makes children vulnerable to excessive loss of heat and fluids. The child's smaller airway can be blocked easily by swelling or foreign bodies. Successfully performing procedures such as endotracheal intubation and intravenous injections in children requires equipment sized appropriately for smaller airways and blood vessels. Accommodating a child's shorter trachea and higher larynx also requires special care during intubation. In very young children, especially, the head is proportionally larger and heavier than in older children and adults, making it a prominent point of injury. The size of the head also affects the alignment of the airway and spine when a child lies face up. Less rigid bones and skeletal structures lead to fewer fractures or fractures of a different character than those seen in adults. Significant lung injury, for example, can occur in children without the rib fractures that would be a hallmark of such injury in an adult.

Normal respiratory rates and heart rates are higher in children than in adults and vary inversely with the age of the child (i.e., highest rates in the youngest children). In contrast, normal blood pressure in children is lower than adult levels. These differences in normal rates must be understood in order to distinguish normal and abnormal states in children. Furthermore, the characteristic changes in these vital signs that signal deterioration in adults may not occur in children. For example, impending shock from loss of blood or dehydration can be hard to detect in children because their

generally healthier cardiovascular systems can maintain normal blood pressures far longer than adult systems can.

Developmental changes over the course of childhood also must be considered. In infants the major organ systems, including the cardiovascular, renal, pulmonary, and immune systems, continue to mature. Neurologic development during childhood leads to marked changes in children's language abilities, motor skills, and coordination. Adult assessment tools need to be modified to reflect age-appropriate responses. Preverbal children, for example, cannot answer questions or respond to instructions.

Emotional and Behavioral Development

Children progress through recognizable stages in emotional and behavioral development that affect their risk of injury and illness and their responses to the people and procedures involved in emergency medical care. During the first year of life, infants develop early motor skills and an awareness of their surroundings. By about six months, they begin to fear separation from their parents. They cannot yet communicate verbally or understand events around them; crying is their only means of expressing physical distress from injury or illness. For toddlers, increasing mobility is not yet matched by an understanding of dangers in their environment. They are developing a sense of autonomy but fear separation from their parents and familiar surroundings. Their language skills allow them to express and understand simple information.

Preschool children have good basic motor skills and an increasing vocabulary. They do not yet understand the workings of the body and they fear physical injury. An increasing range of activities exposes them to additional risk of injury. Motor control and language skills continue to improve in schoolchildren. Pedestrian and bicycle injuries are a particular risk for them, and participation in sports presents new hazards. Through school and other activities, these children develop relationships and experiences beyond the family. They are increasingly aware of their bodies and begin to have concerns about death.

Adolescents face a special challenge in making the transition from child to adult. Their physical development begins to give them adult capabilities that their emotional and intellectual development may not match. Efforts to separate themselves from the family, combined with a sense of indestructibility, lead them to behave in ways that put them at increased risk of injury. Access to motor vehicles, for example, creates substantial hazards for adolescents who are (or are with) inexperienced drivers, do not wear seatbelts, or may be impaired by alcohol or drugs.

Patterns of Morbidity and Mortality

Two especially important differences exist between children and adults in their experience of illness and injury. First, differences in the origin of cardiac arrest in adults and in children have a significant impact on survival. In adults, cardiac arrest occurs most often as a direct result of disturbances in heart rhythms in individuals with cardiovascular disease. Rapid initiation of CPR and defibrillation substantially improves survival from arrests with ventricular fibrillation. Among children, however, cardiac arrest occurs most often as a final stage in progressive deterioration from respiratory or circulatory insufficiencies that can arise from a variety of conditions (e.g., sudden infant death syndrome [SIDS], near-drowning, airway obstruction from respiratory disease or foreign bodies, injury, dehydration, or seizures). Once a child reaches this stage, chances for successful resuscitation are small. Because the origins of cardiac arrest are so different in adults and children, adult-oriented ALS training does not provide adequate guidance for treating children.

Second, head injury, which poses serious risk of death or long-term impairment in survivors, is a special concern. Among injured children and adults, children are more likely to have experienced a head injury. In 1985, it accounted for about 30 percent of children's and about 12 percent of adults' hospitalizations for unintentional traumatic injury (MacKenzie et al., 1990a,b). Data from two large trauma registries, the National Pediatric Trauma Registry (NPTR) and the Major Trauma Outcome Study (MTOS), reveal that 44 percent of the children and 33 percent of the adults experienced head injury alone or in conjunction with other injuries (Tepas et al., 1990). In these two groups, survival was better among the children than the adults except among the most severely injured, where rates were comparable. Evidence indicates, however, that among children outcomes are worse in those who are less than 2 years old (Luerssen et al., 1988).

Special Concerns in Caring for Children

Recognizing Serious Illness and Injury

Prompt identification and treatment of serious illness and injury in children can be critical to achieving good outcomes. The primary condition must be treated and steps must be taken to ensure that secondary disorders (e.g., respiratory compromise, shock, cerebral edema) do not occur. Health care providers who lack appropriate pediatric training, experience, and guidelines may, however, find it difficult to recognize the children who are critically ill and require the most urgent care amongst the many others who have only minor injuries, uncomplicated illnesses, or other non-life-threatening

conditions (Wiebe and Rosen, 1991)—to identify, for example, the youngster with meningitis from among the stream of patients with fever and headache. Evaluation of infants can be particularly difficult, and in some settings it may be appropriate to give all infants less than six months old the highest priority for care.

Recognizing whether a child's condition is life-threatening can be complicated by the fact that indicators of serious illness or disorder may not appear until the child is near collapse. Infants, for example, may not develop a fever to signal infection. Blood pressure levels may not reliably reflect a child's circulating blood volume or level of hydration, and a critical loss of fluids may have occurred before low blood pressure is observed. Risk of cardiopulmonary arrest in children is signaled by respiratory arrest or shock rather than by the cardiac arrhythmias that typically precede arrest in adults.

Health care providers also need to be able to recognize those children whose condition may seriously worsen if appropriate care is not provided in a timely manner. Thus, knowledge of the potential complications of chronic diseases such as asthma, cystic fibrosis, sickle-cell anemia, and bronchopulmonary dysplasia is important. Providers also must be aware of conditions that are unique to children such as growth-plate fractures and croup syndromes, characteristics of urinary tract infections in infants, and shaken-baby syndrome (a cause of brain injury in abused infants).

Numerous assessment tools have been developed to help prehospital, ED, and hospital personnel evaluate the severity of injury and to guide decisions about where and how to treat an injured patient. (They are discussed further in Chapters 5 and 7.) Efforts to develop similar systems for illness have had limited success, in part because it has been difficult to identify objective criteria that can be applied broadly and consistently.

Treating Children

Once the need for emergency care has been recognized, successfully treating children requires particular knowledge and skills. Providers in all health care settings—prehospital, ED, intensive care unit (ICU), inpatient, and ambulatory care—need to know about the anatomic, physiologic, and psychological characteristics of children and how those factors influence what care is needed and how it is delivered.

Only in the past 5 to 10 years have emergency care providers outside major pediatric hospitals begun to have access to training courses specifically in emergency care for children. Many of those with training may, however, have little opportunity to use their skills because they encounter few seriously ill or injured children; they may lack confidence in their ability to perform even simple, noninvasive procedures (Gausche et al.,

1990). Limited training and experience help make pediatric care especially stressful for many providers. Moreover, their emotional responses to seriously ill or injured children can be strong.

Helping Children with Special Health Care Needs

Although the vast majority of children in this country are fundamentally healthy, an increasing population has serious ongoing health conditions. Among these are children with acquired diseases such as malignancies; children with unstable medical conditions such as asthma, diabetes, or sickle-cell disease; very-low-birthweight infants with residual problems such as bronchopulmonary dysplasia; and children who depend for their survival on high-technology interventions such as respirators, dialysis, or parenteral nutrition. Added to these are children with fixed neurologic deficits and serious birth defects, as well as survivors of previous trauma or illness who are left with residual disabilities.

The Office of Technology Assessment (OTA, 1987) estimates that the technology-dependent population may be as large as 100,000 children, and it continues to expand. Estimates of the numbers of other children with chronic conditions are even larger. These children are of special concern because they tend to use emergency care services recurrently and in some circumstances they have special vulnerabilities that are not shared by the general population. Ordinary illness or injury may place them at risk for additional complications.

EMS-C systems need special features to ensure that these children receive safe care. Assessment in the field or in the hospital cannot rely on the usual assumptions about a normal baseline condition before the emergency. Furthermore, emergency care providers should not assume that family members of these children are ill-prepared to deal with emergency situations. On the contrary, these family members have often received extensive instruction in caring for their child. In an emergency, they and other caretakers are likely to know a great deal about a child's immediate needs and can make an important contribution to appropriate emergency care. Emergency care providers should be prepared to work with knowledgeable caretakers, should take into account the special needs that these children have, and should understand that appropriate care may be available only at tertiary care centers.

EPIDEMIOLOGY OF CHILDHOOD EMERGENCIES

Although no one doubts that *too many* children experience emergencies from injury or illness, it is difficult to offer any precise account of how

many or what kind of emergencies occur or what happens to the children who experience them. Why is this so?

Part of the answer is that there is no single authoritative way to identify an emergency. Some conditions that parents believe require emergency care may prove to be much less serious when assessed by a well-trained, experienced physician who regularly treats serious illness and injury in a well-equipped pediatric ED. At other times, however, parents and health care providers alike may fail to recognize conditions that, if left untreated, pose a true threat to a child's health.

Regardless of how cases are identified, data on traumatic or illness-related emergencies in children are seriously limited. Data on severe injuries that lead to death or hospitalization are somewhat better than those on illness. Diagnostic coding based on the International Classification of Diseases (the clinical modification of the ninth revision—ICD-9-CM—is currently in use) can identify specific kinds of injuries (e.g., laceration, fracture, burn) and events that produce injuries (e.g., fall, motor vehicle collision, bicycle crash). No similar set of diagnostic categories has been recognized as defining emergency illness, making it difficult to compile consistent data.

The data that are available come from a variety of sources. The vital statistics system can provide state and national data on numbers of deaths. Hospital discharge data help identify the many additional cases in which seriously ill or injured children do not die. About 30 states maintain databases on hospital discharges (CDC, 1992a). National data on hospital discharges are available from a sample survey of hospital records, but the sample is too small to permit state level estimates (NCHS, 1992a).

Data on ED visits and prehospital care are even more limited. The American Hospital Association (1991) reports estimates of total numbers of visits (about 92 million in 1990) but does not identify children separately. The National Health Interview Survey estimates that, in 1989, 14.5 million visits were made by children under age 18 (unpublished data, National Health Interview Survey, National Center for Health Statistics, 1991). In a survey of this sort, however, underestimates are likely; respondents may forget to report visits or may not know about visits by other members of the household. No national data are available on prehospital care, but 29 states collect at least some data on these services (*Emergency Medical Services,* 1992).

Much of what has been learned about illness-related emergencies and about children receiving prehospital and ED care comes from studies in specific localities (e.g., a single state or city) or even in individual EMS agencies and hospitals. These valuable studies are usually able to assemble much greater detail than the vital statistics or hospital discharge reports, but because they are not broadly based their results must be seen as one piece of a larger picture that may vary somewhat. Unfortunately, comparisons

among the studies are often difficult because definitions and reporting categories vary. These limitations in the data on emergency medical care for children are a serious impediment to full understanding of the scope and character of the conditions requiring care and the effectiveness of the care that is given. Chapter 7 returns to issues of data and data collection with specific proposals for improvements in the current situation.

For purposes of the present discussion, what follows draws from the varied sources of available data to assemble a description of the numbers and kinds of conditions for which children need emergency care. It highlights the differences in the distribution of those conditions among various settings of care—office practices, prehospital care, and EDs, ICUs, and other inpatient settings in community hospitals and in major referral centers. Injury, as the leading cause of death among children, is the starting point for this discussion.

Injury

Injury has been defined by the National Committee for Injury Prevention and Control (1989, p. 4) as "unintentional or intentional damage to the body resulting from acute exposure to thermal, mechanical, electrical, or chemical energy or from the absence of such essentials as heat or oxygen." Injuries sustained from an event such as a motor vehicle crash or a gunshot reflect the effect of mechanical energy. Lack of oxygen is operating in drowning or asphyxiation. For some purposes, trauma or traumatic injury is distinguished from the broader class of injuries. Drowning, near-drowning, and poisoning may be considered nontraumatic injuries (Weinberg, 1989).

Unintentional injuries[1] are the leading cause of death among children over the age of 1 (Table 2-1), and all injury deaths in children have been estimated to cause the loss of 1.2 million years of potential life before age 65 (CDC, 1990). In 1988, unintentional injuries led to the deaths of 7,073 children between the ages of 1 and 15, about 43 percent of deaths at those ages. Among 15- to 19-year-olds alone, unintentional injury led to 8,498 deaths, 53 percent of all deaths. There also were 936 deaths among infants less than 1 year old. Intentional injury—homicide (including child abuse and neglect) and suicide—added another 5,575 deaths in 1988 among children and young people less than 20 years old. About 24 percent of all injury deaths in infants were attributed to homicide compared to 10 percent among children ages 1 to 14 and 16 percent among 15- to 19-year-olds. At every age, more boys than girls die from injuries.[2]

Injuries associated with motor vehicles account for the largest number of deaths of any given cause. The specific motor vehicle risks vary with age, however. Children 1 to 4 years old die in about equal numbers as pedestrians and as motor vehicle occupants; among the 5- to 9-year-olds,

pedestrian deaths are more frequent; deaths of older children tend to be as occupants of motor vehicles (Children's Safety Network, 1991). Burns (including fire-related factors such as smoke inhalation) and drowning are the next most frequent causes of death in younger children. Among children over age 10, however, homicide and suicide are exceeded only by motor vehicle deaths.

TABLE 2-1 Deaths from Injurya Among Children and Adolescents Ages 0 to 19, by Cause, Age, and Sex, 1988

Categories of Injury	Age					
	<1	1-4	5-9	10-14	15-19	0-19
Males						
Unintentional injuries						
Motor vehicle	118	543	735	803	4,767	6,966
Other	412	1,185	607	647	1,464	4,315
Intentional injuries						
Homicide	151	217	98	169	1,727	2,362
Suicide	0	0	5	176	1,668	1,849
Other injuries	28	26	15	44	139	252
All injuries	709	1,971	1,460	1,839	9,765	15,744
Females						
Unintentional injuries						
Motor vehicle	97	462	441	444	2,018	3,462
Other	309	668	319	219	249	1,764
Intentional injuries						
Homicide	164	164	81	110	392	911
Suicide	0	0	1	61	391	453
Other injuries	14	29	7	8	34	92
All injuries	584	1,323	849	842	3,084	6,682
TOTAL INJURIES	1,293	3,294	2,309	2,681	12,849	21,133

NOTE: The following ICD-9-CM codes were used to define specific categories of injury: unintentional injuries, E800-E949; motor vehicle injuries, E810-E825; homicide, E960-E969; suicide, E950-E959; and other injuries, E970-E999.

[a] Deaths attributed to injury as the underlying cause of death.

SOURCE: Data from NCHS (1992b).

At all ages, intentional injury deaths are likely to be misreported because they are unrecognized or deliberately misrepresented (Guyer et al., 1989; McClain et al., 1993). A recent analysis suggests that about 85 percent of child abuse deaths, which occur primarily in children under age 5, are attributed to other causes (McClain et al., 1993). In 1988, there were

246 reported deaths from child abuse and neglect among children under age 5.[3]

A state-based analysis of the causes of injury-related deaths between 1980 and 1985 among children under the age of 15 revealed differences from the overall national pattern (Waller et al., 1989). In 26 states, injuries to motor vehicle occupants accounted for the largest number of deaths; by contrast, children in 11 states died most often from injuries in house fires, in 10 states from drowning, and in 3 states from pedestrian injuries. In the District of Columbia, homicide was the leading cause of injury death.

The impact of injury on children (and their families) is substantially greater than just the toll in deaths. Many more children are hospitalized than die, and an even greater number are treated in emergency rooms or primary care providers' offices without admission to the hospital. Recent estimates are that over the 1985-1987 period children under the age of 18 annually experienced an average of 20 million injuries of all kinds, of which about 18.4 million received some kind of medical attention (NCHS, 1990). About 3.3 million of the injuries required that children spend time in bed (at home or in the hospital) (NCHS, 1990). Data from the National Hospital Discharge Survey show that in 1990 injury was associated with about 468,000 hospitalizations among children under the age of 15 (NCHS, 1992a).[4]

Data from poison control centers provide insight into one particular source of injury. Unintentional poisoning is a special hazard for young children. Cases involving 1- and 2-year-olds accounted for 38 percent of the 1.8 million calls reported by poison control centers for 1991 (Litovitz et al., 1992). Among adolescents, drug overdoses and poisonings related to suicide are seen. In all, 71 percent of poison control center calls involved children and young people through age 19 (Litovitz et al., 1992). These cases included just under 15 percent of deaths known to the centers, however. Deaths to adolescents (ages 13 through 19) accounted for 57 percent of the deaths among those under age 20.

State and local studies have assessed the causes and relative frequencies of injury-related deaths, hospitalization, and ED visits among children in their populations. Studies in Massachusetts found that, for every death from unintentional injury, 45 children (ages 0 to 19) were hospitalized and 1,300 were treated and released at an ED (Gallagher et al., 1984); intentional injury led to 26 hospitalizations and 222 ED visits for each death (Guyer et al., 1989). In North Carolina (Runyan et al., 1985) and New York (Cooper et al., 1992), there were, respectively, 21 and 34 hospitalizations for every injury-related death. A smaller study in Seattle found no deaths; 2.5 percent of unintentional injuries treated in the ED or health maintenance organization clinic resulted in admission to the hospital, somewhat less than the 3.4 percent admission level in Massachusetts (Rivara et al., 1989).

The injury events that result in the greatest numbers of deaths are not

necessarily the same ones that are most likely to bring children into the ED or require hospitalization. Some injuries, such as falls, occur frequently and often are not serious. Others, such as drowning, occur less often but are much more likely to be fatal or to require hospital care. In the Massachusetts study, falls accounted for 18 percent of all injuries to children (the largest single category), but only 3 percent of the children injured in falls required hospitalization and none of those children died. Nevertheless, because so many injuries were caused by falls (4,767 out of 19,483 cases), a large proportion (24 percent) of hospital admissions resulted from falls (Gallagher et al., 1984). In contrast, the 5 drownings resulted in 3 deaths.

A similar assessment can be made of the nature of injuries, that is, their anatomic and physiologic characteristics. Sprains, lacerations, and contusions are among the injuries most commonly seen in the ED, but they do not usually require hospitalization (Gallagher et al., 1984; Rivara et al., 1989). In contrast, internal injuries are seen in far fewer children but almost always require hospitalization.

Head injury is of special concern. It is associated with a large proportion of injury deaths in children, by some estimates as much as 75 percent of deaths from mechanical injury (Luerssen, 1992) and about 85 to 90 percent of deaths in some trauma registries (Eichelberger et al., 1988b; Tepas et al., 1990). The presence of other injuries appears to worsen a child's chances of survival (Peclet et al., 1990b; Tepas et al., 1990).

The more serious injuries occur particularly to pedestrians, bicyclists, and motor vehicle occupants and in falls (Gallagher et al., 1984; Tepas et al., 1990). In infants, falls account for many injuries but child abuse is the cause of some of the more serious cases (Luerssen, 1992). Damage to the brain results not only from traumatic injury but also as a consequence of diseases such as meningitis or of conditions secondary to injury that cause the brain to swell or to receive inadequate circulation or oxygen. Transport to or between hospitals, or even within hospitals, seems to pose particular risks if adequate attention is not given to maintaining an open airway and proper breathing (Andrews et al., 1990; Gentleman and Jennett, 1990; Noah et al., 1992).

Children who survive brain injuries may experience long-term cognitive and neurologic impairments and may, in fact, be more vulnerable to them than adults are (Luerssen, 1993). Although severe injuries often lead to well-recognized problems, mild injuries may also result in lingering physical, psychosocial, and behavioral changes (IOM, 1991b). A recent study found residual deficits, particularly in speech and language, in 30 percent of a group of children who had experienced mild traumatic brain injury an average of two-years earlier (District of Columbia EMS-C Project, 1991).

Many kinds of injuries other than those to the brain also have the potential to leave residual impairments or limitations. Even among children

whose injuries were treated entirely on an outpatient basis (e.g., in the ED), 4 percent still had some limitations on their activities a month after receiving the injury (Rivara et al., 1991). Recent NPTR data show that about 32 percent of the children had some degree of activity limitation at the time they were discharged from the hospital (NPTR, 1992). In another study of a group of seriously injured children, 54 percent had some remaining functional limitation as long as six months after the injury (Wesson et al., 1989).[5] Head and spinal cord injuries were responsible for half of these cases; lower extremity injuries accounted for another one-quarter.

Illness

A broad range of illnesses can become serious enough to require prompt emergency care, especially among very young children. Serious illness often develops rapidly with little opportunity to forestall its impact, but at other times, it may result from inadequate treatment of a less serious condition. Acute complications also may arise in chronic illnesses. Respiratory, circulatory, or neurologic crises, which can be produced by a variety of illnesses, characterize many emergencies. Some of the many acute conditions that have the potential to become life-threatening are anaphylaxis, bronchiolitis, epiglottitis, pertussis, pneumonia, sepsis, dehydration, meningitis, encephalitis, and seizures (Ludwig and Selbst, 1990). Among the chronic diseases that can produce acute crises are asthma, congenital heart disease, diabetes, epilepsy, leukemia and other malignancies, and sickle-cell disease. Children who have congenital disorders or chronic diseases are vulnerable to a worsening of their underlying condition and to other illnesses and injuries.

With no commonly accepted set of diagnoses defining illness-related emergencies, however, determining specific numbers of cases from available mortality and hospitalization data is difficult. Tables 2-2 and 2-3 present data on deaths and hospitalizations for broad categories of illness.

Two age-specific features of noninjury mortality should be noted. First, most infant deaths are due to congenital anomalies and birth-related conditions—26,177 of 37,617 deaths from illness in 1988. Although acute crises may arise, these conditions typically are not responsible for a substantial share of illness-related emergencies. Second, sudden infant death syndrome (SIDS), the second largest cause of noninjury deaths in children, occurs (by definition) only in infants.[6] At least some deaths officially attributed to SIDS may be due to child abuse, inadvertent suffocation, or an unrecognized illness (McClain et al., 1993). A thorough investigation is needed to exclude other possible causes of death before attributing a case to SIDS (Reece, 1993).

Illnesses that affect the respiratory system (e.g., asthma, pneumonia,

TABLE 2-2 Deaths from Specified Categories of Illnessa Among Children and Adolescents Ages 0 to 19, by Cause, Age, and Sex, 1988

Categories of Illness	Age <1	1-4	5-9	10-14	15-19	0-19
Males						
Infectious diseases[b]	532	300	92	77	107	1,108
Neoplasms	72	317	378	315	510	1,592
Endocrine, Metabolic, Nutritional	192	71	40	34	65	402
Immunologic	12	8	3	4	2	29
Cardiovascular	504	180	83	119	273	1,159
Neurologic	340	254	128	173	338	1,233
Respiratory	736	226	96	99	145	1,302
Digestive	216	79	35	33	50	413
Urologic	129	14	4	8	25	180
Congenital anomalies and birth-related conditions	14,664	590	173	129	139	15,695
Sudden infant death syndrome	3,295	na	na	na	na	3,295
Other illnesses	606	211	82	77	268	1,244
All illnesses	21,298	2,250	1,114	1,068	1,922	27,652
Females						
Infectious diseases[b]	428	239	98	59	94	918
Neoplasms	77	294	262	244	342	1,219
Endocrine, Metabolic, Nutritional	181	72	81	57	69	460
Immunologic	8	11	1	1	1	22
Cardiovascular	405	176	69	64	134	848
Neurologic	263	209	139	109	148	868
Respiratory	528	196	65	84	105	978
Digestive	165	64	25	20	39	313
Urologic	113	15	8	9	16	161
Pregnancy-related conditions	na	na	na	0	34	34
Congenital anomalies and birth-related conditions	11,513	452	125	94	103	12,287
Sudden infant death syndrome	2,181	na	na	na	na	2,181
Other illnesses	457	157	61	78	175	928
All illnesses	16,319	1,885	934	819	1,260	21,217
TOTAL ILLNESSES	37,617	4,135	2,048	1,887	3,182	48,869

NOTE: na = not applicable. The following ICD-9-CM codes were used to define specific categories of illness: Infectious diseases: 001-139, 320-326; Neoplasms: 140-239; Endocrine, Metabolic, Nutritional: 240-278; Immunologic: 279; Cardiovascular: 390-429, 451-459; Neurologic: 330-359, 430-448, 780.0-780.5; Respiratory: 460-519, 799.0-799.1; Digestive: 520-579; Urologic: 580-609; Pregnancy-related conditions: 630-674; Congenital anomalies and birth-related conditions: 740-779; SIDS: 798.0; Other: noninjury residual.

[a] Deaths attributed to illness as the underlying cause of death.

[b] Includes a total of 278 deaths attributed to human immunodeficiency virus infection; diagnostic codes *042-*044 (which are not official ICD-9-CM codes) are used to identify these deaths.

SOURCE: Data from NCHS (1992b).

bronchiolitis) are the leading causes of hospitalization among children—701,000 cases in 1990 due principally to these conditions (NCHS, 1992a). This represents nearly a third of all hospitalizations among children less than 15 years old. Disorders affecting the central nervous system are another prominent concern; seizures (which can occur as a result of conditions such as head injury, epilepsy, and poisoning) and some infections (e.g., meningitis) fall in this category. Severe diarrhea, vomiting, and dehydration, which can lead to such an extensive loss of body fluids that the blood circulation cannot be maintained, are especially serious in very young children.

Arguably, the most serious emergency in children is cardiopulmonary arrest (Eisenberg et al., 1983; Chameides, 1990). It can arise from trauma or illness (e.g., drowning, SIDS, or severe respiratory problems) and generally is the final consequence of other serious conditions. By the time their hearts stop, children have already been seriously weakened (Seidel, 1986b). Resuscitation is rarely successful, particularly for SIDS and trauma cases: only 7 percent of cases not related to trauma in one study (Eisenberg et al., 1983) and only 4 percent in another that included trauma-related arrests (Thompson et al., 1990). A study of submersion victims found that 32 percent of those who received ALS services survived cardiopulmonary arrest (12 of 38 cases), but only one of those survivors was free of neurological impairment (Quan et al., 1990).

Among the increasing numbers of low-birthweight and premature infants, as well as children with chronic illnesses, who are surviving and surviving longer, disorders such as asthma and epilepsy and susceptibility to other secondary conditions create greater emergency health care needs. Some of the impact of chronic illness can be seen in recent estimates that about 4 percent of children with mild or more serious chronic conditions were hospitalized over the preceding year; among only those children with

TABLE 2-3 Hospitalizations for Injury and Specified Categories of Illness Among Children and Adolescents Less than 15 Years Old, by Cause, 1990

Categories	As First-Listed Diagnosis	As Any Diagnosis
Injury (including poisoning and complications)	266,000	468,000
Illness		
Infectious diseases[a]	197,000	462,000
Neoplasms	41,000	98,000
Endocrine, Metabolic, Nutritional	105,000	371,000
Immunologic	*	*5,000
Cardiovascular	25,000	107,000
Neurologic	38,000	245,000
Respiratory	701,000	1,136,000
Digestive	252,000	426,000
Urologic	70,000	140,000
Pregnancy-related conditions	23,000	46,000
Congenital anomalies and birth-related conditions	279,000	694,000
Mental disorders	50,000	128,000
Other noninjury causes	365,000	1,234,000
ALL CAUSES	2,412,000	5,560,000

NOTE: Numbers of hospitalizations are based on a survey of patient records for discharges from non-Federal short-stay hospitals. An asterisk (*) indicates that no estimate was reported or that the reported estimate is based on a small number of sample records and should be used with caution. The original source reported no estimates based on fewer than 30 sample records or with a relative standard error of more than 30 percent. Because these factors affect some of the components of the categories used in this table, these estimates may understate the true numbers of hospitalizations.

The following ICD-9-CM codes were used to define diagnostic categories: Injury (injury, poisoning, and complications): 800-999; Infectious diseases: 001-139, 320-326; Neoplasms: 140-239; Endocrine, Metabolic, Nutritional: 240-278; Immunologic: 279; Cardiovascular: 390-429, 451-459; Neurologic: 330-359, 430-448, 780.0-780.5; Respiratory: 460-519, 799.0-799.1; Digestive: 520-579; Urologic: 580-609; Pregnancy-related conditions: 630-674, V27-V31; Congenital anomalies and birth-related conditions: 740-779; Mental disorders: 290-319; Other noninjury: (residual).

[a]Includes discharges for hospitalizations attributed to human immunodeficiency virus infection with the diagnostic codes *042-*044 (which are not official ICD-9-CM codes). No estimate of these discharges was reported separately.

SOURCE: Data from NCHS (1992a).

serious chronic illnesses, 16 percent were hospitalized (Newacheck and Taylor, 1992). A shift to home care for technology-dependent children who would previously have been cared for in hospitals and long-term care facilities is contributing to increased demand for emergency care (OTA, 1987).

Other Aspects of Pediatric Emergencies

Beyond the broad categories of injury and illness that encompass the largest portion of pediatric emergencies are specific conditions or circumstances that should be noted. Among adolescent girls, pregnancy-related conditions account for a substantial number of hospitalizations—nearly 600,000 for 15- to 19-year-olds in 1989 (HRSA, 1991). Although few deaths are attributable to pregnancy, emergency deliveries, especially of premature infants, as well as complications during pregnancy can create a need for emergency care.

Children and adolescents experiencing psychiatric or behavioral emergencies are a growing concern among public health and clinical experts. Two factors are particularly significant: the increasing rates of major depression in that age group (Cross-National Collaborative Group, 1992) and the contribution of preventable behaviors and social-environmental conditions to much of the morbidity and mortality among adolescents (Millstein et al., 1992). Situations that require an emergency response include suicidal behavior, threats to harm others, and psychoses (sometimes induced by drugs). During 1991, 49 percent of the calls to poison control centers regarding children 13 to 17 years of age involved intentional poisoning (Litovitz et al., 1992). Of prehospital calls for 16- to 20-year-olds on Oahu, Hawaii, 12 percent were attributed to behavioral conditions (Yamamoto et al., 1991a). These children, who may require the same medical and surgical care that other ill or injured children need, also require the care of mental health professionals.

Violence, in various forms, poses a serious threat to the health of children and adolescents. With suicide, young people are turning the violence against themselves, but many suffer at the hands of others through homicide, assault, or child abuse and neglect. Children who witness violence may suffer emotional wounds even without physical ones (Groves et al., 1993). Use of firearms is increasing the toll of violence, particularly in urban areas (Barlow, 1992; Ropp et al., 1992), and is increasingly seen as a public health emergency (AAP, 1992b,c; Koop and Lundberg, 1992; Rosenberg et al., 1992). Major urban trauma centers have seen a 300 percent rise in gunshot wounds (Tanz, 1989), and in Harlem, gunshot wounds have become the leading cause of hospitalization for injury among adolescents (Barlow, 1992).

In 1988, firearms were involved in 65 percent of suicides and 77 percent

of homicides among boys 15 to 19 years old (Children's Safety Network, 1991). Ready access to handguns among individuals 15 to 24 years of age in one city in the United States was associated with a higher rate of suicide than in a matching city in Canada (Sloan et al., 1990); in a different analysis, the availability of any type of gun, not just handguns, appeared to be associated with a higher risk of suicide among adolescents (Brent et al., 1991).

Among 15- to 19-year-olds, firearm homicide is second only to motor vehicle crashes as a cause of death and is increasing more rapidly than any other cause of death (Fingerhut et al., 1992a). In core urban areas it is the leading cause of death (Fingerhut et al., 1992a,b), particularly among black males (in a small number of identifiable metropolitan counties). Overall, firearm deaths in this age group have increased by 61 percent since 1979. In Detroit, firearm homicides tripled between 1980 and 1988 among young black men 15 to 18 years old (Ropp et al., 1992).

Although child abuse and neglect can be fatal, they are often much harder to identify than a gunshot wound. Emergency care can require the services of medical, surgical, and mental health professionals who must report suspected abuse to the proper authorities. Determining how many children have experienced abuse is difficult: reports may not be confirmed; some cases may not be recognized (or at least not reported); and definitions and reporting criteria can vary among sources or over time (Coulter, 1992). For 1990, the National Child Abuse and Neglect Data System (1992) shows about 1.7 million reports of child abuse and neglect involving 2.7 million children. About 45 percent of these cases are attributed to neglect, and about 40 percent of all the cases have been substantiated. Furthermore, to the extent that child-abusers are themselves children, the issue poses extraordinary challenges in the EMS-C arena.

Settings for Emergency Care

Emergencies Encountered in the Pediatrician's Office

Discussions of emergency care tend to concentrate on the principal providers of such care—prehospital services, EDs, and hospital inpatient settings—but office-based physicians and nurse practitioners also encounter emergency conditions among the children that they see. Among Chicago-area physicians in one study, 62 percent reported seeing each week at least one child who required hospitalization or urgent treatment (Fuchs et al., 1989). A national survey of pediatricians found that more than 50 percent had seen in their offices in the past year children with meningitis, severe asthma, and severe dehydration (Schweich et al., 1991). Other conditions encountered included seizures, head trauma accompanied by a change in

mental status, probable epiglottitis, anaphylaxis, and cardiopulmonary arrest. Illness predominates, probably because parents can recognize serious injury more easily and seek emergency care more directly. Office-based physicians and nurse practitioners need to be prepared to diagnose possibly life-threatening medical conditions and to provide the immediate treatment that will stabilize a child's condition until additional care is available.

Paradoxically, some of the children whose conditions can be treated successfully in the office setting rely on the ED for care. Lack of access to a primary care provider may delay routine care for some conditions, making them more serious when they are treated. For children who have a regular source of care, the ED may be chosen for its convenience. Some primary care providers also send their patients directly to the ED (with or without use of prehospital services) for injuries such as cuts, falls, possible fractures, and ingestions and for "after-hours" care of all kinds.

Prehospital Care

Infants, children, and adolescents make up about 30 percent of the population, but they have generally been found to be about 10 percent of the patients cared for in the prehospital setting (Seidel et al., 1984; Tsai and Kallsen, 1987; Yamamoto et al., 1991a). In Arkansas, however, children under age 15 accounted for only 2 percent of prehospital transports in 1986 (Arkansas EMS-C Project, 1991). Variations such as these are less likely to reflect differences in the relative frequency of injury and illness among children than in expectations about whether prehospital services should be used for children. Younger children in particular are more "transportable" than adolescents and adults, making it easy for parents to take them by car directly to an ED. For some of these children, however, EMS transport may be more appropriate because of the difficulty of making an accurate assessment of the seriousness of a child's condition and the potential for causing additional damage when an injured child is moved.

Both ill and injured children receive prehospital care. Seizures and respiratory distress are among the more common illness-related conditions encountered; the two most frequent causes of injury are motor vehicle crashes and falls (Seidel et al., 1984, 1991b; Tsai and Kallsen, 1987; Johnston and King, 1988). The distribution of prehospital cases with injuries or illnesses varies as expected with age; the youngest children experience more illness and the oldest ones, more trauma.

Patterns differ some by geography. For children in Los Angeles County, illness accounted for about 55 percent of cases (Seidel et al., 1984). In New York State, however, traumatic injuries and burns among children under age 15 were 65 percent of the pediatric prehospital cases (Cooper et al., 1993). (These children also represented 21 percent of all prehospital trauma care.)

A comparison of rural and urban cases found that 64 percent of rural cases and 56 percent of urban cases were for trauma (Seidel et al., 1991b). Studies that include older adolescents have found that injury was responsible for about 55 to 65 percent of the cases (Ramenofsky et al., 1983; Tsai and Kallsen, 1987; Johnston and King, 1988). Tsai and Kallsen (1987) note, however, that the severity of the illness-related cases in their study was somewhat greater than the severity of the injuries.

The distribution of calls for prehospital care for children during the day and over the year appears to be related, at least in part, to the timing of school activities. During the day, for example, calls rise steadily from about 6 a.m. with a peak for injuries in mid-afternoon after the school day typically has ended (Tsai and Kallsen, 1987; Seidel et al., 1991b). Calls for illness show an afternoon and evening plateau rather than a peak (Tsai and Kallsen, 1987). Over the course of a year, calls have been found to be higher in the summer for injuries and in the winter for illness (Johnston and King, 1988).

ED Care

Experts estimate that about one-third of visits to EDs are for children (ACEP, 1990d). This average spans children's hospitals that see children almost exclusively and general hospitals with proportions of pediatric cases as high as 41 percent (Guterman et al., 1985) and as low as 23 percent (Nelson et al., 1992). In a pattern consistent with the use of prehospital services, most children arrive at the ED in the late afternoon and evening (Fifield et al., 1984; Mayol and Mora, 1989; Krauss et al., 1991; Nelson et al., 1992). At those hours, the offices of private practitioners and clinics are less likely to be open, making the ED the most readily available source of care (Guterman et al., 1985). In addition to patients who come to the ED on their own, large numbers of primary care providers refer patients into the ED.

Only a small share of children treated in the ED arrive via ambulance. Reports suggest about 5 to 10 percent (Fifield et al., 1984; Guterman et al., 1985; Pon et al., 1989; Yamamoto et al., 1991b), although it may be less than 1 percent in some areas (Arkansas EMS-C Project, 1991). Among more seriously ill or injured children, the proportion is generally believed to be higher, but not necessarily equivalent to that for adults. In many settings, a large percentage of critically ill children who need hospitalization are brought directly to the ED by their families. Even among trauma center patients injured as pedestrians, 76 percent of the children were transported by ambulance compared with 90 percent of the adults (Derlet et al., 1989).

Injury is typically the single most frequent condition treated in the ED, but illness accounts for the larger share overall (Fifield et al., 1984; Mayol

and Mora, 1989; Krauss et al., 1991; Nelson et al., 1992). In the Boston area, a comparison between a children's hospital and a general ED found that injury accounted for 24 percent of the cases in the former but as much as 43 percent in the latter (Nelson et al., 1992). Sprains and lacerations made up 64 percent of the injuries in the general ED; trauma requiring hospitalization was less than 1 percent of cases in both settings. Upper respiratory infections accounted for 20 percent of the cases in the children's hospital ED but only 8 percent in the general hospital. Elsewhere, a study conducted during summer months found that upper respiratory infection accounted for just 2 percent of ED cases (Fifield et al., 1984).

Behavioral and psychiatric emergencies place an additional burden on the emergency response system for children, particularly hospital EDs. Although experts recognize that these problems are growing in frequency and severity, the overall mental health resources (for all ages) have not kept pace; furthermore, the numbers of practitioners and inpatient facilities available in most locales to respond to these emergencies in children are a fraction of the resources available for adults. Thus, children with acute behavioral emergencies are often kept in EDs and acute care inpatient facilities that may be ill-prepared to care properly for them.

General Inpatient Settings

Many have found that fewer than 10 percent of the children seen in general EDs require admission to the hospital (Fifield et al., 1984; Mayol and Mora, 1989; Arkansas EMS-C Project, 1991; Nelson et al., 1992), but the proportion of children admitted may be higher in some hospitals. Among children with injuries, fewer than 5 percent require inpatient care (Gallagher et al., 1984; Gofin et al., 1989; Rivara et al., 1989; Yamamoto et al., 1991b). Overall, trauma accounts for about 15 percent of admissions from the ED (Weinberg, 1989; Peclet et al., 1990a; Nelson et al., 1992). Some seriously ill or injured children are admitted directly to inpatient units without any preliminary care in the ED.

As noted earlier, motor vehicle crashes, falls, and burns (which include fire and scalding) are among the more common causes of injuries that require hospitalization (Runyan et al., 1985; MacKenzie et al., 1990a; Peclet et al., 1990a). Translated into anatomic and physiologic terms, musculoskeletal injuries and head injuries account for large numbers of trauma-related hospitalizations (Gallagher et al., 1984; Runyan et al., 1985; MacKenzie et al., 1990a; Cooper et al., 1992). About 60 percent of children treated in one trauma center after injury as pedestrians were admitted (Derlet et al., 1989). Among a group of seriously injured trauma patients (who were admitted, transferred, or died), 70 percent were admitted and 18 percent were transferred (Seidel et al., 1984).

Admission rates for illness differ somewhat from those for injury. Among the most seriously ill patients seen at one group of general hospitals, 59 percent were admitted and another 5 percent were transferred to another hospital (Fifield et al., 1984). Admission rates are also high for specific conditions: 45 percent of the children with chronic diseases (e.g., hemophilia, sickle-cell disease, cystic fibrosis) (Nelson et al., 1992) and about 25 percent of pediatric ED asthma cases (Canny et al., 1989; Krauss et al., 1991).

Community-specific factors other than illness *per se* can affect hospitalization rates: variations in the practice patterns of physicians, the availability of primary care, and general socioeconomic characteristics of the localities. A comparison of hospitalization rates for children among Boston, New Haven, and Rochester (New York) found that, in general, children in Boston were hospitalized for illness at least twice as frequently as children in Rochester and as much as five times more often for conditions such as otitis media and upper respiratory infections, croup, and toxic ingestions (Perrin et al., 1989). For other conditions that are generally regarded as *requiring* hospital care—bacterial meningitis, fracture of the femur, and appendicitis—the three cities had similar discharge rates. Some surgical procedures were, however, more frequent in Rochester than in the other two cities. The authors of the study argue that these differences reflect structural and socioeconomic factors more than real differences in the health of children in these cities (Perrin et al., 1989).

Intensive or Specialized Inpatient Care

For most of the children admitted to the hospital on an emergency basis, general inpatient care is adequate. The most critically ill or injured children, however, require the specialized care available in pediatric ICUs (PICUs); they generally represent less than 1 percent of children seen in the ED (Kissoon and Walia, 1989; Weinberg, 1989). The Pediatric Intensive Care Network of Northern and Central California has found for their service area that about 240 children per 100,000 will require intensive care each year (Pettigrew et al., 1986). Illness, led by respiratory disorders, predominates in PICU admissions; as with overall admissions from the ED, only 15 to 20 percent of these children suffer from serious trauma (Pollack et al., 1988a; Kissoon and Walia, 1989; Weinberg, 1989).

Pediatric trauma centers (PTCs), with specialized services and skilled surgical teams for care of seriously injured children, have begun to develop as part of regional trauma systems (Haller and Beaver, 1989). Recent studies have begun to demonstrate that care in PTCs and PICUs leads to improved survival for seriously injured children (Pollack et al., 1991; Nakayama et al., 1992; Cooper et al., 1993). Distinctions between PTCs and PICUs

should not obscure the need for skilled medical *and* surgical resources to provide the best care for all seriously ill or injured children (Ramenofsky, 1989b; Weinberg, 1989).

Rehabilitation Services

Most children make a good recovery from injury and illness, but as has been noted, some survive with impairments of varying degrees of severity that affect their ability to function physically or mentally. Brain and spinal cord injuries, in particular, can lead to permanent loss of functional capacities.

For some children, access to rehabilitation services can reduce long-term morbidity and disability, but such services are not always available and may not be affordable (Bush, 1989; Quint, 1992). Data from the NPTR show that in only 1.5 percent of the registered cases were children placed in inpatient rehabilitation following their discharge from the hospital (Osberg et al., 1990). Among children with four or more disabilities, about 31 percent were placed in inpatient rehabilitation on discharge. Children who were not treated in major trauma centers or in centers with a rehabilitation program were significantly less likely to be discharged to such a program (Osberg et al., 1990).

COSTS OF INJURY AND ILLNESS

Injury

Most assessments of financial costs of emergency care have focused on injury. Estimates for 1985 suggest that injury to children under age 15 generated lifetime costs of $13.8 billion, of which $5.8 billion was for direct costs of medical care and the remaining $8 billion for long-term costs associated with mortality and morbidity (Rice et al., 1989). For 15- to 24-year-olds, the total cost was substantially higher—$39.1 billion, with only $8.9 billion going for direct cost of medical care. Motor vehicle crashes accounted for the largest share: $4.1 billion for children under age 15 and $16.1 billion for the 15- to 24-year-olds (Rice et al., 1989). The initial cost of ED care for the many injured children who are treated without hospitalization has been estimated at about $2.5 billion per year (1987 dollars) (Malek et al., 1991).

The greatest costs *per injured person* are apparently associated with firearm injuries among children under age 5 ($108,386) and with drowning and near-drowning among children and young people age 5 to 24 ($159,021 for ages 5 to 14, and $351,406 for ages 15 to 24) (Rice et al., 1989). Other

estimates of the cost of only initial hospital care have found burns to be the most costly on a per-person basis (Peclet et al., 1990a; Malek et al., 1991).

In 1985, the trauma component of unintentional injury accounted for 266,248 hospitalizations among children under age 15, about 85 percent of hospitalizations for injury of any kind to children of those ages (Rice et al., 1989; MacKenzie et al., 1990a[7]). The hospital charges for these patients were about $946 million. About 9 percent of children admitted for trauma were judged to have needed advanced trauma care;[8] these children accounted for 21 percent of hospital charges for children (MacKenzie et al., 1990b). Overall, children under age 15 comprised 13 percent of trauma hospitalizations and incurred about 8 percent of the charges (MacKenzie et al., 1990b).

Illness

As implied by the discussion just above, data on the direct and indirect financial costs of emergencies and emergency care for children suffering injuries are neither especially timely nor complete. The situation for cost information about illnesses is even worse. (The present inadequacy of financial information is sufficiently great that the collection and analysis of such data receive high priority in the committee's recommendations for planning, evaluation, and research in Chapter 7.)

Asthma is one major illness for which costs have been estimated. Annual direct and indirect costs for children under age 18, excluding medications, amounted to $1.3 billion in 1985, about 28 percent of the total of $4.5 billion for patients of all ages (Weiss et al., 1992). The direct cost component, which includes hospital and outpatient care plus physicians' fees, was estimated at about $465 million. The cost of ED care for children (about $90 million) was 45 percent of total ED costs, probably reflecting a greater reliance on care in that setting than on inpatient care.

Nonmonetary Costs

Costs are most easily measured in monetary terms, but substantial nonmonetary costs are also incurred (Harris et al., 1989; Malek et al., 1991). Children experience pain, discomfort, and distress even for relatively minor injury and illness. The lives of their parents and families are also disrupted with psychological stress, loss of work time, and often new or increased child care requirements. Loss of school time or need for special schooling for the ill or injured child pose yet other challenges for all family members. Even when a child's physical recovery is complete, achieving emotional recovery may require continued care for the child and the family (Walsh, 1993). The more serious the condition, the greater are these physical and

psychological costs. Virtually no quantitative information on these aspects of emergencies in children is available.

SUMMARY

Injury and illness can pose serious threats to life and health that call for emergency care. In 1988, about 21,000 children under the age of 20 died from injuries; additional deaths occurred as a result of acute illness. Hundreds of thousands more children were hospitalized, and millions visited EDs. Appropriate care should be available to children of all ages—infants, toddlers and preschoolers, schoolchildren, and adolescents—and for all emergencies. To provide that care, EMS-C includes prevention; prehospital services; hospital EDs, ICUs, and other inpatient settings; and rehabilitation. Links with and return to the primary care environment are especially important.

Ensuring that children receive the best emergency care possible requires modification of adult-based care to accommodate the unique anatomic and physiologic characteristics of children, their behavioral and emotional development, and the specific disorders and injuries they suffer. Recognizing and treating severe illness or injury in children can be especially difficult for those emergency care providers who have had little experience with children as patients or limited training in caring for them. Children with chronic illness or other special health care needs may require more and more specialized emergency care than other children.

Serious gaps exist in the epidemiologic information about pediatric emergencies, but some patterns seem clear. Injury is the leading cause of death among children over the age of 1; infants are at risk as well. At least 20 times more children are hospitalized for injury than die, and even larger numbers of children are successfully treated in the ED on an outpatient basis. Nationally, motor vehicle-related injuries account for the largest number of deaths, but in some states drowning and burns are more deadly, especially among younger children. Homicide and suicide are more frequent among adolescents than among younger children, but child abuse is a particular threat to children under 5.

Illness is the leading cause of ED department admissions to PICUs, particularly for conditions such as respiratory distress, severe dehydration, or infections affecting the brain. Chronic conditions such as asthma may require repeated episodes of emergency care. Among adolescent girls, pregnancy-related conditions may require emergency care. Psychiatric or behavioral emergencies are a particular concern in view of the increasing rates of major depression in the adolescent age group and the underlying elements of these problems (e.g., preventable behaviors and social-environmental conditions).

Violence, in various forms, poses a serious threat to the health of children and adolescents, particularly with increased use of firearms. Children who witness violence may suffer emotional wounds even without physical ones.

Children receive emergency care in many settings. They appear to make up about 10 percent of patients receiving prehospital services and between 20 and 40 percent of patients in general EDs. The most seriously ill and injured children may require care in pediatric specialty centers and access to rehabilitation services. Office-based practices also encounter children requiring emergency care, but studies suggest that many offices may not be adequately prepared to provide the immediate care that those children need.

Lifetime costs associated with injury have been estimated at $13.8 billion for children under age 15 and $39.1 billion for 15- to 24-year-olds. Asthma is one of the few major illness for which costs have been estimated: annual direct and indirect costs for children under age 18, excluding medications, amounted to $1.3 billion in 1985. Beyond the monetary costs of illness and injury are significant costs for children in pain, discomfort, and distress even for relatively minor injury and illness. The distress extends to parents and families.

NOTES

1. External cause-of-injury codes (which identify the mechanism of injury) from the ICD-9-CM system include E800-E949 for unintentional injuries, E950-E959 for suicide, and E960-E969 for homicide.

2. *The Injury Fact Book* (Baker et al., 1992) provides a comprehensive overview of patterns of morbidity and mortality for leading causes of injury by age, sex, race, income, and residence. Detailed data on state-specific injury patterns are available in *Childhood Injury: State-by-State Mortality Facts* (Baker and Waller, 1989).

3. In this report, recorded deaths from child abuse and neglect are those identified as having an underlying cause attributed to ICD-9-CM codes E904.0, E968.4, or E967. Although child abuse and neglect are commonly viewed as actions by caretakers, some advocate a broader concept of "maltreatment" that would include any behavior by any person that poses a substantial risk of physical or emotional harm to a child (NICHD, 1992). Thus, all homicides and assaults and many unintentional injuries (e.g., due to reckless driving) could be considered child maltreatment. A report to be released in 1993 by a National Research Council panel will address the subject of child abuse and neglect in much greater detail (NRC, forthcoming).

4. Hospitalization data from the National Hospital Discharge Survey are based on reviews of a sample of patient records from hospitals within the survey's sampling units. An alternative estimate of injury hospitalizations, 600,000 in 1985 for children ages 0 to 19, is derived from applying hospitalization rates observed in a Massachusetts injury surveillance program to the national population (Guyer and Ellers, 1990).

5. In studying long-term disability among injured children, Wesson et al. (1989) defined disability as inability to perform age-appropriate physical activities as determined through questions based on instruments developed by the RAND Corporation's Health Insurance Experiment (citing Eisen et al., 1980).

6. Sudden infant death syndrome has been defined by the National Institute of Child Health

and Human Development as the sudden death of an infant under one-year of age that remains unexplained after a thorough case investigation, including performance of a complete autopsy, examination of the death scene, and review of the clinical history (Willinger et al., 1991)

7. Excluded from traumatic injury in one analysis were drowning, suffocation, injuries associated with foreign bodies (ICD-9-CM 930-939), complications of injury, and late effects of injury (MacKenzie et al., 1990a).

8. In the analysis by MacKenzie et al. (1990b), the need for trauma center care was determined on the basis of a child's age, the nature of the injury, and the severity of the injury measured by the number of body systems injured and the score on the Abbreviated Injury Scale. Advanced trauma care was defined as that available at a Level I or Level II trauma center.

3

Emergency Medical Services Systems: Origins and Operations

Efforts to ensure that children will receive good emergency care are a recent development of the relatively young field of emergency medical services (EMS). In the 1960s, emergency care in most communities and hospitals was little more than first aid. Since then, efforts have been made to achieve better outcomes by organizing services so that increasingly complex care can be made available to patients as promptly as possible. Although much work remains to be done in many areas to determine optimal forms of emergency care, studies have demonstrated benefits from enhancement of EMS systems. Trauma systems, for example, have been able to improve survival (e.g., West et al., 1979; Shackford et al., 1986). Until recently, attention has focused primarily on adult patients. Promising results in recent studies of children argue for ensuring that EMS systems attend to the needs of their pediatric patients as well (e.g., Pollack et al., 1991; Cooper et al., 1993).

This chapter reviews the history of EMS systems and traces the emergence of efforts on behalf of children. It also describes the diversity of administrative and operational structures under which EMS systems function and through which the changes needed to incorporate services for children (i.e., EMS-C) will be made. Some of the factors that have made it difficult to address children's needs are discussed, as are some of the successes to date.

DEVELOPMENT OF EMS AND EMS SYSTEMS

The 1960s and Earlier

Until the 1960s, emergency medical care had received little attention in most communities or from health care providers. Care at the scene of an emergency was based largely on first aid, and emergency departments (EDs) at many hospitals could themselves do little for the severely ill or injured.[1]

Recognizing a Need

In the United States, EMS first became the focus of widespread and continuing attention following publication in 1966 of the landmark report of the National Academy of Sciences (NAS) and National Research Council (NRC), *Accidental Death and Disability: The Neglected Disease of Modern Society* (NAS/NRC, 1970a). Pointing to trauma, especially motor vehicle crashes on highways, as the leading cause of prolonged disability and as the fourth major cause of death in the United States, the report raised considerable concern among policymakers, health professionals, and the public because of the limitations and deficiencies it documented in the EMS systems of the day.

At the time the NAS/NRC report was issued, neither prehospital nor hospital services were adequate for emergency medical care. Although a few communities provided ambulance services through their fire or police departments, the report estimated that morticians provided about 50 percent of such services. This rather pessimistic approach to prehospital care arose, in large measure, because hearses were the only available vehicles that could accommodate stretchers. No specific training was required for ambulance attendants and many had very little. Most EDs appeared able to offer only advanced first aid (NAS/NRC, 1970a). Only a few hospitals had the staffing, equipment, and facilities needed to provide *complete* care for the seriously injured or ill. Although the 1966 report focused on the needs of trauma victims, many of the concerns and recommendations applied to emergency care for illness as well.

Work in two areas set the stage for a strong response to the NAS/NRC report. First, surgeons with military experience in Korea and Vietnam recognized that trauma care available to wounded soldiers was substantially better than the care available to civilians (Boyd, 1983). The need for rapid response to serious injury had long been recognized on the battlefield, and the medical services of the U.S. military had developed increasingly sophisticated systems of triage, transport, and field hospital care for casualties (NAS/NRC, 1970a). Important aspects of that experience were directly applicable to the civilian setting. In particular, the growing interstate highway

system was contributing to increased risk of serious injury in high-speed motor vehicle crashes in locations that might be distant from major medical facilities. Active concern over safety deficiencies in motor vehicle design was developing as well (National Committee for Injury Prevention and Control, 1989).

The second development was the demonstration by physicians in Ireland that rapid treatment of cardiac emergencies could improve survival (Pantridge and Geddes, 1967). Mobile intensive care units were developed to bring care to patients more rapidly than they could reach the hospital (Nagel et al., 1970; Lewis et al., 1972). In Europe these units were staffed by physicians, but in the United States this care was delegated to public safety personnel already available in community fire departments. This choice led to the development of specially trained personnel—paramedics—to provide this prehospital care.

This period generally was one of broad and growing interest in health planning on a national level. Health planning, which included the notion of regionalizing services, was seen as a way to distribute resources more equitably and to expand access to the country's health care system (IOM, 1980a).[2] EMS also was being influenced by increasing use of hospital EDs for nonurgent care—more than two-thirds of 40 million ED visits in 1966 (NAS/NRC, 1970a). With fewer primary care providers making house calls or keeping extended hours, changes in the character of medical practice were contributing to the growing reliance on hospital EDs.

Initial Responses

The NAS/NRC report (1970a) put forward a broad range of recommendations for actions by federal, state, and local governments and by the medical community to improve emergency medical care. (The full text of the recommendations from that report appears in Appendix 3A at the conclusion of this chapter.) Major points included the following:

- increase attention to accident prevention;
- expand public education in first aid;
- adopt standards and regulations for ambulance services and for routine use of radio and other means of communication between ambulances and EDs;
- consider a single national emergency access number;
- assess the numbers and kinds of EDs needed for optimal care;
- implement routine evaluation of ED capabilities;
- develop trauma registries; and
- initiate clinical and health services studies on trauma and other aspects of emergency medical care.

The attention focused on highway fatalities led to federal action first through highway safety legislation—the Highway Safety Act of 1966 (Public Law [P.L.] 89-564)—which created the National Highway Traffic Safety Administration (NHTSA) in the U.S. Department of Transportation (DOT). Initial work on guidelines and curricula for training ambulance personnel and guidelines for ambulance equipment was followed by broader activities in EMS planning, training and personnel, communications, and transportation (NHTSA, 1990a). The agency's research and grant programs helped states develop the EMS component of federally mandated highway safety programs. The activities of the U.S. Department of Health, Education, and Welfare (DHEW), through the Division of Emergency Health Services, were limited at this time.

Subsequent NAS/NRC (1968, 1970b,c) reports on ambulance services addressed training standards for ambulance personnel, identified specific roles and responsibilities in providing care for patients, and specified medical requirements for ambulance design and for the equipment to be used by ambulance personnel. Requirements for pediatric care received some attention in these early reports. For example, training and equipment requirements for airway management, ventilation, and oxygenation specifically mentioned the need to have masks and airway devices in sizes appropriate for infants and children as well as adults (NAS/NRC 1968, 1970c). Although proposals for hospital-based clinical training called for experience in obstetrics, the nursery, and *pediatrics*, the detailed specifications included only delivery, postdelivery care, and care of newborns (NAS/NRC, 1970b).

Drawing on the new developments and recommendations, individual communities across the country began to enhance their capabilities for emergency care through greater attention to resources, training, and coordination of services, particularly for treating cardiac cases. The medical community undertook activities of its own in response to the nation's concern over emergency medical care. Training programs for emergency medical technicians (EMTs) and paramedics were begun. An NAS/NRC conference produced recommendations that medical professionals and allied health staff be trained in cardiopulmonary resuscitation (CPR) (Ad Hoc Committee on Cardiopulmonary Resuscitation, 1966).

Increasingly sophisticated hospital services became available. Specialized trauma units were established in hospitals in Chicago and Baltimore. Advancing critical care skills and technology were reflected in the first dedicated neonatal and pediatric intensive care units (NICUs and PICUs) (Downes, 1992). Regionally organized programs of neonatal intensive care, which made use of specially equipped ambulances and hospital transport teams, improved access to specialty services and succeeded in reducing neonatal mortality. Similar programs for older children have been slow to develop.

New professional organizations created during the 1960s demonstrated a growing sense of provider awareness of and identification with emergency medical care (NAS/NRC, 1972). Among them were the American College of Emergency Physicians (ACEP), the Commission on Emergency Medical Services of the American Medical Association, the American Trauma Society, the Emergency Nurses Association (ENA), and the National Association of Emergency Medical Technicians (NAEMT). Other groups that had already existed, such as the Committee on Trauma of the American College of Surgeons (ACS) and the American Academy of Orthopaedic Surgeons (AAOS), became more active.

Other Activities

Important work in injury prevention had begun well before attention was drawn to EMS. Traffic safety became a concern as early as the 1920s. Risks to children received attention in the early 1950s with the "anticipatory guidance" that the American Academy of Pediatrics (AAP) urged physicians to give to parents about specific hazards (National Committee for Injury Prevention and Control, 1989). The first poison control centers also were established in the 1950s. Federally funded demonstration projects in the 1960s encouraged state and local public health programs to address a variety of injury hazards in the home (National Committee for Injury Prevention and Control, 1989). As EMS systems began to develop, they saw prevention as an important aspect of their activities. NHTSA's prominent role in early EMS development encouraged particular attention to injuries related to motor vehicles.

The 1970s

EMS in General

Public support for EMS activities grew as people became more aware of the potential benefits. The television program *Emergency*, which began in 1971, contributed in a noticeable way to this growing awareness of EMS. As interest and activities in EMS grew, strong recommendations were being made for the highest levels of the executive branch of the federal government to lead nationwide efforts to improve the delivery of emergency services. The ACS and the AAOS addressed this issue in the proceedings of a joint conference, *Emergency Medical Services. Recommendations for an Approach to an Urgent National Problem* (ACS/AAOS, 1969). The NAS/NRC (1972) made a similar recommendation in its report, *Roles and Resources of Federal Agencies in Support of Comprehensive Emergency Medical Services*. The report went on to recommend assigning to DHEW the

administrative leadership role in federal level EMS activities. (More than 20 agencies located across six cabinet-level departments had activities related to EMS.)

The NAS/NRC report also recognized the need for effective planning at state, regional, and local levels to ensure the coordination of prehospital and hospital phases of emergency medical care. This "systems approach" was a fundamental aspect of a new federal program authorized by the Emergency Medical Services Systems (EMSS) Act of 1973 (P.L. 93-154).

The EMSS Act created a new categorical grant program in the Division of Emergency Medical Services of DHEW. This program became a decisive factor in the nationwide development of regional EMS systems. Under the new law, states established a total of about 300 EMS regions, most covering several counties, which were eligible for up to five-years of funding to develop EMS systems. About $30 million was available each year for regional grants (Boyd, 1983). Rural areas were targeted for specific attention (OTA, 1989) as were certain patient populations (major trauma, burn injuries, spinal cord injuries, heart attacks and other acute coronary events, poisonings, high-risk infants and mothers, and behavioral and psychiatric emergencies) (Boyd, 1983). The expectation was that systems developed to care for these patients would serve as models for care of other categories of patients such as children.

The EMSS Act was intended specifically to promote the development of regional systems built around 15 key components (see Table 3-1): health personnel, training, communications, transportation, medical facilities, specialized critical care units, other public safety personnel and equipment, public participation in policymaking, access to service regardless of ability to pay, transfer agreements, standardized record keeping, public education, evaluation, disaster planning, and links to adjacent EMS systems (Boyd, 1983). Although the grant program ended in 1981, these components continued to guide development and evaluation of EMS systems.

The emphasis in the EMSS Act on regional planning was consistent with other federal programs. The 1974 National Health Planning and Development Act (P.L. 93-641) created and supported through federal monies a two-tiered network of health planning agencies: 200 area-level agencies, or Health Systems Agencies, and 57 State Health Planning and Development Agencies (IOM, 1980a). This legislation called for each agency to complete a health systems plan outlining long-range goals for the community, mandated technical assistance centers, and emphasized creation of a comprehensive database for health planning. Guidelines for national health planning policy that were developed under this program included (among 11 different types of services) provisions related to neonatal special care units and pediatric inpatient services (IOM, 1980a, Appendix B); emergency services were not among those covered.

TABLE 3-1 Essential Components of Emergency Medical Services Systems, as Specified by the Emergency Medical Services Systems Act of 1973 (P.L. 93-154)

Personnel: adequate numbers of health professionals, allied health professionals, and other personnel with appropriate training and experience
Training: adequate training and continuing education opportunities for personnel in all aspects of the EMS system
Communications: a centralized system to receive requests for assistance (ultimately through 9-1-1) and provide direct communication links among personnel and facilities throughout the system and with other EMS systems
Transportation: adequate numbers of vehicles (ground, air, or water) appropriate for the region, which meet standards for design, performance, and equipment and whose operators have necessary training and experience
Medical facilities: adequate numbers of accessible emergency care facilities collectively providing continuous services, with appropriate categorization of capabilities and coordination with other system facilities
Critical care units: access (including transportation) to facilities with critical care services within a local EMS system or to such facilities in neighboring areas
Public safety agencies: coordination and cooperation with public safety agencies (e.g., police, fire, lifeguards, park services) in use of personnel, facilities, and equipment
Consumer participation: opportunities for participation by the lay public in system policymaking
Accessibility to care: access to services of the EMS system without regard to ability to pay for those services
Transfer of patients: triage and transfer arrangements to ensure patient access to an appropriate level of care
Coordinated patient record keeping: patient record systems that are consistent across phases of care in key data elements and that allow a patient's care to be tracked across those phases of care
Public information and education: programs to inform the public about how to use the EMS system, about first aid and other interim care, and about the availability of training programs
Review and evaluation: periodic, comprehensive reviews of the extent and quality of services provided by an EMS system, with the results reported to DHEW
Disaster linkage: system plans for responding, with other local, regional, or state agencies as necessary, to natural disasters, national emergencies, or other mass casualty events
Mutual aid: reciprocal agreements with neighboring EMS systems or other related agencies to respond to an emergency in the neighboring system when that system cannot respond as effectively

SOURCE: Boyd (1983).

Other federal efforts also were contributing to EMS development. NHTSA worked through highway safety programs to help states improve the prehospital components of their EMS systems and was overseeing the development of standard curricula for varying levels of EMT training. Recommendations from many sources for a national emergency telephone number led, in 1973,

to a policy statement by the White House Office of Telecommunications Policy encouraging local authorities to establish 9-1-1 systems (Whitehead, 1973). The statement emphasized the need for such systems to operate at the local level so that they could respond to meet local needs and circumstances.

In this same period, the Robert Wood Johnson (RWJ) Foundation, in consultation with the NAS, committed $15 million to 44 regional EMS projects (NAS/NRC, 1978b). The program improved availability of and access to emergency services, improved links between system components, upgraded communications and training, and developed community institutions and resources for continuing support of EMS. It demonstrated that the various players in emergency care—including health professionals, local and regional governments, and concerned private organizations—could cooperate effectively (NAS/NRC, 1978b). Efforts to further the adoption of 9-1-1 access systems were successful in nearly half of the projects. More successful were efforts to reduce the variety of different emergency access telephone numbers in use in a system and to identify a primary number for EMS calls.

Through both the federal and foundation programs, as well as local efforts, the level, type, and organization of emergency services were all substantially improved. A steady proliferation of EMS systems was accompanied by establishment of state EMS offices and local EMS councils, widespread state level legislation setting standards for emergency vehicles and personnel, a large (more than 115,000) and growing number of EMTs, and improved training and staffing for emergency departments (NAS/NRC, 1978a). Also during this period, air transport services (via helicopter or airplane) specifically for medical purposes began to develop (Freilich and Spiegel, 1990).

Progress was not universal or uniform, however, and important issues required further attention. In particular, efforts to develop regional systems were hampered by several difficulties: deciding what constitutes an EMS region, resolving who should determine its size and configuration, and determining how to assess the success of regionalization. A narrow focus on individual system components specified in the 1973 EMSS Act obscured the need for broader planning based on the functional requirements of EMS systems; it also limited the attention given to avoiding or resolving conflicts arising from competing interests among system components (e.g., emergency department resistance to categorization). System evaluation relied on compliance with structural and process standards without addressing outcome or cost-effectiveness. (Even today, outcome and cost assessments are limited, especially for services other than adult cardiac and trauma care.) Inadequate attention to long-term plans for operational funding left some

systems with financing difficulties once their federal or RWJ grants had expired.

EMS system development was also affected by the problems facing hospital EDs. Although EDs are a critical component of successful EMS operations, they had benefited less than prehospital services from the EMS systems funding made available to communities (NAS/NRC, 1980). EDs suffered then (and do today) the dual burdens of relative neglect and soaring patient loads (both urgent and nonurgent cases). The ability of EDs to treat acutely ill or injured patients was hampered by insufficient staffing, limited availability of adequately trained staff, inadequate equipment, and a lack of influence in hospital management (NAS/NRC, 1980). Expanding EMS systems with increasingly visible prehospital services contributed to the pressures on EDs by raising public awareness of emergency care and expectations for prompt treatment by highly skilled providers.

Despite slowness on the part of hospitals to devote adequate attention and resources to their EDs, the field of emergency medicine was continuing to develop. As early as 1974, the ACEP issued a policy statement on EMS system needs, "Emergency Medical Services: Problems, Programs and Policies" (ACEP, 1976). In 1976, the ACS adopted guidelines on hospital trauma care requirements (ACS, 1990). Cardiac resuscitation skills were spreading through courses such as the American Heart Association's (AHA) Advanced Cardiac Life Support (ACLS) course, which became available in 1975. The first residency program in emergency medicine was started at the University of Cincinnati in 1970; by 1980, programs were available across the country (Seidel and Henderson, 1991). Most, however, devoted relatively little time to pediatric emergency care compared to the volume of pediatric patients seen in the emergency room.

Children and EMS

Although the EMSS Act was encouraging the development of EMS systems, children were not a target population, and only limited expertise in pediatric emergency medicine existed in 1973 (Foltin and Fuchs, 1991). Members of the pediatric community began to recognize, however, that the progress in trauma and cardiac care to meet the needs of the adult population was not preparing EMS systems to care for children.

Children's emergencies are more likely than adults' to arise from respiratory distress or seizures; their physiologic baselines and responses to illness and injury do not match adult patterns; important anatomic features are different; and characteristic psychological and developmental responses not only differ from adults' responses but differ among children of different ages. (Chapter 2 discusses these differences more fully.)

Failure to differentiate between the needs of adult and pediatric emergency patients was linked to poorer medical outcomes for pediatric patients (Seidel et al., 1984; Seidel, 1986a,b). One study of 88 general acute care hospitals in Los Angeles County, for example, found nearly twice as many deaths among children with serious traumatic injuries (caused chiefly by motor vehicles and guns) than among adults with similar injuries: 12 percent versus 7 percent (Seidel et al., 1984). Most of these deaths occurred in areas lacking pediatric tertiary care centers.

By the mid-1970s, efforts were beginning on a variety of fronts to incorporate pediatric needs into emergency medicine and EMS systems.[3] Dedicated pediatric EDs with full-time coverage by pediatricians were becoming more widespread. Most major pediatric centers established PICUs. The original programs, plus ones in Washington, D.C., Dallas, Baltimore, and Boston, made especially significant contributions to the growth of this field through their training of physicians and their research activities (Downes, 1992). In 1979, the AHA adopted standards for pediatric basic life support and guidelines for neonatal resuscitation (National Conference on Cardiopulmonary Resuscitation and Emergency Cardiac Care, 1980). In contrast to the emphasis on trauma in adult emergency care, the developing services for children gave considerable attention from the beginning to both illness and injury.

Los Angeles was among the first areas to address guidelines for prehospital care of pediatric patients. Concerned pediatricians working with local professional societies and the county EMS agency developed a pediatric-focused training curriculum for paramedics and management guidelines for pediatric prehospital care (Seidel, 1986b). Over the ensuing years, their work led to the implementation of a two-tiered approach for organizing EMS-C (Henderson, 1988; Seidel, 1989). At one level were Emergency Departments Approved for Pediatrics (EDAPs), which had to meet a minimum set of standards for the care of critically ill and injured children and could provide basic emergency services. More specialized care would be provided in Pediatric Critical Care Centers (PCCCs), which could offer such services as PICUs and access to a broad set of medical and surgical specialists with expertise in pediatric care.

Pediatric surgeons took the lead in focusing attention on specialized trauma care for children. In 1975, Maryland established a statewide regional pediatric trauma center, one of the first in the country (Haller et al., 1983). This service operated through the Maryland Institute for Emergency Medical Services Systems, a well-known model for a fully integrated EMS and trauma system (Foltin and Fuchs, 1991). Still, in the vast majority of regions developing EMS systems, the special emergency care needs of children remained unrecognized through the 1970s.

The 1980s to the Present

The Federal Role in EMS

A Change in Focus In 1981, Congress passed legislation that fundamentally changed the philosophy of federal support for state EMS activities and the manner in which states received federal funds. The focus of the EMSS Act on regional planning and systems development reflected the character of an era in which health planning agencies were expected to be the agents of an efficient and effective allocation of health resources. The federal government was to help direct and fund those efforts as part of its responsibility to further broad social goals, in this particular case the improvement of EMS systems and emergency medical care.

Under the Omnibus Budget Reconciliation Act (OBRA) of 1981 (P.L. 97-35), the "categorical" funds that had been awarded specifically for regional EMS activities were replaced by a new funding mechanism—the Preventive Health and Health Services Block Grant—that folded the EMS funds and money for six other preventive health programs into one lump sum. All funding went to state governments, which became free to allocate the grant monies among the seven preventive health service areas in the manner that best suited their needs.[4]

The block grant program had the effect of shifting responsibility from the federal government to the states for many preventive health activities. Supporters saw this as a way to give states greater control over and flexibility in paying for these services. Critics of this "new federalism" charged that the federal government was abdicating its responsibilities and warned that the states would be unable or unwilling to support EMS at the pre-block-grant level. In fact, block grant funding allocated to EMS—about $13 million in FY 1990—is now less than half the $30 million available annually under the EMSS Act (with no adjustment for inflation) (OTA, 1989; Public Health Foundation, 1991).

In addition, the block grant program eliminated most EMS and emergency medicine activities within DHEW (renamed the Department of Health and Human Services [DHHS]). NHTSA (in DOT) emerged as the most prominent and most long-standing federal presence in EMS. The State and Community Highway Safety Program ("Section 402") had included funds for support of EMS systems since it was established in 1966, and EMS was designated as a priority program after the passage of the 1981 OBRA legislation (NHTSA, 1990a). Nevertheless, at the same time that the DHHS block grant program was initiated, NHTSA's Section 402 funds were reduced.

Funding The immediate impact of these federal funding changes was a reduction in total funds allocated by states to EMS. In 1983, states used

$17.6 million in block grant funds for EMS (OTA, 1989). In 1982, NHTSA had available $5.4 million for EMS from Section 402 funds, down from $12.7 million in 1981 (OTA, 1989).

An assessment by the U.S. General Accounting Office (GAO) of the impact in six states of changes in federal funding found that EMS funding fell by 34 percent between 1981 and 1983 (GAO, 1986). Over the next few years, some states compensated with increases in state funding for EMS (GAO, 1986). Total federal and state spending on EMS in the six states in the GAO study was almost $18 million in 1981, with about 27 percent of this amount contributed by the states; in 1985, EMS expenditures were almost $16 million, with 50 percent funded by the states (the dollar amounts are apparently not adjusted for inflation). By 1988, estimates suggested that, on a national basis, state and local funds accounted for 82 percent of the support for state EMS programs (OTA, 1989). Some states introduced special funding mechanisms, such as surcharges on fees for driver's licenses and vehicle registrations, to raise money for EMS (NASEMSD, 1991).

Consequences The end of the categorical EMSS funding program produced mixed results. Some states increased their involvement in EMS system development. For example, five of the six states examined by the GAO had expanded their authority in EMS, either by passing legislation or by developing new regulations (GAO, 1986). In other states, however, the state EMS office retained only limited authority.

The block grant program carried no requirement for states to adhere to the 15-component EMS system model that was central to the EMSS Act, but it allowed states to continue funding for EMS regions that were not eligible for additional categorical grants. There were, however, restrictions that prevented use of block grant funds for purchases of needed communications equipment. The GAO (1986) also found interest among states in a national clearinghouse through which they could learn about EMS activities in other states.

Other Developments into the 1980s

The 1970s and 1980s saw growing attention to prevention and a willingness to use legislation and regulation to implement prevention measures. In 1970, the Poison Prevention Packaging Act, for example, mandated the use of safety caps on a variety of products. The Consumer Product Safety Commission became responsible for enforcing use of flame-retardant fabric for children's sleepwear and product labeling on hazards to children. By 1985, every state had passed legislation requiring the use of child safety seats. State and local laws have been used to establish requirements regarding the installation of smoke detectors, window guards to prevent window

falls in multistory buildings, and pool fencing to reduce the risk of drowning.

Broad DHHS concern regarding prevention of injury and illness was reflected in the publication of specific national health promotion and disease prevention goals; the first set of goals, for 1990, was issued in 1980 and was followed with the 1990 release of goals for the year 2000 (DHHS, 1980, 1991). Injury prevention was highlighted by a 1985 report, *Injury in America: A Continuing Public Health Problem* (NRC/IOM, 1985). This report renewed attention to the heavy toll taken by injuries and called for research in prevention and improved care following injuries. Its recommendations led to creation of an injury prevention program at the Centers for Disease Control and Prevention (CDC) in DHHS. In June 1992, the program gained greater prominence with its designation at CDC as the National Center for Injury Prevention and Control.

Concerns Emerging in the 1980s

A 1988 conference on issues in emergency medical care highlighted the need to ensure the consistent delivery of high quality care (AHA-ACEP-AMA, 1988). Recommendations from the conference targeted the need for classification of system capabilities, medical control, system evaluation, research, national training standards, and adequate levels of financial support.

For EDs, uncompensated care and inadequate reimbursement for emergency care of Medicaid patients created problems. Some urban trauma centers found it difficult to remain within the trauma system because of the financial burden of caring for large numbers of seriously injured but uninsured patients. In addition, federal legislation, the Consolidated Omnibus Budget Reconciliation Act of 1985 (COBRA 1985, P.L. 99-272) and OBRA 1989 (P.L. 101-239), established a universal requirement for EDs to evaluate, or stabilize for transfer to a more appropriate facility, any patient requesting care. In rural areas, hospital closings further reduced the already limited emergency care resources in those areas. Hospitals also faced a serious shortage of nursing staff. The emergence of acquired immune deficiency syndrome (AIDS) during the 1980s created a new risk for health care providers.

Efforts by the surgical community, led by the ACS, to develop emergency care systems specifically focused on trauma care had produced widespread acceptance of the value of such an approach. Implementation of trauma systems increased during the 1980s but faced continuing difficulties (Mendeloff and Cayten, 1991). Only Maryland and Virginia had essentially statewide systems at the end of the decade (mendeloff and Cayten, 1991). Many other states have not sought authority or have not used available

authority to direct the designation of trauma centers. Some hospitals have resisted creation of trauma systems out of concern over potential loss of paying patients or an increase in uninsured patients; for some hospitals, those apprehensions have proved quite real, resulting in serious financial consequences (GAO, 1991b). Widespread coordination of highly diverse prehospital services has also been difficult. In addition, tensions continue within the medical community. Surgical leadership of trauma centers contrasts with the primary role played by emergency physicians in other areas of EMS.

Nominal federal support for further development of trauma systems was reflected in the passage in 1990 of the Trauma Care Systems Planning and Development Act (P.L. 101-590). The act provides for an advisory council for the Secretary of DHHS, a clearinghouse, special attention to rural areas, and matching-fund grants for states to develop trauma system plans. Greater awareness of pediatric concerns is reflected in two requirements in the law: that the advisory council include "an individual experienced or specially trained in the care of injured children" and that the model trauma care plan to be developed by DHHS take AAP standards into account. For FY 1992, only $5 million of an authorized $60 million was appropriated (EMS-C National Resource Center, 1992). In 1992, additional funds were authorized for grants to trauma centers to offset costs of uncompensated care to victims of drug-related violence (P.L. 102-321).

Children and EMS

The 1980s saw a substantial increase in attention to EMS-C issues. In some ways, this period of rapidly expanding developments in EMS-C paralleled the experiences of the late 1960s and early 1970s for the original adult-focused development of EMS. Recognition of the need for EMS-C began to spread, professional organizations were created, new training programs were developed, guidelines specifically addressing pediatric requirements were introduced, and the federal government assumed a role in supporting development of systems of care.

Greater Attention to EMS-C Local efforts in various places across the country were attracting greater attention to the need for EMS-C and producing some visible changes. For example, the Los Angeles EDAP-PCCC program described above became firmly established; a network of PICUs in northern and central California coordinated services for the region; and pediatric trauma centers were established in several cities (Seidel and Henderson, 1991).

An increasing number of studies began appearing that provided badly needed information on the demographic characteristics of children who were

using emergency services, the kinds of injuries and illnesses that they experienced, and the readiness of providers to care for them. Evidence suggested that about 10 percent of ambulance runs were for children; young children were likely to be suffering from respiratory distress or seizures whereas older children and adolescents were likely to need care for trauma; up to half of trauma deaths might be preventable; prehospital personnel generally had little training in pediatrics and often lacked appropriate equipment (e.g., Haller et al., 1983; Ramenofsky et al., 1983, 1984; Fifield et al., 1984; Gallagher et al., 1984; Seidel et al., 1984; Seidel, 1986a,b; Tsai and Kallsen, 1987; Kissoon and Walia, 1989).

Developments in the Professional Communities Professional societies and similar organizations provided a national base for addressing EMS-C concerns. In 1981, AAP established its Section on Pediatric Emergency Medicine. A separate AAP task force evolved over time into the Committee on Pediatric Emergency Medicine, which has been the focal point for the Academy's substantial contributions to EMS-C. ACEP established a committee on pediatric emergency medicine in 1984 and a section on pediatric emergency medicine in 1988. Together AAP and ACEP formed a Joint Task Force on Pediatric Emergency Medicine in 1984 to facilitate communication and coordination between the two groups in their activities to improve emergency care for children.

The Society of Critical Care Medicine established a pediatric section in 1982; in 1984, in a nice piece of symmetry, AAP created a section on critical care medicine (Downes, 1992). AAP also formed a section on transport medicine in 1989. AHA established its Subcommittee on Pediatric Resuscitation in 1983. By the end of the decade, both ENA and the National Association of EMS Physicians (NAEMSP) had established pediatric sections. In the Ambulatory Pediatric Association a Special Interest Group on Emergency Medicine was established in 1985 and has become the fastest growing of all of the organization's special interest groups. A new organization, the Society of Pediatric Emergency Medicine, had also been formed. Even more recent was the creation in 1991 of the Society of Pediatric Nurses (Fredrickson, 1992). The National Association of Children's Hospitals and Related Institutions (NACHRI) has brought EMS-C concerns to the attention of its member organizations and has supported continuation of federal support for EMS-C activities (Pilotte, 1992).

Training and Educational Courses Valuable new training resources began to appear in the 1980s, although little material specifically on pediatric emergency care was being incorporated into basic qualifying curricula. Specialty training for physicians became available with fellowships in pediatric emergency medicine and pediatric critical care. Subspecialty certification in pediatric emergency medicine is now available through the American

Board of Pediatrics and the American Board of Emergency Medicine and in pediatric critical care through the American Board of Pediatrics.

Continuing education courses developed by national and by local groups offered needed pediatric training to providers already in practice, including physicians, nurses, paramedics, and EMTs. AHA addressed pediatric resuscitation needs at its 1983 conference and, in 1985, issued revised standards for pediatric basic life support (BLS) and guidelines for training in pediatric advanced life support (ALS) and neonatal resuscitation (Chameides, 1990). This work led to the development of the AHA's Pediatric Advanced Life Support (PALS) course (Seidel and Burkett, 1988; Chameides, 1990), which became widely available in 1988. Newly revised guidelines were issued in 1992 (AHA, 1992a,b).

Over the decade, other courses also became available to a national audience. Recognition by AAP members that better training in the care of acutely ill and injured children was needed led to the development of the Advanced Pediatric Life Support (APLS) course (Bushore et al., 1989), which is offered under joint sponsorship of AAP and ACEP. ACS incorporated in its 1984 revision of the Advanced Trauma Life Support (ATLS) course a module specifically addressing pediatric trauma stabilization (ACS, 1989). In addition, the Pre-Hospital Trauma Life Support (PHTLS) course developed by NAEMT in cooperation with the ACS Committee on Trauma incorporated material on prehospital pediatric assessment and stabilization (NAEMT, 1990). In 1993, ENA was scheduled to begin offering courses based on a Pediatric Emergency Nursing Curriculum (*Etcetera*, 1992). ENA also collaborated with grantees in the federal EMS-C demonstration program to develop a self-instruction curriculum intended particularly for nurses in rural areas where opportunities for classroom training are limited (Henderson and Brownstein, forthcoming).

Locally developed courses were also making an important contribution, particularly in training prehospital providers; AAP's *Pediatric Resources for Prehospital Care* identifies 16 such programs (Brownstein, 1990). Children's National Medical Center in Washington, D.C., developed its Pediatric Emergency Medical Services Training Program (PEMSTP) specifically to prepare EMT instructors to teach pediatric aspects of emergency care (Eichelberger, 1989). Training programs were also developed to meet the needs of nurses (e.g., Bonalumi, 1989; Moloney-Harman, 1989; Taylor and Soud, 1991; CNMC, 1991, 1992).

A Federal Program for EMS-C Some members of the pediatric community felt that the need to develop EMS-C capabilities and resources was sufficiently great and the task sufficiently difficult that a federally funded program was needed to spur progress. In the late 1970s, Calvin Sia began working with Senator Daniel Inouye (D-HI) and Patrick DeLeon of the

Senator's staff to develop such a program. As a result of these efforts, the Emergency Medical Services for Children (EMS-C) Program was established by Congress through the Health Services, Preventive Health Services, and Home and Community Based Services Act of 1984 (P.L. 98-555). The original authorization provided $2 million per year for up to four one-year demonstration grants per year with the option for grantees to seek approval for an additional year's funding. Later reauthorizations of the program (P.L. 100-607 and P.L. 102-410) increased the available funds (to $5 million for FY 1992), allowed a third year of funding, and lifted the four-grant-per-year restriction. The program is currently authorized to continue through 1997.

From 1986 through 1992, the EMS-C program has funded projects in 31 states. The first 20 awards (1986 through 1990) were designated "demonstration" grants; 11 subsequent "implementation" grants have been made (1991 and 1992). In addition, five "targeted issues" grants have been awarded to previous grantees to allow them to do further work on specific issues identified in their original projects. Beginning in October 1991, EMS-C funds have also supported the operation of two resource centers (described more fully in Chapter 8). (Appendix 3B lists all EMS-C projects to date.)

The 1990 guidance to grant applicants stated the following goals for these projects (Funke, 1992, p. 42, citing HRSA, 1990):

(1) expand and improve State and local capability for reducing pediatric emergencies and their consequences in the State and (ultimately, collectively, throughout the Nation), paying special attention to handicapped and minority populations, including Native Americans;
(2) generate financial support from local and private sources for the continuation of the programs after Federal support terminates; and
(3) foster in other States, the capability to reduce pediatric emergencies and their consequences.

The intent has been for the projects funded by these grants to "demonstrate" both the outcomes of their activities and the processes that they used.

In addressing these goals, individual projects have used a variety of approaches reflecting the specific needs and resources of the state or community. Project activities have included collecting data on pediatric emergencies (to assess the need for specialized EMS-C programs); assisting in categorization of hospitals receiving pediatric emergencies and promoting regionalization of services; developing EMS-C standards, protocols, and algorithms for prehospital and ED care; and designing EMS-C training programs for health care providers in prehospital and hospital settings (Shaperman and Backer, 1991; Funke, 1992).

Committee Observations

Since the mid-1960s, the combined efforts of individuals, organizations, and public agencies have enabled EMS in this country to achieve major progress. It has advanced from being the province of concerned but largely untrained volunteers and the most junior medical staff to a highly sophisticated field of medical and paramedical care for which even the many volunteers still involved must have special training. Even with the substantial accomplishments recounted above, however, EMS systems continue to face very real problems in ensuring the consistent delivery of optimum care.

Children are at particular risk because of the long-standing failure to recognize the distinct nature of the care that they require. Over the past 10 years, clinical and organizational requirements in emergency care for children have gained much needed attention, and changes are beginning in the way providers are trained and EMS systems are run. For example, in August 1992, the Maryland EMS system named an associate medical director specifically for children's programs (MIEMSS, 1992), and in September 1992, the governor of New Jersey signed legislation establishing an EMS-C program in the state EMS office (New Jersey P.L. 1992, c.96). In Texas, legislation to establish EMS-C has been drafted for consideration during the 1993 session of the state legislature (EMS-C National Resource Center, 1992). Steps such as these must continue and the need for them must be widely recognized if children are to benefit from the full capabilities of modern emergency services.

PROVIDING EMERGENCY MEDICAL SERVICES

EMS systems must to be able to perform certain basic functions in order to deliver timely and appropriate care, but they must have both a narrow and a broad view of their responsibilities. In the narrow and most immediate situation, EMS systems have to address how to provide rapid access to effective care for each individual patient they see. From a broader perspective, they have to look at how the pieces of the system can be organized to bring that care to the largest number of cases. Achieving these goals involves both medical and administrative considerations.

The 1973 EMSS Act was one of the first efforts to delineate EMS system functions. The 15 components that it specified shaped the development of EMS systems throughout the United States by defining the proper scope of such systems and the competencies needed to provide good care (see Table 3-1). Although they are reflected in many systems, these components sometimes have become independent activities without the kind of interconnections that a true *system* of care requires (NAS/NRC, 1978a; Foltin

and Fuchs, 1991). Furthermore, these system components need to be revisited to ensure that adequate provision is made for optimum care for *pediatric* patients.

Essential Services for Emergency Care of Children

EMS-C should be able to provide a continuum of care from initial problem identification through a broad spectrum of services that include prehospital care; hospital-based emergency, inpatient, and critical care; and rehabilitative services appropriate for children. An EMS-C system should ensure links with children's primary care providers and should apply its experience with illness and injury to prevention priorities. Parents and primary care providers, who are important system participants, should be working to prevent emergencies where they can and ready to respond appropriately when emergencies do arise. They also should be responsible for establishing the foundation of comprehensive and continuing primary care that should constitute a child's "medical home" (Sia and Stewart, 1989; AAP, 1992e); the medical home should provide a base from which to address all aspects of care that a child may require as a result of an emergency.

The committee sees seven basic responsibilities for EMS-C systems:

1. identifying emergencies and the need for emergency care;
2. ensuring access to the services of the system (e.g., through 9-1-1 telephone service) with dispatch of personnel and equipment;
3. providing appropriate prehospital care;
4. transporting children to appropriate points of care;
5. providing definitive treatment, including access to tertiary and rehabilitative care as needed;
6. ensuring communication among emergency care providers and with other interested parties including parents and primary care providers; and
7. using information systems and feedback to assess and improve patient care and system performance and to point to areas for prevention efforts.

Parents, primary care providers, and other adults responsible for the care of children (e.g., teachers, day-care providers, coaches) must be able to recognize conditions that require urgent medical attention and know how to obtain help from the EMS system. A simple and reliable means of contacting the EMS system should be available; the widely used three-digit 9-1-1 telephone number often serves this purpose. EMTs and paramedics who are dispatched to provide prehospital care must be able to make accurate assessments of children's conditions and, at a minimum, to stabilize them for transport to an ED where more definitive care can begin. Many other

children who need emergency care arrive at EDs without using EMS transport.

Often, EDs can provide the definitive care necessary to treat serious conditions. Because they also treat many children who are not seriously ill or injured, they must have a sound triage system in place to identify the children who have the most immediate need for care.

ED services alone cannot meet the needs of children in all emergencies. Therefore, EDs must be able to recognize these children and direct them to appropriate inpatient or other follow-up care. In rural and community hospitals with limited resources in pediatric expertise and inpatient services, children may require skilled and timely transport to another hospital for more extensive care.

Once an appropriate destination is reached, definitive care should address all aspects of a child's illness or injury in order to achieve the most complete recovery possible. Access to medical specialists or to specialized inpatient care (in a PICU, for example) may be needed. Early attention to possible rehabilitation needs must be a part of truly definitive care.

EMS systems should not provide care in an information vacuum (a point explored more fully in Chapters 6 and 7). Individual providers benefit from learning about the outcomes of cases they have treated and whether the care they provided was appropriate. System planning benefits from descriptive data on numbers of cases, characteristics of patients, and kinds of treatments. Evaluators need to be able to assess more generally how well the various elements of an EMS system are performing. Furthermore, because preventing emergencies is always preferable to coping with them after the fact, clinicians, administrators, planners, and the public should receive information that will highlight areas (diseases, environmental conditions, behaviors) in which prevention activities will have a large payoff.

STRUCTURE OF EMS SYSTEMS

EMS systems perform their functions through a variety of administrative and operational arrangements and with the participation of many people in various roles. Only rarely is a single mechanism in place with the authority to manage an entire EMS "system." Instead, the pieces of the system are the responsibility of separate agencies or institutions, and the EMS system arises out of cooperation among the separately managed pieces. The discussion that follows examines state and local aspects of EMS along with the role of professional and voluntary organizations. Across the country, systems differ in significant ways because of factors such as geography, history, economics, and governmental arrangements.

In general, the EMS agencies providing prehospital care are the part of the system most closely controlled by state and local governments, being

either directly operated or heavily regulated. Some agencies have well-defined responsibilities centering on providing emergency medical care and emergency transport; in other configurations, EMS may be one of several functions for which an organization such as a fire department is responsible. Hospitals, on the other hand, provide ED care as only one of many services. They, too, are subject to governmental regulation but are more likely to be privately owned and operated than are EMS agencies providing prehospital care. The medical community itself plays a large role in hospital oversight and regulation and in defining the practice of emergency medicine.

Participants in the delivery of emergency medical care include physicians, nurses, allied health personnel such as respiratory therapists, paramedics with ALS skills, EMTs with varying levels of training, "first responders" such as police and firefighters with essential CPR and first-aid skills, emergency service dispatchers, plus members of the public who may provide important interim or bystander care. Most hospital-based personnel are paid employees, but many of the people providing prehospital services are volunteers, especially in smaller communities and rural areas.

Ensuring that EMS systems are prepared to care for children will require reaching this diverse mix of organizations and individuals with appropriate and compelling messages and useful guidance on needed improvements. The committee emphasizes that its goal is to enhance the ability of existing EMS systems to care for children, *not* to create a separate EMS system for children.

State-Level Activities

For the most part, state governments hold the broadest authority for addressing delivery of emergency medical care. The character of state involvement varies widely but generally relates more to regulation and oversight of services and service providers than to direct delivery of services.

EMS Offices and Advisory Councils

Every state has established an EMS Office, usually within the state health department, with responsibility for state activities related to prehospital emergency medical care. The authority and influence of these offices vary widely. A 1990 survey by the National Association of State EMS Directors on functions performed by state EMS offices determined that none of the functions was performed by every EMS office and that in some states the EMS office played a secondary rather than a primary role in performing particular functions (NASEMSD, 1991).

The tasks for which the greatest number of EMS offices (about 35) have primary responsibility relate to oversight of EMTs with basic skill

levels: adopting written qualifying tests, adopting practical tests, licensing (or certifying) personnel, and regulating their scope of practice (NASEMSD, 1991). Other common responsibilities include adopting curricula for basic and advanced training, testing and licensing providers with advanced training, and licensing and regulating ambulance services. Some state EMS offices have a major role in establishing protocols for treatment, triage, and transfer and in categorizing or designating trauma centers. Fewer than five are responsible for such functions as providing training or operating a training academy, approving training centers, or regulating ambulance rates. In addition, EMS offices may have a role in public information and education programs and in data collection and analysis.

Most states also have EMS advisory councils. Many are established by statute, and appointments are made by the governor in some states. Although some councils are strictly advisory in nature, others have the authority to make independent proposals and funding recommendations and to review and approve state EMS plans, training programs, and regulations.

Public Health and Health Care

State health agencies other than the EMS office typically have responsibility for or authority over important pieces of EMS systems. State regulations governing licensing for hospitals and for physicians and nurses can influence the availability of services, and the standards applied can affect capabilities for providing emergency care. Responsibility for the development and oversight of trauma systems, including the operation of a trauma registry, frequently rests with state health agencies. Maternal and child health agencies may have strong influence in matters specifically related to care of children. Prevention programs, for both illness and injury, may fall under such agencies.

Public Safety

Public safety agencies also may have an interest in EMS systems, particularly through highway safety matters. Some NHTSA programs, for example, operate through the Governor's Highway Safety Office. In California, the state highway patrol is responsible for ensuring compliance with ambulance equipment requirements (California Highway Patrol, 1990); in Maryland, emergency helicopter transport and care are provided by the state police (Ramzy, 1990). Emergency communications is also an area of considerable importance to EMS systems that may fall under the jurisdiction of other agencies. Regulation of or support for implementation of 9-1-1 telephone systems involves the interests of public safety agencies (police and fire departments as well as EMS) and public utility issues in connection

with telephone companies. Some states have mandated statewide 9-1-1, whereas others have authorized its implementation by localities without directly participating in the implementation process.

Two Examples of Unusual State-Level Efforts

Maryland Maryland has established a unique private, nonprofit organization with responsibility for coordinating EMS across the state—the Maryland Institute for Emergency Medical Services Systems (MIEMSS) (Ramzy, 1990). A statewide EMS system was first instituted by the governor in 1973. The MIEMSS was created in 1977 by the state legislature with the merger of the state Division of EMS and the Maryland Institute for Emergency Medicine at the University of Maryland, which had grown out of the pioneering work by R. Adams Cowley on treatment of shock and trauma. Until August 1992, the head of the MIEMSS served as the state's EMS director; a separate EMS director is now appointed by the head of MIEMSS (MIEMSS, 1992). Emergency air and ground transportation are provided as a public service, and special EMS communication systems, including 9-1-1, are available throughout the state. The early emphasis on trauma led to a sophisticated trauma system that designates trauma centers on the basis of compliance with standards *and* demonstrated need for those services. A need for specialized pediatric trauma services, recognized in the mid-1970s, led to official designation of a regional pediatric trauma center as part of the state's trauma system (Haller et al., 1983).

Idaho The EMS system in Idaho also has benefited from early attention at the highest levels of state government. In contrast to Maryland, Idaho is a large, mountainous state with widely scattered communities. In addition to the resident population, visitors make extensive use of wilderness areas. To be able to provide effective services under these conditions, Idaho has emphasized developing four aspects of its EMS system: a centrally coordinated statewide communication network that facilitates medical oversight of care and coordination of EMS system resources, rescue services specifically designed to respond to rural and wilderness emergencies, air and ground transportation services, and mobile training programs to reach rural providers who have little opportunity for offsite continuing education (Anderson, 1981b; Paul Anderson, Idaho EMS Director, personal communication, December 1991).

Enhancing EMS-C

Efforts to enhance EMS-C must take into account the specific organizational, political, and financial characteristics of state EMS activities. Those

agencies beyond the EMS office that have an interest in and influence over critical aspects of EMS systems must be brought into a coordinated EMS-C effort. Agencies with responsibilities for child health must also be included. The diversity of state approaches to EMS and children's health issues ensures that no single means of implementing EMS-C will be appropriate in every state.

Local and Regional Activities

It is at the local level that services reach individual patients. The organization of those services is likely to reflect traditional relationships in local government and with local hospitals and health care providers. Community interest in EMS also influences the character of the system. In some states, counties or broader regions established under the 1973 EMSS Act play a significant role. In California, for example, counties have been given responsibility for administering local EMS programs, which requires coordinating the hospital and EMS resources for communities within the county (McArdle et al., 1990).

Prehospital Services

Communities have taken many different approaches to organizing prehospital services. In 50 percent of the 200 most populous cities in the nation, EMS services are provided by the fire department, alone or in conjunction with a private provider (Cady, 1992). In some fire department services, EMS providers have only EMS responsibilities, whereas in others firefighters perform both fire and EMS functions. In another 15 percent of these cities (accounting for 25 percent of the population of the surveyed cities), the EMS agency operates as a "third service" separate from the police or fire departments. In another 25 percent of the cities, private firms are the EMS providers.

All but 4 of the 200 surveyed cities reported providing ALS services (Cady, 1992). Most of these cities use a "one-tier" system with a direct ALS response for each call. Other cities use "two-tier" systems, which respond with varying combinations of ALS and BLS providers and emergency vehicles (some of which are not intended to transport patients) (Braun et al., 1990). Among 25 moderately sized cities (population 400,000-900,000), 20 had 9-1-1 telephone service, and 17 used EMTs or paramedics as dispatchers (Braun et al., 1990).

Although urban residents generally have access to ALS services, patients in rural areas often do not. Medical oversight for ALS or BLS services in rural areas is often limited and may be reduced further, or lost, when rural hospitals close. Where those hospitals operated prehospital services,

closure is likely to have an even greater impact on the availability of emergency care. The long distances and difficult terrain in rural areas make transportation to hospitals an important concern. Some states have attempted to protect against the delays that such conditions can create for ground transport by establishing an air transport network serving most of the state; access to air transport may, however, be difficult to ensure because the low demand for service can make it costly to provide (OTA, 1989).

In most urban areas, EMTs and paramedics are paid employees of the public or private organizations that provide prehospital emergency services. In some urban areas and many rural areas, volunteers make up most of the prehospital provider staff. Many areas that rely on volunteers are finding it difficult to recruit and retain enough people to provide round-the-clock services (OTA, 1989). Volunteers generally must meet the same training and certification requirements as paid providers, but personal costs in time and money can make it difficult for volunteers to acquire and maintain skills, especially at the advanced level. Volunteer agencies also may face significant costs in acquiring and maintaining ambulances.

Hospitals: Emergency Services and Inpatient Care

The American Hospital Association reported for 1990 that 5,024 acute care hospitals had EDs and that 664 facilities were certified by states as trauma centers (American Hospital Association, 1991). NACHRI (1992) reports that 45 freestanding, acute care children's hospitals operate across the country. Of these, 37 have an ED and 22 are state-certified trauma centers; 5 of the other acute care children's hospitals provide emergency care through arrangements with other hospitals. Another 105 children's hospitals provide specialty care such as orthopedics, rehabilitation, or psychiatric services. Some 2,400 general hospitals have specific pediatric units (American Hospital Association, 1991).

Many EDs are faced with the need to accommodate substantial demand for less urgent care (an average of 43 percent of visits) without compromising their ability to care for true emergencies (GAO, 1993). Some busy EDs have found it possible to direct children (and adults) to clinics and physicians' offices when an assessment of their condition shows that they do not require emergency care (Rivara et al., 1986; Derlet and Nishio, 1990). It is essential, however, that EDs be backed up, within the same hospital or at a referral center, by adequate inpatient resources, particularly critical care services.

Community hospitals are an important part of the EMS system, serving as the most readily accessible source of medical care for many patients. Because they lack the range of specialty services available at referral centers, community hospitals need to be able to recognize children who require

more advanced care and to have in place plans for transferring seriously ill and injured children to referral centers. This ability is especially critical because these facilities face several challenges: only a small fraction of the children they see will be *true* emergency cases; staff is likely to have little specific training in pediatric emergencies (and may, as well, have little formal training in emergency medicine or emergency nursing); and under these circumstances such institutions will find it harder to maintain skills and resources for treating emergencies in children.

Rural areas face additional challenges. Many hospitals are unable to provide 24-hour physician staffing in their EDs, particularly by physicians with specialty training in emergency medicine. Limited numbers of pediatricians are available as well. Moreover, many of the nurses who provide the principal staffing for these EDs have additional responsibilities in other areas of the hospital; they also report a need for better pediatric training (OTA, 1989; Henderson and Avery, 1992).

Major referral centers with specialized pediatric and surgical services are able to provide more extensive care, including highly skilled pediatric intensive care, for the most seriously ill and injured children. These centers are usually large hospitals in major cities and are often affiliated with medical schools; individual hospitals may have areas of special expertise. Typically, they provide services to a larger region than the city in which they are located, which allows limited numbers of specialists to serve a greater number of patients. This kind of "regionalization" of resources is especially necessary for those few hospitals providing highly specialized services such as burn centers, neuroaxis centers for treatment of spinal injuries, replantation centers for repair of severed limbs, or rehabilitation centers (Seidel and Henderson, 1991). Some states have no hospitals able to offer this level of care; their EMS systems must rely on the services of hospitals in other states to provide definitive care for the most serious cases. Regionalization can help ensure that children (and adults) have access to the care they need and can help ensure that hospitals providing that care have sufficient numbers of patients to sustain their specialty services.

Trauma centers are equipped to provide specialized care for the most seriously injured patients. As noted earlier in the chapter, pediatric trauma centers have been established in several cities. In a few states (Maryland, Pennsylvania, and Virginia) and regions (e.g., New York City, San Diego County), trauma centers are designated in conjunction with a trauma system that attempts to coordinate the distribution of trauma care resources and establish the criteria for access to specific levels of care.

Over the past 20 years, freestanding urgent care clinics have emerged in some areas of the country as an alternative source of care (Seidel et al., 1991a). They generally provide care on a walk-in basis for a variety of complaints. Some operate independently; others are affiliated with nearby

hospitals. A survey found that, on average, centers saw 50 patients per day; 10 of those patients were children under 15 years old and another 8 patients were between 15 and 18 years old (Seidel et al., 1991a). About half of the centers reported treating potentially serious complaints such as anaphylaxis, seizures, and chest pain; about a third accepted patients brought by EMS or private ambulance.

Primary Care Providers

Primary care providers, including pediatricians, family practitioners, internists, and nurse practitioners, play at least three important roles in EMS systems (AAP, 1988b, 1992e; Sia and Stewart, 1989; Seidel and Henderson, 1991). First, they need to be prepared to recognize and treat emergency conditions that they encounter in their offices. Some patients (and parents of patients) seek office care when a condition is actually serious enough to require ED services. Recent studies (Fuchs et al., 1989; Altieri et al., 1990; Schweich et al., 1991) suggest that pediatricians do not have necessary equipment or medications to treat important pediatric emergencies. Similar results have been reported regarding the preparedness of general medical offices to treat emergencies (Kobernick, 1986). In another study, about half of pediatricians surveyed did not use EMS transport for taking seriously ill children from their offices to referral center hospitals (Baker and Ludwig, 1991).

Second, primary care providers have a significant responsibility in educating parents and children about prevention of injury and illness and about proper use of the EMS system. School nurses also are well-placed to help educate parents and children. A third important role, one that is especially pertinent for pediatricians to consider, is participating in the planning and operation of EMS systems. In rural areas and small communities, office-based physicians are an important source of medical direction for prehospital services. They can contribute pediatric expertise that may otherwise be lacking. The AAP's (1992e) recently published manual, *Emergency Medical Services for Children: The Role of the Primary Care Provider*, provides valuable guidance for all of these roles.

The Community

Members of the community contribute to the operation of EMS systems in a variety of ways. Volunteers who provide prehospital services in many communities have, perhaps, the most visible role, but other activities are important as well. Public education programs on safety and on use of the EMS system organized by individuals, organizations, and schools help reach diverse groups and can emphasize specific messages (e.g., bicycle and sports

safety for parents and children or appropriate responses to chest pain for older adults). Local fund-raising efforts for equipment and training can enable EMS systems to respond to special community needs, including EMS-C. Parents can bring EMS-C concerns to the attention of a variety of groups in the community and can—as role models—encourage children to adopt safe and healthful behaviors. Participation in advisory groups provides an opportunity to shape policies. Members of the community can also become advocates for their concerns at the state level.

Other EMS Systems

Two other a typical EMS "systems" might be mentioned here, both with a need to provide care for pediatric patients. The Indian Health Service and the Department of Defense provide medical care to sometimes isolated populations scattered across the country. Their concerns combine the oversight typical at the state level in other EMS systems and the actual delivery of services at the local level. Planning in these medical systems needs to address guidelines for pediatric emergency care that are appropriate for the settings in which their service providers operate. In addition, it should address coordination with surrounding communities in order to facilitate access to appropriate levels of care.

Enhancing EMS-C at the Local Level

At the local level, providing EMS involves many interested parties and includes political and jurisdictional concerns as well as those related to care of patients. For EMS-C, this means that there are many channels through which to work and which must be taken into account. As noted in Chapter 1, progress can be achieved through a "top down" approach in which local areas respond to new requirements implemented through the efforts of state and national agencies and organizations, but it can also be realized from the "bottom up" by making use of individual and community interest to promote changes or provide resources that can lead to better care.

Professional and Voluntary Organizations

Many organizations that do not participate directly in the operation of EMS system elements or in the delivery of care are, nevertheless, important in influencing the development of EMS in general and EMS-C in particular. The Joint Commission on Accreditation of Healthcare Organizations (JCAHO), for example, establishes standards for hospital services, including the ED, and conducts periodic reviews at individual hospitals to monitor compliance with those standards (JCAHO, 1990). The current ED requirements call for

written policies and procedures on the management of pediatric emergencies and child abuse but make no other explicit reference to pediatric care. Because the JCAHO has such a substantial influence on hospital practices, it may prove to be an important vehicle for advancing EMS-C.

Similarly, EMS-C advocates will need to work with organizations that oversee professional standards and that represent the interests of their members. A long list of organizations could begin with groups such as the AAP, ACEP, ENA, and NAEMT, whose members deliver emergency care to children; the American Hospital Association, the American Medical Association, and the American Nurses Association, which have broad interests in health care services; and the Accreditation Council on Graduate Medical Education, the National League for Nursing, and the Committee on Allied Health Education and Accreditation, which have a role in the accreditation of training programs.

As noted above, professional organizations representing the providers of emergency medical care have played an especially large role in establishing an identifiable field of expertise. Their guidelines for facilities, equipment, and care provide authoritative reference points for evaluating elements of EMS systems, and their training programs help bring important new information and skills to providers already in practice. They provide their members with a forum for exchanging ideas and with a nationally recognized voice for speaking to broader audiences about issues of concern. For EMS-C, such organizations have pursued efforts to bring attention to deficiencies in pediatric emergency care, to implement new standards for care, to develop training materials, to secure federal and state funds for EMS-C programs, and to represent pediatric interests in legislative and programmatic arenas.

An organization not previously mentioned, which has been involved in developing standards for prehospital services, is the American Society for Testing and Materials (ASTM). This voluntary organization (whose activities span a broad range of fields) provides a framework for interested participants to develop consensus standards. Working with NHTSA, an ASTM committee is addressing a variety of nonclinical aspects of EMS systems, including equipment, training, management, and communications.

Public service and advocacy organizations also play a role in EMS and EMS-C issues, particularly in public education and awareness. The American Red Cross, for example, has a long tradition of teaching first aid and water safety skills to children and adults. They and the AHA have each developed courses for the public in CPR. The National Safety Council, through a variety of publications and activities, promotes discussion of safety and health concerns. The National SAFE KIDS Campaign organizes national and local activities to educate parents and children about injury prevention and seeks corporate and public sector action to promote safety and

injury prevention. Some private groups contribute considerable financial support for the operation of specific kinds of facilities; for example, the Kiwanis International Organization has underwritten creation of pediatric trauma centers, and the Shriners have given special support to burn centers.

Many other organizations concerned with child health and welfare are potential advocates for EMS-C on the national, state, and local levels. Some of these might include the Children's Defense Fund, the Children's Safety Network, church groups, Mothers Against Drunk Driving (MADD) and Students Against Drunk Driving (SADD), Parent-Teacher Associations, scouting organizations, YMCAs and YWCAs, and sponsors of organized sports for children. These organizations only begin to illustrate the many groups that are currently active (or that might become active) in efforts to prevent injury and illness in children and to ensure high quality emergency care for children who need it.

Funding for EMS Systems

Funding mechanisms and levels for EMS systems are difficult to summarize. They vary across the components of systems, across systems within a state, and across states. At the local level, public funding (from local revenues or state allocations) may support or subsidize prehospital care as a public service similar to police or fire departments; some systems use subscription or fee-for-service approaches instead of or in addition to public funding. Some communities may depend on privately owned ambulance services to provide prehospital emergency care. For the many prehospital systems, especially in rural areas, that are built around volunteer providers, public funding may be available to offset some operating costs, but local fundraising efforts are often critical, especially for purchases of ambulances or other costly equipment.

In general, hospital ED and inpatient care is provided on a fee-for-service basis (or under the prepayment or copayment arrangements of health maintenance organizations). Private insurance and Medicaid provide at least partial payment for many prehospital and acute care services. Insurance coverage of outpatient or rehabilitation follow-up care is generally limited, however. EMS agencies and hospitals, particularly trauma centers, that care for uninsured patients can incur substantial unreimbursed costs (GAO, 1991b; Mendeloff and Cayten, 1991).

In many states, EMS activities at the state and local levels are funded, at least in part, by state appropriations of general funds. The amount of such appropriations varies quite widely—from none in Virginia to about $28 million in Hawaii (NASEMSD, 1991; *Emergency Medical Services*, (1992). EMS can also receive state funds through specially designated appropriations. At least 18 states rely on fees or surcharges (e.g., on vehicle

or driver registrations or on fines for moving violations) designed specifically to raise funds for EMS activities (NASEMSD, 1991). Virginia, for example, added a $1.00 fee to motor vehicle registrations in 1983 (Mayer et al., 1990); in 1990, the fee was raised to $2.00 (Code of Virginia, § 46.2694), generating about $10 million in 1991. In 1991, Minnesota adopted a $25.00 fine (increased from $10.00) for seatbelt violations; 90 percent of the fines collected are distributed to the state's eight regional EMS systems (*Emergency Medical Services* , 1992). Using a similar approach, various states and local areas have adopted surcharges on business and residential telephone service to fund 9-1-1 telephone systems.

As has been described, federal funding is also available to support state and local EMS activities, particularly through the Preventive Health Services Block Grant and Section 402 highway safety funds. Overall, states allocated about $13 million to EMS out of $86 million in prevention block grant funds for FY 1990 (Public Health Foundation, 1991). This represents about 10 percent of the total of $127 million that state health agencies are estimated to have spent on EMS (Public Health Foundation, 1991).[5] A few states also have used small amounts from the Maternal and Child Health Block Grant for EMS. Beginning in 1986, the EMS-C demonstration grant program has contributed an additional $2 million to $5 million dollars. Unlike block grant funding, which is available to every state, only a limited number of EMS-C grants are made each year to support specific projects intended to advance EMS-C capabilities.

Comparing EMS funding across states or communities is difficult. Apparent differences in levels of state support reflect not only differences in fundamental commitment to EMS but also in the regulatory and operational functions for which the state or locality is responsible (Smith, 1990). An assessment of *total* funding for EMS activities in a state requires taking into account regional, county, and community contributions as well as state funding. Comparisons must also consider the value of EMS services provided by volunteers or by private ambulance services that, in other states, are paid for with public funds.

The serious fiscal constraints facing many state and local governments mean that all publicly funded programs must be carefully scrutinized; the variety of approaches used across the country to organize EMS systems provide many models that might be considered. As federal legislation extends Medicaid eligibility to more children, the impact of emergency system care may become a concern. The added children may, however, represent only a small component of Medicaid costs. Even with a 25 percent increase over the past decade in the number of children served by Medicaid, they continue to represent about 44 percent of Medicaid recipients and only 14 percent of Medicaid expenditures (Cartland et al., 1993).

SUMMARY

EMS first received systematic attention from federal, state, and local governments and from the medical community in the mid-1960s. A focus on trauma (especially motor vehicle crashes) and on acute cardiac conditions led to the development of an adult-oriented system. In the 1970s, funding from federal agencies (particularly, DOT and DHHS [then DHEW]) and an RWJ Foundation grant program did much to stimulate the growth of EMS systems. In 1981, folding DHHS funding for EMS into a block grant program covering seven preventive health and health services programs led to less federal funding for EMS. Over time, however, some states and communities increased their own funding for EMS.

By the late 1970s, pediatricians and pediatric surgeons had begun to recognize that children's emergency care needs had not received adequate attention. Efforts in their own communities and through professional organizations began to gain wider attention with such developments as the designation of a regional pediatric trauma center in Maryland, the creation of the EDAP program in Los Angeles, and the introduction of courses such as PEMSTP, PALS, and APLS. In 1984, a federal demonstration grant program specifically targeting EMS-C was approved. This ongoing program, administered by HRSA, aims to expand access to and improve the quality of EMS-C services available through existing EMS systems. It also is generating a body of knowledge and experience that other states and localities can draw on in their efforts to enhance EMS-C capabilities. Since the first grants were awarded in 1986, projects in a total of 31 states have produced a variety of resource materials and taken many useful steps to improve EMS-C.

Progressive development of EMS systems has made clear that certain core functions need to be performed in every system. Fifteen system elements specified by the 1973 EMSS Act (e.g., training, communications, transportation, critical care facilities, and standard record keeping) have been important in shaping EMS systems. The committee sees seven essential responsibilities for EMS-C systems: (1) identification of emergencies and the need for emergency care; (2) access to the services of the system (e.g., a 9-1-1 emergency number) with the dispatch of personnel and equipment; (3) appropriate prehospital care; (4) transportation to appropriate points of care; (5) definitive treatment, including access to needed tertiary and rehabilitative care; (6) reliable communication among emergency care providers; and (7) use of information systems and feedback to assess and improve care and system performance and to point to areas for prevention.

Meeting these responsibilities involves medical and administrative considerations and requires the participation and cooperation of a variety of individuals and institutions. No one agency or institution has authority over

all of the elements involved. State governments have broad authority over EMS activities, principally through regulation and oversight of services and providers. At the local level, EMS agencies (which provide prehospital care) are generally regulated, and often operated, by local governments. EDs and hospital inpatient services are also subject to governmental regulation but are more likely than EMS agencies to be privately owned and operated. Community hospitals provide emergency care for many children while major referral centers, with highly skilled pediatric specialists and pediatric intensive care facilities, are prepared to care for more seriously ill or injured children. Other contributors to emergency care in the community include health care providers. Primary care clinicians and parents (and their surrogates) have special responsibilities for preventing injury and illness and initiating contact with the emergency care system.

In sum, EMS systems originally developed to care for adult victims of trauma and acute cardiac disease have tended to overlook children and the differences in care that they require. Efforts to address the emergency care needs of children must consider all the elements that constitute EMS systems and understand the specific channels through which change can be implemented in each. Progress can be seen in bringing these needs to public and professional notice, and the EMS-C grant program has provided valuable resources for these efforts. Still, the need for special attention to the care of children must be more widely recognized in federal, state, and local governments, in the health care community, and among the public. It must be made a genuine and continuing priority with decisionmakers in a position to influence the future direction of emergency medical care and to ensure that adequate financial resources are available. Through this report, the committee aims to identify areas of special concern regarding EMS-C and to put forward suggestions and recommendations for specific actions on the part of a variety of individuals and organizations.

NOTES

1. Throughout this report, "emergency department" and ED are used as generic terms that encompass all varieties of organized hospital-based outpatient services available to provide unscheduled care for patients whose conditions may require immediate treatment. In some settings, such facilities may be known as emergency rooms; elsewhere emergency care is the responsibility of a full-fledged hospital department.

2. An early step, the Hill-Burton hospital construction program under the 1946 Hospital Survey and Construction Act, was followed in the early 1960s by the Regional Medical Program (RMP) to apply better knowledge and technical development to medical care (especially for heart disease, cancer, and stroke). The Comprehensive Health Planning program expanded areawide planning (through the 1966 Community Health Planning Amendment to the Public Health Service Act) at the same time that it de-emphasized hospital construction through Hill-Burton and the disease-category approaches of RMPs.

3. For more detailed accounts of the history of EMS-C, see Haller (1989b), Foltin and Fuchs (1991), and Seidel and Henderson (1991).

4. States could elect to use preventive health block grant monies to finance programs in the following areas: EMS, comprehensive public health services, rodent control, fluoridation, hypertension control, health education and risk reduction programs, and establishment of home health agencies (OTA, 1989).

5. The amount spent on EMS by state health agencies does not include funds spent on EMS-related activities by other state agencies or funds spent independently by local EMS systems.

Appendix 3A

Recommendations from Accidental Death and Disability: The Neglected Disease of Modern Society

ACCIDENT PREVENTION

- Formation of a National Council on Accident Prevention at the Executive level for coordination of information and advice on implementation of measures and regulations now vested in scattered private, industrial, and federal agencies, and for research, public education, and development of improved standards in accident prevention.

EMERGENCY FIRST AID AND MEDICAL CARE

First Aid

- Extension of basic and advanced first aid training to greater numbers of the lay population.
- Preparation of nationally acceptable texts, training aids, and courses of instruction for rescue squad personnel, policemen, firemen, and ambulance attendants.

Ambulance Services

- Implementation of recent traffic safety legislation to ensure completely adequate standards for ambulance design and construction, for ambulance equipment and supplies, and for the qualifications and supervision of ambulance personnel.
- Adoption at the state level of general policies and regulations pertaining to ambulance services.
- Adoption at district, county, and municipal levels of ways and means of providing ambulance services applicable to the conditions of the locality, control and surveillance of ambulance services, and coordination of ambulance services with health departments, hospitals, traffic authorities, and communication services.
- Pilot programs to determine the efficacy of providing physician-staffed ambulances for care at the site of injury and during transportation.
- Initiation of pilot programs to evaluate automotive and helicopter ambulance services in sparsely populated areas and in regions where many communities lack hospital facilities adequate to care for seriously injured persons.

SOURCE: NAS/NRC (1970a, pp. 35-37)

Communication

- Delineation of radio frequency channels and of equipment suitable to provide voice communication between ambulances, emergency departments, and other health-related agencies at community, regional, and national levels.
- Pilot studies across the nation for evaluation of models of radio and telephone installations to ensure effectiveness of communication facilities.
- Day-to-day use of voice communication facilities by the agencies serving emergency medical needs.
- Active exploration of the feasibility of designating a single nationwide telephone number to summon an ambulance.

Emergency Departments

- Initiation of surveys and pilot programs to establish patterns of and the numbers and types of emergency departments necessary for optimal care of emergency surgical and medical casualties in a selected number of cities, groups of small communities, and sparsely populated areas.
- Development of a mechanism for inspection, categorization, and accreditation of emergency rooms on a continuing basis.
- Federal fund support to design, construct, and in part, operate model emergency facilities of each type.

Interrelationships between the Emergency Department and the Intensive Care Unit

- Expansion of intensive care programs to ensure uninterrupted care beyond the immediate measures rendered in emergency departments.

THE DEVELOPMENT OF TRAUMA REGISTRIES

- Establishment of trauma registries in selected hospitals as a mechanism for the continuing description of the natural history of the various forms of injuries.
- Subsequent consideration of establishment of a national computerized central registry.
- Studies on the feasibility of designating selected injuries to be incorporated with reportable diseases under Public Health Service control.

HOSPITAL TRAUMA COMMITTEES

- Formation of hospital trauma committees, on a pilot basis, in selected hospitals.

CONVALESCENCE, DISABILITY AND REHABILITATION

- Development of additional studies on the quantitation of degrees of disability and the stages of convalescence at which return to productive work is indicated.
- Development of studies on rehabilitation with emphasis on measures to be initiated in the earliest phases of treatment.

MEDICOLEGAL PROBLEMS

- Judicial application of the principle of seeking impartial medical advice in the determination of disability.
- Replacement, on a national scale, of lay coroners by medical examiners who are not only physicians but also qualified pathologists experienced in medicolegal problems.

AUTOPSY OF THE VICTIM

- Routine performance and analysis of complete autopsies of accident victims.

CARE OF CASUALTIES UNDER CONDITIONS OF NATURAL DISASTER

- Development of a center to document and analyze types and numbers of casualties in disasters, to identify by on-site medical observation problems encountered in caring for disaster victims, and to serve as a national educational and advisory body to the public and the medical profession in the orderly expansion of day-to-day emergency services to meet the needs imposed by disaster or national emergency.

RESEARCH IN TRAUMA

- Increased federal and voluntary financial support of basic and applied research in trauma.
- Long-term financial support of specialized centers for clinical research in shock and trauma.
- Expansion of clinical research in war wounds.
- Expansion within the U.S. Public Health Service of research in shock, trauma, and emergency medical conditions, with the goal of establishing a National Institute of Trauma.

Appendix 3B

Emergency Medical Services for Children Demonstration Grant Program

The Emergency Medical Services for Children (EMS-C) demonstration grant program, administered by the Health Resources and Services Administration of the Department of Health and Human Services, is aimed at reducing the mortality and morbidity experienced by children as a consequence of emergencies due to injury and illness. The program is designed to develop knowledge that can be applied to improving the pediatric care capabilities of existing emergency medical services (EMS) systems around the country. Specific priorities include learning about the types, frequencies, and characteristics of pediatric emergencies and how EMS systems address them; developing curriculum content appropriate for training EMS personnel in the emergency care of children; designing effective EMS-C systems; formulating strategies for developing and maintaining state and local support for EMS-C; and reducing the impact of emergencies on children and their families.

The initial federal legislation authorizing the EMS-C program was passed in 1984 (P.L. 98-555). It provided for $2 million annually to fund four new grants in each year of a three-year program. The first grants were awarded in early 1986. Reauthorization of the program in 1988 (P.L. 100-607) lifted the initial limit of four grants per year and provided for funding of $3 million for FY 1989, $4 million for FY 1990, and $5 million for FY 1991 and FY 1992. With a further reauthorization in 1992 (P.L. 102-410), the program was extended through 1997; no limit was set on annual funding for this period or the number of grants that can be made. From 1986 through 1992, a total of 36 projects in 31 states and two EMS-C resource centers were funded.

In 1991, the focus of the program shifted from "demonstration" projects to "implementation" projects. The new orientation calls for use of existing knowledge and the experience gained from the earlier projects to introduce or improve state resources for the emergency care of children. Also introduced in 1991 are "targeted issues" grants to address specific concerns such as reducing the psychosocial impact of emergencies, developing information systems, or applying new technologies to education and training. The two resource centers offer information and assistance to grantees and others interested in EMS-C. Some of the specific activities include publishing newsletters, collecting and disseminating EMS-C grant products, providing technical assistance on system development concerns and longer-term funding for EMS-C activities, providing information about data collection systems, and providing guidance on developing community coalitions to further EMS-C efforts. Individual EMS-C projects are listed in the table that follows.

TABLE 3B-1 Projects Funded by the EMS-C Demonstration Grant Program, 1986-1992

State	Project Title[a]	Grantee Organization	Project Period
Demonstration and Implementation Grants			
Alabama	Demonstration Project for Pediatric EMS Systems Components	Division of Pediatric Critical Care, University of South Alabama	February 1986 to June 1989
Alaska	Alaska EMS for Children	EMS Section, Division of Public Health, Alaska Department of Health and Social Services	October 1989 to September 1992
Arizona	Emergency Medical Services for Children (I)	University of Arizona College of Medicine	October 1992[b]
Arkansas	Arkansas Demonstration Project: EMS for Children	Arkansas Children's Hospital, University of Arkansas for Medical Sciences	October 1987 to December 1990
California	Comprehensive Approach to Emergency Medical Services for Children in Rural and Urban Settings	Department of Emergency Medicine and Pediatrics, Harbor-UCLA Medical Center	February 1986 to May 1989
Colorado	Colorado EMS for Children Grant (I)	EMS Division, Colorado Department of Health	October 1992[b]
District of Columbia	Emergency Medical Services for Children —Focus on the Neurologically Impaired Child	Children's National Medical Center, George Washington University	October 1987 to September 1991
Florida	Emergency Medical Services Grant for Children	University Medical Center, University of Florida Health Science Center, Jacksonville	October 1987 to June 1991
Hawaii	Emergency Medical Services for Children	Emergency Medical Services Systems Branch, Hawaii Department of Health	October 1987 to September 1991
Idaho	Idaho Statewide EMSC Project	EMS Bureau, Health Division, Idaho Department of Health and Welfare	October 1989 to September 1992

State	Project Title[a]	Grantee Organization	Project Period
Louisiana	Emergency Services for Children for Louisiana	Tulane University School of Medicine	October 1989 to September 1991
Maine	Emergency Medical Services for Children	Maine Emergency Medical Services and Medical Care Development, Inc.	October 1987 to September 1991
Maryland	Organization for Comprehensive Emergency Medical Services for Children in Maryland	Maryland Institute for EMS Systems, University of Maryland at Baltimore	October 1987 to September 1991
Massachusetts	Emergency Medical Services for Children (I)	Massachusetts Department of Health	October 1992[b]
Michigan	Michigan Model for Improving Pediatric EMS: A Strategic Planning and Systems Approach (I)	Michigan Department of Health	October 1991[b]
Missouri	EMSC Project: Missouri (I)	Missouri Department of Health	October 1991[b]
Nevada	EMSC Implementation Demonstration Grant (I)	Nevada Division of Health	October 1991[b]
New Hampshire	Improving the Quality and Delivery of Emergency Medical Care for Children (I)	Trustees of Dartmouth College	October 1991[b]
New Jersey	Pediatric EMS System Development for New Jersey (I)	New Jersey Department of Health	October 1991[b]
New Mexico	Emergency Medical Services for Children	Division of Emergency Medicine, University of New Mexico School of Medicine	October 1990[b]
New York	New York State EMS for Children	New York State Health and Health Research, Inc.	February 1986 to June 1989
North Carolina	Emergency Medical Services for Children	North Carolina Children's Hospital, University of North Carolina at Chapel Hill	October 1990[b]

State	Project Title[a]	Grantee Organization	Project Period
Ohio	Emergency Medical Services for Children Demonstration Grant	Division of Maternal and Child Health, Ohio Department of Health	October 1990[b]
Oklahoma	Developing and Improving the Capacity of Existing Pediatric EMS in Oklahoma (I)	University of Oklahoma Health Sciences Center	October 1991[b]
Oregon	Emergency Medical Services for Children in Oregon	Oregon State Health Division	February 1986 to May 1989
Texas	Training, Public Education and EMS/ Trauma System Planning, Pediatric Data Management (I)	Texas Department of Health	October 1991[b]
Utah	Utah Emergency Medical Services for Children	Bureau of Emergency Medical Services, Utah Department of Health	October 1990[b]
Vermont	EMS for Children: Improvement of the Pediatric Component of a Rural EMS System	EMS Division, Vermont Department of Health	October 1989 to September 1992
West Virginia	Tri-State Appalachian Alliance for EMSC (I)	Department of Pediatrics, West Virginia University	October 1992[b]
Washington	Emergency Medical Services for Children	Washington EMSC, Children's Hospital and Medical Center and Washington Department of Health	October 1987 to September 1991
Wisconsin	Improving Emergency Services for Children in Wisconsin	Emergency Medical Services Section, Division of Health, Wisconsin Department of Health and Social Services	October 1987 to September 1991
Targeted Issues Grants			
California	Development of EMS for Children Subsystems in California	EMS Authority, State of California	October 1991[b]

State	Project Title[a]	Grantee Organization	Project Period
Idaho	"Pediatric Medical Emergencies" Interactive Videodisc	Idaho Department of Program Health and Welfare	October 1991[b]
Maine	Maine Pediatric Quality Assurance Project	Maine Board of EMS	October 1991[b]
New York			
New York City	New York City EMSC Project	School of Medicine, New York University	October 1991[b]
Rochester	Development of a Regional Pediatric Data Surveillance System	School of Medicine and Dentistry, University of Rochester	October 1991[b]
EMSC Resource Centers			
State	Center	Grantee Organization	Project Period
California	National EMSC Resource Alliance	Research and Education Institute, Inc., Harbor-UCLA Medical Center	October 1991[b]
District of Columbia	EMSC National Resource Center	Children's National Medical Center, George Washington University	October 1991[b]

[a] (I) designates Implementation Grants.
[b] Ongoing project, no completion date set.
SOURCE: NCEMCH (1992); Peter Conway, Maternal and Child Health Bureau, personal communication, November 1992.

4

Learning How to Provide Good Care: Education and Training

Previous chapters have emphasized that many aspects of emergency medical care are different for children than for adults. With the recognition of these differences comes the need to ensure that individuals responsible for the emergency care of children have the knowledge, understanding, and skills necessary to provide appropriate care. Evidence exists, however, that errors in various phases of emergency care for injured children have led to unnecessary loss of life (Ramenofsky et al., 1984). Education to prevent such errors in caring for injured or ill children must be a high priority for the public and for health care providers.

This chapter reviews the need for education and training for the public and for health care providers, proposes the desirable elements of such educational efforts, and discusses ways that such coursework is now presented and how it might be enhanced and augmented. It also presents seven of the committee's formal recommendations, which promote its view that better education and training are essential for achieving larger goals for EMS-C and that improvements can be made in a relatively short period of time.

EDUCATION AND TRAINING FOR THE PUBLIC

Parents, as well as others with routine responsibility for the well-being of children, play a vital role in preventing illness and injury, in recognizing (when prevention has failed) that urgent medical care is needed, and in gaining access to such care. Evidence suggests a variety of shortcomings in successfully fulfilling these roles, however. Parents are not always aware

of the greatest risks to their children, and they can, therefore, be poorly prepared to prevent them. In one study, parents showed little understanding of children's risk of death from burns and drowning (two of the leading causes of injury deaths after motor vehicle crashes), and reported taking few measures to prevent such injuries (Eichelberger et al., 1990).

The public also must understand when and how to use the EMS system. In a study of injury deaths in children, delay in seeking emergency care was the most frequent error (Ramenofsky et al., 1984). In some cases, necessary emergency care may be delayed by efforts to contact a primary care provider first. In other cases, unnecessary use of EMS resources can impair the system's ability to provide care for true emergencies. Thus, educational efforts directed at parents and other responsible adults, and the public at large, must be especially clear about appropriate and inappropriate use of prehospital and hospital services.

Who Should Be Included

Parents and Other Responsible Adults

Public information and education programs on emergency medical care for children should ultimately reach the entire population, including children themselves. In planning such efforts, reaching adults who are involved most directly in the care, education, and oversight of children should be the highest priority. Parents are obvious and important targets for educational efforts. Educational efforts must also aim to reach other "responsible adults" with whom children spend extended periods of time; the committee includes in this group individuals such as teachers, day-care providers, coaches, life-guards and other camp and recreation personnel, and scouting and other youth group leaders. Unlike parents, whose responsibility usually focuses on only two or three children, adults in these other roles are often responsible for large groups of children.

Other Adults, Adolescents, and Children

Ideally, all adults should acquire a minimum level of understanding of the EMS system to be able to obtain help for children, but reaching the general population is likely to remain a long-term goal. In the near term, adolescents and even elementary schoolchildren are a promising audience. The American Academy of Pediatrics (AAP, 1993) has, in fact, recommended that high school students receive training in basic life support (BLS) and pediatric BLS as part of the health education curriculum. Programs directed at these young people, perhaps as early as kindergarten, have the potential to increase their personal awareness of prevention and their ability

to take appropriate steps when adult supervision is not available. Targeting young people directly has the additional positive effect, over time, of increasing the level of knowledge in the general population.

What Needs to Be Taught

The committee concluded that public education efforts should focus on three areas: prevention and safety; basic first aid and cardiopulmonary resuscitation (CPR); and when and how to use the EMS system. The specific needs of communities and individuals should shape these efforts.

Prevention and Safety

The public must come to recognize that some illnesses and many injuries in children can be avoided by active attention to prominent risks. Immunization, for example, is a strong defense against many serious diseases including measles, pertussis (whooping cough), poliomyelitis, and hepatitis B. In fact, the success of past immunization efforts has made these diseases so rare that parents and the public in general may not appreciate how serious they can be or that unimmunized children are at risk. Parents in particular need to understand the importance of immunization and of completing the immunization process. School-entry requirements help to ensure that children are immunized by 5 or 6 years of age, but delays until that age leave infants and toddlers at risk of serious illness. Factors such as limited access to health care in general and specifically to immunization clinics, lack of insurance coverage for immunizations, and missed opportunities to provide immunization services or to educate parents about them are serious obstacles to complete immunization for some children (Interagency Committee to Improve Access to Immunization Services, 1992).

Injury prevention efforts should address the sources of risk for injury, explain the degree of risk of injury and death, and identify specific steps that can lessen the risks. Nationally, the greatest risks of injury-related death for children under the age of 15 come from motor vehicle crashes (involving occupants, pedestrians, and bicyclists), drowning, and residential fires (Waller et al., 1989). Specific steps such as using child safety seats in cars, having children wear bicycle helmets, improving fencing around pools, and installing smoke detectors in homes illustrate actions that parents and communities can take to help prevent injuries and deaths.

Other concerns should include emphasizing the value of comprehensive primary care and a "medical home" in helping to avoid serious illness and injury (see Chapter 1). Parents and the public in general need to be aware of the important contribution that careful management of factors such as medication, diet, and exercise can make in averting crises that require emergency care for common chronic disorders such as asthma, diabetes, and

epilepsy. Parents should be cautioned about their own behaviors as well. Smoking, for example, poses a risk of fire in the home and exposes children to the harmful effects of passive smoking. Child abuse also must be addressed; parents should be made aware of counseling and other resources available to prevent or end abusive behavior in the home.

Prevention and safety efforts need to take into account developmental differences among children and the implications those differences have for the nature and degree of injury risk and for the kinds of interventions that will be appropriate. For instance, guidance regarding toddlers and young children should address protecting children against household hazards such as poisons (including medications), scalds, falls on stairs, and firearms. Outside the home, pedestrian injuries shift from nontraffic events (e.g., in driveways) for 1- and 2-year-olds to traffic events for 3- and 4-year olds, who do not yet have the cognitive skills for pedestrian safety (Winn et al., 1991). For older children, bicycle safety becomes an important concern.

Basic First Aid and CPR

With sound training in first aid and CPR, parents and other responsible adults can treat minor conditions and, for more serious conditions, can provide essential interim care until more skilled assistance is available. The most recent guidelines on CPR and emergency cardiac care issued by the American Heart Association (AHA, 1992a,c) emphasize preparing the public to make contact with the EMS system and to initiate CPR or other appropriate care. A newly developed National Standard Curriculum for Bystander Care from the National Highway Traffic Safety Administration (NHTSA) is intended to teach the public a few essential skills to apply at the scene of a motor vehicle crash (Ryan, 1992).

When parents were asked in a survey about what safety information they wanted, they were most interested in receiving material on first aid and CPR (Eichelberger et al., 1990). Organizations such as the AHA and the American Red Cross, as well as community hospitals and EMS agencies, can provide this kind of training. Important topics include rescue breathing, CPR, airway management, control of bleeding, wound care, and burn treatment. Parents and others who care for children with chronic conditions that carry a special risk for cardiopulmonary arrest, such as those with chronic airway disease or congenital heart disease, have a special need for training in pediatric BLS care (AHA, 1992a).

When and How to Use EMS

Understanding when emergency care is needed can help avoid dangerous delays in treatment and unnecessary use of emergency services for relatively minor problems when other sources of primary care are available.

When emergency care *is* needed, knowing how to obtain assistance is critical. In many areas, 9-1-1 telephone access systems are available; where 9-1-1 is not available, parents should know the local emergency phone number. Indeed, many experts argue that even young children need to know when and how to call 9-1-1 (or other emergency numbers). Safety programs for children often include teaching them about proper use of 9-1-1 (see, e.g., Nordberg, 1985; Franckowiak, 1992; Stringer, 1992). (Further discussion of 9-1-1 systems appears in Chapter 6.)

An additional part of the public education agenda should be informing parents and the rest of the public about the kinds of emergency care that can be provided within the community so that public expectations are appropriate. For example, the severity of a child's illness or injury may call for transport to a regional center rather than the nearest hospital. On the other hand, some parents may insist, inappropriately, that a child be taken to a specialty hospital when appropriate care could be provided more promptly at a nearby community hospital.

NHTSA's public education activities place special emphasis on the components and capabilities of an EMS system, on how the public gains access to the system, and on the public's role in promoting successful operation of the system (NHTSA, 1990b). Together with the U.S. Fire Administration, NHTSA provides materials for a public education program called "Make the Right Call," which addresses awareness of the role of EMS and of when and how to use the EMS system (U.S. Fire Administration and NHTSA, no date).

Opportunities for Education and Training

Public education efforts can operate through a variety of channels. Encounters with health care providers are important opportunities to reach parents. Community, school, recreation, and worksite programs are able to reach the broader range of responsible adults who should have such training. Many opportunities also are available to provide children with valuable training in safety and emergency care. To be able to reach as large an audience as possible, public education programs need to be a continuing activity rather than a special project. Furthermore, programs must be reviewed periodically to ensure that their content is consistent with current medical practice guidelines.

Health Care Visits

Primary care providers, who traditionally have had an ongoing relationship with children and their parents, should teach parents about prevention and safety measures, basic first aid, where to learn CPR, and when to seek emergency assistance; they can also direct families to a variety of books

and other useful materials (Ludwig and Selbst, 1990; AAP, 1992e). An AAP program—The Injury Prevention Program (TIPP)—outlines guidance on injury prevention for children of various ages and can provide written materials to distribute to parents. Studies suggest that parents are especially receptive to such counseling (Eichelberger et al., 1990; Bass et al., 1991). Ideally, much of this information is provided in the course of routine visits and can be reinforced when children are seen for minor injuries and illnesses. Primary care providers also must be prepared to give more immediate and specific guidance when seriously ill or injured children are brought to the office and when parents seek advice over the telephone. The expanding role of nurse practitioners in primary care is increasing the opportunity for patient education and counseling. Pediatric nurse practitioners often take the opportunity during children's routine examinations to educate parents and caregivers.

Courses organized around childbirth preparation and infant care provide an opportunity for some of the training that parents should have. They are also models for new courses that could be created specifically to address prevention, safety, first aid, and emergency care for children. Ludwig and Selbst (1990) argue that parents should be devoting at least as much time to learning pediatric BLS as they do to childbirth preparation.

ED visits offer an opportunity to address prevention and safety. Posters, written materials, and individual counseling are among the approaches being used in ED-based injury prevention programs (e.g., Ellerby and Ward, 1989; Barlow, 1992; Zylke, 1992). ED staff in some hospitals are teaching parents about the immunization and other primary care needs of their children and may also be able to help parents arrange for those services in settings that are more appropriate for ongoing care than the ED is. The ED also provides a vantage point from which to identify specific injury and illness risks in a community; Harlem Hospital, for example, has worked with city government and community groups to address local problems of window falls, pedestrian and bicycle risks, dangerous playground equipment, and violence (Barlow, 1992).

Not all such interventions may be immediately effective. An effort to promote helmet use among children seen for bicycle injuries at one hospital's ED produced no greater adoption of helmets among the test group than among the control group (Cushman et al., 1991a). The investigators speculate that achieving adoption of a relatively unfamiliar practice, such as wearing a bicycle helmet, may require broader community acceptance of the practice in addition to physician recommendations.

Schools, Day Care, Recreation, and Community Programs

As noted above, specific groups of responsible adults who supervise

organized activities for children should be trained in prevention, safety, first aid, and access to emergency care. The locales in which those activities take place—schools (and their ancillary facilities such as gymnasiums, arenas, libraries, and multipurpose rooms), community centers, and local libraries—are sites that should be considered for this type of training.

Instruction of various kinds can be provided by professional educators and also by trained staff from hospitals, EMS agencies, local fire and police departments, and the state police, many of which have outreach programs that involve the community and local schools. School nurses are a resource already situated in the school system. A few of the many specific examples of such activities are cited here.

Community programs in CPR, which are often built around materials developed by the American Red Cross or the AHA and taught by EMS and hospital personnel, offer an opportunity for a broad range of people to participate. Some communities and their EMS systems have made CPR training for the public a high priority. For example, during the 1970s, about 265,000 residents in Seattle and surrounding King County were trained in CPR (Cobb and Hallstrom, 1982). The proportion of resuscitations initiated by bystanders rose from 5 percent in 1970 to 40 percent in 1980.

A variety of other programs are offered in communities across the country. For example, the Phoenix Fire Department has addressed prevention of child drowning in materials that describe fencing requirements for pools, pool safety practices, and the appropriate response if a child is found in distress in a pool (Phoenix Fire Department, 1990; Worley and Simmons, 1990). An annual fair for children on safety and health, which is organized by the Southern Region EMS Council in Anchorage, Alaska, includes participants from the police and fire departments, the state police, hospital programs on health and safety, and the Alaska School Nurses Association (Stringer, 1992). In the Boston area, a medical center's nurses, emergency medical technicians (EMTs), and paramedics have organized a program for schools and community groups on reducing alcohol-related emergencies (Nordberg, 1988). National EMS Week, an event recognized by presidential proclamation since 1990, has provided a valuable opportunity to encourage media attention to national, state, and local EMS issues and to organize participatory activities for the community that can increase awareness and understanding of the EMS system (ACEP, no date).

Private organizations also play an important role by developing educational materials and by sponsoring programs in the community. National Safety Council publications and activities, for example, highlight injuries in specific settings (home, school, workplace). The National SAFE KIDS Campaign and the American Red Cross each produce a variety of materials and sponsor activities for adults or older adolescents responsible for child care as well as for children. The National SAFE KIDS Campaign materials,

such as *How to Protect Your Child from Injury*, generally emphasize five high-risk areas: traffic injuries (to motor vehicle occupants, bicyclists, and pedestrians), drowning, burns and scalds, choking and poisoning, and falls (Feely and Bhatia, 1993). A new program from the American Red Cross (1992), First Aid for Children Today (FACT), is aimed at children in kindergarten through third grade. It uses stories, games, posters, and workbooks to help children learn about injury prevention and first aid. A similar program, Basic Aid Training (or BAT), is for 8- to 10-year-olds. These activities only begin to illustrate resources in safety and injury prevention. The media—including newspapers, magazines, radio, and television—also contribute to public education through public service announcements, news reports that highlight prevention measures (e.g., use of seatbelts), and feature stories. Safety messages have also been incorporated into entertainment programs.

Professional groups such as the AAP, the American Academy of Orthopaedic Surgeons (AAOS), and the American College of Emergency Physicians (ACEP), which usually work through their physician members, sometimes target the public directly. For example, the AAP's TIPP, which generally provides resources for pediatricians to use in advising parents during office visits, has also developed a public education program to encourage use of bicycle helmets. In 1991, the AAOS began a public education program that, in its initial phases, is focusing on playground safety (AAOS, 1991). The ACEP has developed various materials including a public service announcement for television on drowning prevention and an extensive home health packet (HOME: Home Organizer for Medical Emergencies), which is intended to help families organize important medical information, prevent injury and illness, and recognize and respond appropriately to emergencies that do occur (ACEP, 1992b).

In assessments of state EMS systems, NHTSA (1992) found that most states needed to give greater attention to public information and education activities on prevention and EMS system use. Only 8 of 26 states studied had funding dedicated to these activities, and in all 26 states, public education was among the first areas to be affected by EMS budget cuts.

At the national level, the extensive injury control activities at NHTSA and at the National Center for Injury Prevention and Control (NCIPC) and the Maternal and Child Health Bureau (MCHB) in the Department of Health and Human Services (DHHS)[1] contribute to programs at the state and local levels. NHTSA's focus on highway safety has led it to develop programs to prevent impaired driving (due to alcohol consumption); to promote occupant safety measures, including a child safety component; and to improve motorcycle safety (NHTSA, 1990b). The NCIPC addresses a broad range of injury risks including falls, drowning, poisoning, burns, and injuries due to violence (CDC, 1992b), and MCHB supports projects to prevent violence and various unintentional injuries.

Legislative Actions

Successful implementation of prevention measures generally requires continuing educational efforts and may require legislative mandates as well (e.g., Walton, 1982; Margolis et al., 1988; National Committee for Injury Prevention and Control, 1989; Runyan and Runyan, 1991; Cote et al., 1992). The federal Poison Prevention Packaging Act, passed in 1970, succeeded in reducing the number of ingestions of toxic substances and associated deaths; by 1978, the death rate from poisoning was less than half what it had been at the time the law was passed (Walton, 1982). Child restraint laws, which have been enacted separately by each state, have been found to reduce fatalities in motor vehicle collisions (Agran et al., 1990)[2] and to reduce the number of head injuries requiring hospitalization (Margolis et al., 1988).

Efforts to ensure that responsible adults can provide immediate assistance in the event of an emergency have resulted, in some places, in legislative or administrative requirements for specific training. California, for example, now requires that all teachers have CPR training (California Education Code, § EDC44261, c. 307, ¶ 2, 1991), and Virginia requires that two staff members in each school be trained in first aid and CPR (Commonwealth of Virginia, 1989). Individual states and localities will need to evaluate the appropriateness and cost-effectiveness of such steps for their specific circumstances. Even with a legislative mandate, however, lack of funding to implement training programs or lack of enforcement can keep such laws from having much impact.

Legislated requirements for the use of bicycle helmets have been particularly successful in increasing the proportion of children who use them (Cushman et al., 1991a,b; Cote et al., 1992; Pendergrast et al., 1992). Over a one-year period in two adjacent Maryland counties, an education program raised helmet use from 8 percent to 19 percent in one county, but legislation requiring helmets brought use from 4 percent to 47 percent in the other county (Cote et al., 1992).[3] Five states (California, Massachusetts, New Jersey, New York, and Pennsylvania) have now passed legislation on helmet use (Feely, 1992). Even legislative action may be limited in scope, however: California's helmet law applies only to children less than 5 years old or less than 40 pounds who are bicycle passengers, not to older bicycle riders who are, nevertheless, at risk for serious head injury (Kamela and Demes, 1991).

Meeting Local Needs

To be most effective, public education programs should address both a core of universally appropriate material and issues of specifically local concern. Guidance in using the EMS system, for example, must always take

into account specific local mechanisms for requesting assistance, the capabilities within the system components, and the particular risks for illness and injury that children in that community face.

As noted in Chapter 2, injury to motor vehicle occupants is, overall, the leading cause of injury-related death among children, but in some states and communities, drowning or house fires are greater threats (Waller et al., 1989). In various urban areas, falls from buildings, pedestrian injuries, house fires, and, far too often, firearm injuries and homicide require attention (Barlow, 1992; Ropp et al., 1992; Weesner et al., 1992). Where swimming pools are common, drowning should be a special concern (Wintemute, 1990). Rural areas face the problem of injuries from farm equipment (Brennan et al., 1990; Rhodes et al., 1990).

Specific settings also must be considered. For example, the AAP (1990a) has published guidelines for schools for developing plans to meet urgent care needs in the absence of school medical personnel; these guidelines stress having designated staff members trained in first aid, CPR, and anaphylaxis treatment.[4] One or more emergency care manuals and medical kits should be in specified locations, written first-aid orders should be available, and procedures for requesting EMS or other assistance should be in place. Materials specifically on the management of asthma have been prepared for schools by the National Asthma Education Program of the National Institutes of Health in DHHS (National Asthma Education Program, 1991). Local efforts may target schools as well. San Diego, for example, developed materials for school staff on the importance of rapid contact with the EMS system through 9-1-1 when there is any possibility that a child (or school staff member) may need emergency care (San Diego County Division of Emergency Medical Services, 1991).

States and communities also must consider how to reach populations that may have unusual needs or that may not be part of the mainstream culture. Children who are chronically ill are likely to require emergency medical aid more frequently than other children, and they may need special types of care as well. Their parents and the teachers and other adults involved with such children need to be familiar with the particular risk factors for injury and illness and with the first aid or other care that they should render when emergency assistance is requested. Approaches geared specifically to the cultural, ethnic, linguistic, and economic characteristics of communities are likely to be more effective in reaching those populations (National Committee for Injury Prevention and Control, 1989; Narita, 1991; Belkin, 1992; Buchwald et al., 1992). The families of homeless children may be especially difficult to reach.

Many projects in the Health Resources and Services Administration (HRSA) EMS-C demonstration grant program produced public education materials, often aimed at specific community concerns (Shaperman and Backer,

1991). Among these products are public service announcements for television (Arkansas, Wisconsin), water safety programs (Alaska, Hawaii), playground safety programs (Maine, Vermont), first aid courses for parents and for child care providers (New York, Vermont), and a graphic brochure on child health, safety, and emergency care adaptable to various non-English-speaking audiences (Washington).

A Need for Public Education Programs

Reviewing these factors led the committee to a consensus on recommendations for education and training for the public in matters relating to the delivery of high quality emergency care to children. Specifically, **the committee recommends that states and localities develop and sustain programs to provide to the general public of all ages adequate and age-appropriate levels of education and training in safety and prevention, in first aid and cardiopulmonary resuscitation, and in when and how to use the emergency medical services system appropriately for children. It recommends further that:**

- the content of such programs reflect the particular needs of each community;
- the content of such programs reflect the special medical, developmental, and social needs of children;
- parents and other adults who are responsible for the care and education of children (e.g., day-care workers, teachers, coaches) receive highest priority in such programs; and
- adolescents also be a high priority in this endeavor.

Finally, **the committee recommends that states and localities develop and maintain specific guidelines or criteria to ensure basic consistency and quality of educational programs across communities and populations reached, including specific content elements that those education programs should cover**.

EDUCATION AND TRAINING FOR HEALTH CARE PROFESSIONALS

Until very recently, there has been little overlap between training for emergency medical care and for pediatrics. Training for pediatricians, family physicians, nurse practitioners, physician assistants, and other pediatric primary care providers has not given sufficient attention to recognition and management of emergencies or to the appropriate use of EMS systems. At the same time, programs in emergency medicine have not adequately addressed

pediatric emergency care; similarly, training in trauma surgery has lacked an adequate pediatric component.

Various studies have documented some of these deficiencies. Seidel (1986a) found that in programs of 50 to 100 hours EMTs received an average of 8 hours of classroom training in pediatrics; in programs of 400 to 2,000 hours, paramedics received an average of 15 hours of training in pediatrics. A survey of residency programs in emergency medicine found that about 15 percent of training time was devoted to pediatrics, although about 25 percent of the patients seen by the trainees were children (Ludwig et al., 1982). A recent survey of EDs in Florida found that only 4 percent of the emergency nurses employed by these EDs had received hospital-based training in pediatric care and only 5 percent had taken the Pediatric Advanced Life Support (PALS) course (Taylor and Soud, 1991). (PALS is described later in the chapter.)

Since the early 1980s, however, the need for better cross-training has become more widely recognized and has led to a variety of developments. For example, joint residency programs for board certification in both pediatrics and emergency medicine have been developed. Fellowship programs have become available in pediatric emergency medicine, as has subspecialty certification. Further, some programs are now beginning the more difficult step of altering the basic qualifying curricula to incorporate needed pediatric or emergency medicine components.

In addition, specialized continuing education courses have begun to reach the many providers already in practice. Among the better known are the following: the AHA's PALS course; the joint AAP-ACEP Advanced Pediatric Life Support (APLS); the Pediatric Emergency Medical Services Training Program (PEMSTP) and the Pediatric Emergency Nursing Education Program, both developed by Children's National Medical Center; a Pediatric Emergency Nursing Course developed by the Emergency Nurses Association (ENA); and various training programs developed by individual EMS-C grantees.

Consistent with its belief that EMS-C should become an integral part of both the general EMS system and the broader aspects of child health care, the committee endorses the extension of these and other efforts to incorporate essential elements of pediatric emergency care into the initial and continuing training of all health care providers who care for children. Some material should be included in training programs for all providers, as discussed just below; other training needs are specific to particular kinds of providers, and these are presented later in this section. A selected set of specialized continuing education courses is described later in the chapter. The committee believes that further development of resources for education and training in various aspects of pediatric emergency care should make it possible to establish expectations for specific competencies at specific levels of training.

General Needs

All health care professionals should receive training in certain essential clinical, psychosocial, and organizational aspects of emergency care of children. The committee singles out two clinical areas for particular attention: patient assessment and basic care for trauma and acute illness (including acute episodes of chronic illness). Underlying these should be adequate training in pediatric anatomy, physiology, and pathophysiology.

First, training must prepare providers to recognize characteristic signs of serious illness and injury in children of all ages. Special attention to assessment skills is called for on two counts: children's responses to illness and injury often differ in important ways from those of adults, and, among children, responses vary with age. Thus, providers may find prompt recognition of a true emergency situation more difficult for a child than for an adult. Training should prepare them to make accurate decisions across the entire pediatric age range.

Furthermore, all providers need to be able to render certain essential kinds of care for all pediatric patients. At a minimum, they ought to be able to provide the same pediatric BLS that this committee and others believe parents and other responsible adults should be prepared to provide (AHA, 1992a). Clearly, however, more can legitimately be expected of health care providers, especially physicians. Fundamental elements of more advanced care include CPR for children of various ages, airway management for respiration and ventilation, vascular access, fluid resuscitation, and medication of appropriate kinds and in appropriate dosages. The AHA advocates that "all prehospital and hospital personnel who are responsible for the care of infants and children" be required to have training in advanced life support (ALS) for children (AHA, 1992a, p. 2251). In settings where relatively few seriously ill or injured children are seen, practice scenarios can help maintain readiness to respond when the need arises.

Addressing psychosocial aspects of pediatric emergency care is especially important, because they are a significant component of the emergency and will influence the care given to a child. From infancy to adolescence, children pass through characteristic developmental stages that affect how they respond to injury or illness and how they respond to efforts by strangers to care for them (Eichelberger et al., 1992; Seidel and Henderson, 1992). Providers need to understand these stages in order to care for the child in a humane and effective way. Moreover, they need to be able to respond to parents' reactions to their child's condition and recognize how those reactions may influence the child's response. Steps to calm parents or other family members, including other children, should be considered crucial to high quality care. Children who are chronically ill or have other special needs, and their families, may require unusual attention; family members

who have been trained to handle particular emergencies also may have an important and direct role to play in the care of these children.

Providers themselves may have strong emotional responses to pediatric emergencies. Many EMTs, nurses, and physicians find caring for seriously ill and injured children an especially stressful task. Those who care for relatively few children can find their anxieties heightened by the need to use rarely practiced skills. Training for providers should acknowledge the presence and impact of these stresses and should address ways to manage them.

In addition to clinical training, emergency care providers must learn about the organization and operation of EMS systems, particularly local and regional services, and about the importance of data collection and analysis.

Needs of Prehospital Providers

On-Scene Care

Various designations are used to identify the personnel who provide prehospital care at the scene of an emergency involving a child or adult. They can be grouped into three general categories: first responder, BLS providers, and ALS providers. (BLS and ALS care are described in Chapter 2.) First responders, who may be police or firefighters, or volunteers in some EMS systems, are generally able to reach patients more quickly than regular EMS units. They usually receive training in essential first aid and CPR. They are not a part of every EMS system and are likely to have much more varied levels of training than other prehospital providers. BLS providers are usually designated EMTs. Several EMT categories exist, distinguished by amount of training or training for specific procedures. Some EMTs, for example, receive special training to perform cardiac defibrillation. ALS providers, generally paramedics, have the most extensive training and perform the most complex procedures.

In training prehospital providers to care for children, attention should focus on characteristic features of pediatric emergencies and on specific difficulties that providers may encounter. Providers should be well versed in caring for trauma, seizures, and respiratory distress. It may be appropriate to devote less training time to significant illness-related emergencies (e.g., meningitis, dehydration, or shock) that are encountered less often by prehospital providers. Parents often transport children with these conditions directly to a hospital ED (Luten, 1990).

In general, learning assessment skills and what care to provide in response to specific organ or system dysfunction is more valuable for prehospital personnel than training in pediatric diagnosis. Because providers may find it more difficult to perform basic assessments of children than of adults,

specific attention should be given to those skills. For example, studies have found that complete vital signs (blood pressure, pulse, and respirations) were taken on only half of the children treated (Gausche et al., 1990; Emerman et al., 1991).[5]

Prehospital providers should receive pediatric training that emphasizes the procedures that their EMS system has authorized them to perform. Training should prepare them to do those procedures under the adverse conditions often encountered at the scene of an emergency. BLS skills such as those for airway management and spinal immobilization should be emphasized even for paramedics who are authorized to perform more advanced procedures. Among the most advanced procedures for which paramedics should receive specific pediatric training are endotracheal intubation, intravenous or intraosseous administration of fluids, and administration of parenteral medications.

First responders, who generally have limited training, need to be made aware of important differences in the care of children and adults. Police are especially likely to be involved in trauma cases, where skills in moving and transporting patients can have a major impact on patient outcome, but special training for pediatric cases appears to be limited (Sinclair and Baker, 1991). Further, it is important that police and other first responders be coordinated with EMS responders. Their contribution to patient care can be especially valuable in rural areas where EMS resources are limited, but rural police have been found to have less training in CPR, basic first aid, and proper techniques for moving trauma patients than their urban counterparts (Sinclair and Baker, 1991).

Training for all prehospital providers also should address the importance of full and accurate data collection and the use of those data to evaluate system performance and quality of care. The value of data on the cause ("mechanism of injury") and the nature (anatomic aspects of injury) of children's injuries in targeting prevention efforts should be emphasized.

Dispatchers

Dispatchers are the critical link between requests for assistance and the activation of prehospital providers. In many EMS systems, dispatchers are responsible for determining the kind of response that is sent; this practice makes it important that they have sound training in the principles and practice of triage. Moreover, dispatcher services may also extend to providing callers with instructions for steps to take until the EMS unit arrives.

Formal EMS dispatch training is available, but some systems rely on on-the-job training (Braun et al., 1990). Regardless of the formality of the educational effort, the information and practical routines included should cover several key points. For example, practice guidelines for triage and

prearrival instructions relevant for adults can be inappropriate for children; thus, dispatchers need to be trained to recognize when and how best to apply specific pediatric criteria and procedures. Moreover, special training can be valuable for developing skills needed to provide effective instructions to distressed callers who usually have no previous experience with life-saving techniques (Clawson and Hauert, 1990).

Variation in Authorized Interventions

Consistent with one major theme of this report is the observation that training and education efforts for prehospital personnel and dispatchers need to be appropriate for local situations. For example, procedures that EMTs are *permitted* to perform (irrespective of the age of the patient) may vary widely across geopolitical entities; consequently, educational efforts concerning patients in the pediatric age range ought, as a general proposition, to reflect those differences. It should still be possible, however, for state or local groups to adopt or adapt sound training curricula pertinent to pediatric EMS care that have been developed by authoritative professional or educational bodies; the committee does not believe that such educational and training programs should be developed entirely *de novo*.

Needs of ED Staff

ED staff are at the heart of the emergency medical care system. The most extensive training is needed by the physicians and nurses, as they have the greatest responsibilities for patient care. Nevertheless, other staff members such as physician assistants, various kinds of technicians and allied health personnel such as respiratory therapists, and perhaps even clerical staff also need to have BLS skills to provide immediate, short-term assistance to children until medical staff can respond.

In the EDs of major pediatric referral centers, the medical and nursing staff will be highly skilled in the care of seriously ill or injured pediatric patients; indeed, all professional and support personnel in such centers can be expected to be attentive to the special characteristics of children (and, generally speaking, their families) and able to respond to medical and other needs of either a major or minor nature. Only limited numbers of pediatric specialists (in medicine, surgery, or nursing) and pediatric referral centers are available, however.

The EMS needs of the vast majority of children in this country must be met by the EDs of "community" hospitals—whether those are small rural facilities able to give only the most basic kinds of care or urban hospitals with many services. ED personnel in these hospitals must be able to stabilize children who need to be transferred to higher levels of care at other

hospitals and to provide appropriate treatment for children who can be cared for locally—and to recognize which children are which.

The readiness of these ED personnel to provide emergency medical care for children should be a special concern because they may have little formal training in emergency medicine or in pediatrics. An informal survey of ACEP members with experience, training, or interest in emergency medicine and pediatrics found that 75 percent of those who responded were practicing in the ED of a general hospital and 25 percent had no residency training in either emergency medicine or pediatrics (Eitzen et al., 1990).

Apart from the clinical elements of training, ED staff should be well-informed about the workings of the EMS system and links that should exist between emergency care and other areas of health care. This knowledge actually should be quite broad: at one end of the spectrum, ED staff need to be familiar with the capabilities and operation of local prehospital services; at the other, they also should appreciate the importance of early attention to the possible rehabilitation needs of ill and injured children and the value of consultation with a child's primary care provider. Staff members of community hospital EDs need to understand the importance of establishing referral links with tertiary care centers, and personnel in such specialty centers need to be familiar with the circumstances under which EDs operate in smaller hospitals. Finally, as already noted with respect to prehospital personnel, the training of ED staff should address the importance of data collection and the use of those data to evaluate system performance and quality of care and to inform prevention efforts.

Needs of Other Health Care Providers

Many other health care providers need basic but adequate preparation to care for children in emergency situations. Training needs exist for hospital staff as well as for staff in primary care and ambulatory services.

Within the hospital, members of the medical, nursing, and allied health staff (e.g., occupational therapists or social services personnel) who typically have little ongoing contact with the ED may not have the necessary life support and resuscitation training or practice in using those skills to respond effectively to sudden crises in pediatric patients. These personnel need to have adequate levels of training with periodic opportunities to practice their skills. They also need to be familiar with the emergency response capabilities and procedures within the hospital. Surgical and intensive care staff who care for children as part of adult or general services should have training in important aspects of pediatric care with an understanding of differences in the treatment of adults and children.

Staff in primary and ambulatory care settings need training in life support and resuscitation as well as specific treatments for certain not-uncommon

emergency conditions that may be encountered, such as meningitis, severe asthma, or severe dehydration. Adequate training in basic pediatric emergency care is particularly important for health care providers staffing freestanding urgent care centers that may be used by some families—and some EMS systems—as an alternative to an ED (Seidel et al., 1991a).

Personnel in outpatient settings must be familiar with the operation of the local EMS system and must know when and how to use its services. More than half of the pediatricians and family practitioners surveyed for one study relied most often on the family's automobile, rather than on EMS vehicles, to transport children referred to tertiary care centers (Baker and Ludwig, 1991). The validity of their perception of greater efficiency in using family transportation should be assessed. The newly published AAP (1992e) manual, *Emergency Medical Services for Children: The Role of the Primary Care Provider*, specifically addresses many such EMS system issues.

Providing Professional Education and Training

The committee sees a need to incorporate EMS-C into three areas of professional education: (1) initial qualifying training for personnel providing prehospital services (e.g., paramedics, EMTs, dispatchers); (2) coursework and practical training in both undergraduate and graduate education in the health professions; and (3) continuing education to refresh the knowledge and skills of trained providers already in practice and to train other providers without adequate preparation in pediatric emergency care.

Although continuing education is currently providing much of the needed training in emergency care of children, enhancing skills of existing practitioners is not a sufficient response to the challenge. Increasingly experts argue that newly graduated or certified health care providers should have received training adequate to equip them to cope with childhood emergencies at the time they embark on their professional careers. Thus, interest also exists in modifying curricula in general, undergraduate, and graduate training programs to incorporate the elements of pediatrics or emergency medicine (or both) that appear to be needed.

Efforts to make such curriculum changes should address not only the content but also the process of training. New approaches to training may make it possible to expand its scope without lengthening the training period. In making curriculum changes, attention needs to be given to effective integration of cognitive elements, psychomotor skills, and affective (emotional and psychological) dimensions of training.

In contemplating the education and training needs of the very broad set of practitioners and providers concerned with EMS-C, the committee recognized that no *single* approach was possible or appropriate—either for initial

training or for continuing education. The range of skills expected of prehospital providers is broad; the range of skills expected of nurses and physicians is even broader. Furthermore, the ways and places in which such providers have to be reached differ greatly, and the knowledge and experience they bring to the task of learning about EMS or EMS-C also differ in myriad ways. Thus, this committee as a general proposition does not advocate a single or "national" course or set of courses, although it does believe that whatever courses and materials are developed and promulgated by various groups should meet certain standards of content, timeliness, and educational value and should attempt insofar as possible to address the drawbacks discussed later in this section.

Initial Qualifying Training for Prehospital Providers

A key step forward, in the committee's view, is to ensure that attention to pediatrics is adequate in all the training courses that qualify prehospital providers. This specifically includes paramedics and EMTs at both the basic and intermediate levels; ideally, it would also include first responders and dispatchers. Ways should be found to incorporate information on infants, toddlers, children, and adolescents into formal course work and lectures, practical "laboratory" work with mannequins and models, and clinical rotations. The committee believes that qualifying for certification should require satisfactory performance and attainment of meaningful educational goals reflecting augmented pediatric content in these training programs.

Through the DOT "National Standard Training Curricula," NHTSA has played a leading role in guiding the content and characteristics of the current training programs for prehospital providers. Many states and localities have used these curricula as the starting point for defining training requirements for provider certification. NHTSA has developed course designs for several levels of training: EMT-Basic (formerly designated EMT-Ambulance), EMT-Intermediate, EMT-Paramedic, EMS Dispatcher, and EMS Instructor (DOT, 1991).

The standard DOT curriculum for EMT-Paramedic, for example, calls for at least 400 hours of training; in practice, many programs require 700 to 1,000 hours. The classroom portion of the DOT curriculum covers six major subject areas: prehospital environment; general and preparatory issues such as management of airways, ventilation, and shock; trauma; medical topics; obstetrics/gynecology and neonatal topics; and behavioral emergencies. Clinical training takes place in eight settings: EDs, intensive care units (ICUs), operating rooms, pediatric units, labor and delivery rooms, psychiatric units, and the morgue. Some programs have an additional requirement for a supervised field internship.

The DOT curriculum for basic EMT training is currently being revised.

The new curriculum is expected to address specifically the care of pediatric patients and to emphasize assessment rather than diagnosis, which is especially appropriate for pediatric cases because of the difficulty in the prehospital setting of diagnosing conditions that cause severe illness in children. The committee believes that including high quality training in the care of children in this curriculum is an essential step in improving the EMS-C capabilities of EMS systems.

Although the committee did not have the opportunity to review revisions to the EMT-Basic course, it believes on the basis of informal consultations that the new curriculum will provide a high quality standard for training. Therefore, it advocates that states examine carefully the new curriculum as soon as it is released, with an eye toward adopting it as an official training standard. Better pediatric components need to be incorporated into other DOT curricula as well. Therefore, the committee encourages NHTSA to undertake revisions of these other programs to incorporate appropriate pediatric elements.

Changes to prehospital curricula should be pursued through a variety of channels because of the diverse character of training programs across the country. State and local agencies that set provider certification requirements or approve training curricula can have significant influence on the content of training in their jurisdictions; acting independently, however, they are less likely to achieve the kind of consistency that national attention would encourage. The Committee on Allied Health Education and Accreditation (CAHEA), which is sponsored by the American Medical Association, is in a position to influence the paramedic programs that it accredits (73 programs with an enrollment of 3,682 in 1990-1991) (Fauser, 1992). CAHEA's influence is limited, however, because many other paramedic training programs have not applied for accreditation under CAHEA's voluntary program. Furthermore, CAHEA does not accredit any EMT programs (IOM, 1989). Organizations such as the National Association of Emergency Medical Technicians (NAEMT) and the National Council of State EMS Training Coordinators are other important national channels through which changes in prehospital training curricula should be pursued.

Because the committee believes that training in the emergency care of children must be seen as an essential component of training for prehospital personnel, **it recommends that organizations that accredit training programs for prehospital care providers require that the curricula for EMT-Basic, EMT-Intermediate, and EMT-Paramedic provide training in pediatric basic life support; in the medical, developmental, and social needs of all children; and in caring for children with special health care needs. In addition, the committee recommends that accreditation organizations require that curricula for EMT-Paramedic programs include training in advanced life support for children.**

Initial Education for Other Health Professionals

High on the committee's list of needed educational reforms is providing undergraduate physicians, nurses, allied health personnel, and similar professionals with a basic understanding of EMS and EMS-C.[6] Attention to EMS-C in postgraduate specialty training in nursing and medicine is also a priority and is addressed in later portions of this chapter. The full scope of "initial qualifying training" for physicians, nurses, allied health professionals, and the like is, of course, far too broad an issue for this committee to address.[7] The committee takes a strong stance, however, that the undergraduate levels of all health professional education need to devote more attention to emergency care for children.

The ENA has, in fact, advocated inclusion of emergency nursing in the classroom and clinical training in undergraduate nursing programs (ENA, 1992). The ENA statement did not specifically address pediatrics, but the committee believes that it should be a component of the training recommended by the ENA. Because most nurses working in EDs have had little previous training in pediatric emergency care, additional clinical experience in general pediatrics also would be valuable for nurses caring for children in EDs (Taylor and Soud, 1991).

The committee believes that such curriculum changes are needed throughout health care training programs, particularly for physicians, nurses, and physician assistants. Thus, **it recommends that appropriate accrediting organizations require that the primary curricula for all health care professionals include training in basic resuscitation skills and the use of the emergency medical services system. These curricula must give specific attention to the unique medical, developmental, and social needs of children.** Such training would equip trainees with important and usable skills that increase their readiness to contribute to the care of patients of all ages.

Graduate and Residency Training for Health Care Professionals

In the committee's view, specialty training for nurses and physicians in pediatrics or emergency care must include specific and adequate attention to pediatric emergency care including advanced skills in pediatric life support. To accomplish these goals, the committee encourages the various professional and accrediting organizations to give prompt and careful consideration to ways in which training programs can be modified to provide better cross-training. Ideally, a respected and influential professional body in each field might take the lead in this effort.

Nursing

Nurses play a critical role in nearly all phases of emergency care, and most nurses will provide that care outside of a pediatric specialty environment. Therefore, the committee takes the position that advanced training and certification in the areas of emergency, trauma, critical care, and rehabilitation nursing must address the proper care of children. Similarly, those nurses and nurse practitioners who practice in a primary care setting need training that will prepare them to provide appropriate emergency care to their pediatric patients.

The current core curricula established by the ENA for emergency nursing (Rea et al., 1987) and by the Rehabilitation Nursing Foundation for rehabilitation (Mumma, 1987) have been found to include little pediatric content (Fredrickson, 1992). In contrast, the ENA's Trauma Nurse Core Course (ENA, 1988) has integrated pediatric material throughout the entire course. The core curriculum from the American Association of Critical Care Nurses (AACN, 1990) covers limited pediatric material, but a separate pediatric certification program has been developed (Carla Stallworth, AACN, personal communication, November 1992). The ENA is also scheduled to begin offering in early 1993 a newly developed Pediatric Emergency Nursing course (*Etcetera*, 1992).

Nurses play a significant role in two other aspects of EMS system operation. First, they may provide radio responses (with physician oversight) when prehospital providers request medical guidance and authorization to perform ALS procedures; they are designated mobile intensive care nurses (MICNs) in some EMS systems. No core curriculum has been developed for MICN training, and the pediatric content of the courses now offered is generally limited (Fredrickson, 1992). There is also no standard training program available for nurses who provide air or ground transport care for critically ill and injured children.

The presence of pediatric committees and interest groups in organizations such as the ENA, AACN, and the Association of Rehabilitation Nurses (ARN) is encouraging the development of new pediatric curricula and training programs in those fields. (Some of these are discussed later in this chapter in the context of continuing education for emergency care providers.) The ARN, for example, is developing a scope of practice for pediatric rehabilitation that may well influence pediatric training in that field (Fredrickson, 1992).

The increasing attention to emergency care for children in the nursing community is most welcome. In the committee's view, it is essential that this training not be limited to specialized courses addressing only pediatric care. Training and certification in all aspects of emergency care, including

medical direction for prehospital providers, transport, critical care, and rehabilitation, must prepare nurses to care for their pediatric patients. Similarly, training, clinical experience, and certification for pediatric nurse practitioners and other nurses specializing in pediatrics, family practice, and other aspects of primary care must prepare them to recognize emergencies, access the EMS system, and provide the appropriate initial care. Certification examinations, such as those administered by the American Nurses Association for nurse practitioners, should address essential aspects of pediatric emergency care. Therefore, **the committee recommends that appropriate accrediting organizations ensure that graduate nursing programs in emergency, pediatric, and family practice nursing include training in emergency care for children, including advanced resuscitation.**

Medicine

For physicians in those disciplines and specialties that figure most prominently in pediatrics and emergency care, the committee strongly believes that additional work or clinical experience should be gained in, respectively, emergency care and pediatrics. To be specific, physicians training for pediatric primary care—in programs in pediatrics and family practice—should have additional clinical exposure and training in EMS beyond that encountered in medical school (as proposed above). Similarly, physicians aiming for a career in emergency medicine should be required to have had adequate experience in their residency years in the care of pediatric cases, explicitly including all pediatric ages from neonates through adolescents. Training in trauma management, which is typically the responsibility of surgeons, has been suggested for emergency medicine residencies as well (Haller, 1993). The committee is persuaded that current requirements for training in pediatric emergency care in residency programs for these specialties are not sufficient.

These principles of cross-training should extend to other specialties as well. For the surgical specialties, surgeons-in-training in pediatric subspecialties not involving trauma should receive an adequate grounding in trauma; those training in trauma should be expected to spend time in settings that include care for pediatric patients. The importance of rehabilitation services for many seriously ill or injured children argues for sound training in pediatrics for residents in physical medicine and rehabilitation residencies and for support of pediatric physiatry as a subspecialty. Along the same line of reasoning, the committee further endorses the idea that physicians in other primary care specialties, such as general internal medicine, should at some point encounter both pediatrics and EMS (or EMS-C) training courses or clinical cases.[8]

These changes must be made in a responsible and coordinated manner

by the medical community itself to ensure both that the overall integrity of the residency programs is maintained and that the additional elements in pediatric emergency care sought by the committee are sound and well integrated into the total program. Therefore, **the committee recommends that the Accreditation Council for Graduate Medical Education (ACGME) ensure that the residency programs for emergency medicine, family medicine, pediatrics, and surgery include training in emergency care for children, including advanced** resuscitation.[9] Although combined residency programs are not accredited as such by the ACGME, the committee firmly believes that programs involving any of these fields, such as the joint program in internal medicine and pediatrics (ABP, 1989), should ensure that their participants receive similar training in emergency care for children and advanced pediatric resuscitation skills.

A growing number of training opportunities permit specialization in pediatric emergency care. For example, the American Board of Emergency Medicine (ABEM) and the American Board of Pediatrics (ABP) have promulgated guidelines for a joint residency program that prepares physicians to become dually certified in emergency medicine and pediatrics (ABEM, 1991). Residents are expected to receive 30 months of training in each specialty.[10] Further training in pediatric emergency medicine is available through postresidency fellowship programs. ABEM and ABP received approval to offer subspecialty certification in pediatric emergency medicine, with the first certification examination offered in 1992. Pediatric emergency medicine is, in fact, the first subspecialty approved in emergency medicine (ABEM, 1992).

One constraint on the growth of specialized training in pediatric emergency medicine has been the limited numbers of qualified faculty. As opportunities for specialty and subspecialty training increase, it should be possible to encourage greater faculty development. The training should also help to develop needed research interest and capabilities among faculty and trainees (Heggers et al., 1990; Petersdorf, 1992). A model research curriculum for emergency medicine residency programs has been proposed by the Society for Academic Emergency Medicine (Cline et al., 1992). In hospitals and medical schools without a commitment to residency and fellowship programs, emergency medicine has tended to concentrate on clinical services over teaching and research (Trott and Blackwell, 1992).

The committee has focused its attention on changes in residency programs for emergency medicine, pediatrics, family medicine, and surgery because it believes that those changes must be an especially high priority for the medical community. It is aware, however, that physicians trained in other specialties, such as internal medicine, may staff EDs and therefore encounter children requiring emergency care. For this reason, the committee also encourages a reassessment of the training requirements in other

specialties to ensure that they provide adequate training in advanced resuscitation skills.

Accomplishing Curriculum Change

The committee believes that changes are needed in professional education programs, but it also recognizes that making those changes may well be difficult. Other specialty fields also want training programs to devote greater attention to their particular concerns. Neither adding curriculum components, which would increase the length of training, nor reducing the amount of time devoted to other areas of training is a ready solution.

New approaches to curriculum change need to address both "content" (e.g., adding information to the curriculum) and "process" (e.g., combining multiple skills and specific elements of knowledge in ways that allow them to be learned at the same time rather than sequentially). Both the content and process of education can be divided into three domains: cognitive, psychomotor, and affective. Cognitive deals with concrete facts; psychomotor deals with physical skills; and affective deals with emotional, psychological, and perhaps cognitive abilities. Generally, medical education emphasizes the first two domains. For EMS-C training, adequate attention also must be given to affective aspects of emergency care for children.

Work on changes in the content and process of training should be a high priority for members of the EMS-C community, but, arguably, they cannot do it alone. In this regard, the committee views the participation of professional educators in curriculum changes as desirable. Efforts to introduce EMS-C components into education programs for physicians and nurses will be countered by concerns that multicultural issues, legal considerations, ethical duties, reimbursement and business changes, and other demands on the knowledge base of health care professionals already (or at least threaten to) overburden the curricula for those providers, both in didactic content during schooling and in clinical time in residency. Professionals in the area of curriculum development and related educational fields can play a useful role in helping all involved parties to strike an appropriate balance among these competing demands.

Specialized Continuing Education Courses

As the attention to pediatric emergency care grows, efforts to provide appropriate education and training are producing specialized courses to meet the needs of the many providers already in practice. These specialized continuing education courses are currently the source of most EMS-C training. As more providers are trained and basic curricula are changed, however, these courses will no longer need to be the primary vehicle for EMS-C

education. Nevertheless, continuing education for EMS-C providers of all types remains essential as it does for other aspects of emergency medical care and for medicine and nursing more generally. Providers need an opportunity to learn about new developments in their field and to practice skills (such as CPR) that are difficult to retain without frequent use.

The content, sponsorship, intended audience, and other characteristics of these programs and curricula vary appreciably. They have considerable advantages and potential, but certain drawbacks and obstacles to expansion and success in meeting the broad educational needs identified by this committee also exist. The remainder of this section surveys such continuing education programs.

A Sampler of Current EMS-C Training Programs and Courses

A wide array of courses exists to meet some of the education and training needs just discussed. Briefly described here are the aims, levels of students, and curriculum content for several different programs; the intent is to illustrate the breadth of topics covered by these various courses, not to provide detailed reports or to evaluate their adequacy in educational terms. The committee notes specifically that mention here does not convey endorsement of any particular course design or program materials, although the courses are generally regarded as among the better options now available in this country.

The PALS (Pediatric Advanced Life Support) course was developed in the mid-1980s by an AHA subcommittee on pediatric resuscitation. It is intended for "health care providers with responsibilities for the well-being of infants and children" (family physicians, pediatricians, emergency physicians, housestaff, nurses, and paramedical personnel) (Chameides, 1990, p. 109). An instructor's manual (Seidel and Burkett, 1988) and textbook (Chameides, 1990) are available for the two-day course. A broad set of topics is covered: recognition of respiratory failure and shock; BLS; pediatric airway management; vascular access; fluid therapy and medications; cardiac rhythm disturbances; neonatal resuscitation; immediate post-arrest stabilization; and ethical and legal aspects of CPR in children. The textbook chapter on BLS, for example, covers in detail the "ABCs" of CPR (airway, breathing, and circulation); the chapter on fluid therapy and medications presents detailed practice guidelines for the use of medications for resuscitation and post-resuscitation stabilization. Course lectures are applied in case discussions in which students work with the instructor to determine the appropriate management of various kinds of patients. Skill stations[11] afford "hands-on" practice in four areas: BLS and bag-valvemask ventilation; advanced airway management; vascular access, fluids,

and medications; and cardiac rhythm disturbances and management (including use of defibrillation equipment) (Seidel and Burkett, 1988).

APLS (Advanced Pediatric Life Support), a training scheme developed by the AAP and ACEP, provides a broader curriculum than PALS, although it is aimed at an overlapping audience (Bushore et al., 1989). The course is approximately 16 hours long; it, too, consists of lectures, practical skill stations, demonstrations, and workshops. The content of the course includes cardiac arrest management (which is the major focus of PALS), but the majority of course time is spent on recognition and initial stabilization of a variety of pediatric emergencies. The approach to acute respiratory failure is covered in a general fashion, followed by the discussion of specific causes such as asthma, bronchiolitis, croup, and epiglottitis. Similarly, the approach to the child in shock and the specific causes of shock are discussed. Trauma, altered level of consciousness, toxicologic problems, and neonatal resuscitation are also included. The APLS course materials are being updated.

The two courses—APLS and PALS—have been run together and are complementary in many ways. Some experts believe that a hybrid course would be ideal, but whether that would come to pass remains open to question. No pediatric trauma course comparable to APLS and PALS has been developed, but material specifically on the care of injured children is included in the Advanced Trauma Life Support (ATLS) course offered by the American College of Surgeons (ACS, 1989) and in the Prehospital Trauma Life Support (PHTLS) course developed by the NAEMT in cooperation with the ACS (NAEMT, 1990).

Various other EMS-C courses and course materials have been developed across the country. Many serve the training needs of EMS systems on a local or regional basis and may also attract participants from across the country. A compilation of information on prehospital training courses and materials appears in the AAP's *Pediatric Resources for Prehospital Care* (AAP, 1990b). Now in its second edition, the sections on education describe courses and give contact-person information for programs from more than a dozen states (Arkansas, the District of Columbia, Florida, Georgia, Hawaii, Maine, Minnesota, Missouri, New York, North Carolina, Oregon, Pennsylvania, Washington, and Wisconsin). Various textbooks (e.g., Seidel and Henderson, 1987; Simon and Goldberg, 1988; Hemby Pediatric Trauma Institute, 1989) and other resource materials are also described. A textbook developed by the Children's National Medical Center (CNMC) in Washington, D.C., based on its experience with its PEMSTP course for EMT instructors, has recently been updated (Eichelberger et al., 1992).

Courses also have been developed specifically for nurses. The Florida EMS-C project, for example, has built an Emergency Nursing—Advanced Pediatric Management course around the PALS curriculum (Taylor and Soud,

1991). Added materials address topics such as pediatric trauma and illness, triage priorities, child abuse, and crisis management. CNMC offers a three-day Pediatric Emergency Nursing Education Program aimed at nurses in community hospitals and can arrange for nurses to participate in an additional clinical rotation in the CNMC ED (CNMC, 1991, 1992). The lectures, demonstrations, and skill stations cover behaviors of children, physiologic differences between children and adults, triage, primary trauma assessment, resuscitation, medical and respiratory emergencies, child abuse, head injuries, burns, family and child responses to emergencies, and preparing a child for transport. A collaborative effort between the ENA and EMS-C grantees has produced a self-teaching program designed to make training accessible to nurses unable to attend other kinds of courses (Henderson and Brownstein, forthcoming). The ENA is also working with the National Association of School Nurses to provide opportunities for training in pediatric assessment (Pam Baker, ENA, personal communication, November 1992).

Many EMS-C grantees developed education and training materials intended for audiences ranging from prehospital providers to nurses and physicians. The National EMS-C Resource Alliance (NERA) is compiling a complete collection of these materials and will list them in a catalog of grantee products (NERA, 1993). NERA is assessing the content, use, and availability of courses developed by grantees.

Materials developed by the Washington EMS-C Project (1991) illustrate the broad front on which education and training is proceeding. One effort involved development of a Pediatric Prehospital Curriculum suitable for training prehospital providers qualified at either BLS or ALS levels: an instructor's manual, lecture outlines and slides, lecture notes for students, scripts for skill stations, teaching scenarios, bibliographies, and evaluation tests. Also created were a series of training videotapes (produced by EMS-C staff and a professional filmmaker and narrator) for prehospital providers and health care personnel in general hospital and acute care settings. Two areas—vascular access via intraosseous infusion and assessment of respiratory distress—were targeted. The Washington project also participated along with other EMS-C projects in the ENA efforts to develop the new pediatric emergency nursing curriculum.

Benefits and Building Blocks

The contributions these and similar programs have already made and can make to the expansion of EMS-C across the health care system of this nation, and to the integration of EMS-C into the broader EMS system, are substantial. Perhaps the most obvious and the most prosaic will prove to be the most significant: the improvement in skills for health care professionals

and the concomitant enhancement in their confidence in making appropriate assessment decisions and in delivering appropriate services in situations in which pediatric patients, families, and providers alike are under extreme stress. Assessments in early PEMSTP courses found the greatest improvements in pre- to posttest scores for managing injured children and for handling respiratory emergencies (Eichelberger et al., 1985). They also found that basic EMTs, who would have had the least prior training, showed much greater improvement in their scores than the intermediate EMTs and paramedics taking the course.

A secondary salutary effect of these kinds of programs and training sessions is that the improved attitudes, perceptions, knowledge, and skills of trainees themselves may well diffuse to colleagues. This may include members of the EMS "team" itself; for example, as individuals acquire paramedic training, they may be a source of inspiration, assistance, and technical expertise to volunteers with only lower-level training. Such diffusion also may occur well beyond EMS personnel; for instance, emergency nurses who acquire specialized pediatric training may similarly become sources of help and experienced advice for nurses in the rest of a hospital or for the physicians without training in emergency medicine with whom they come in contact.

Out of the variety of courses that now exist, it may become possible to define a core curriculum in pediatric emergency care that can encompass the training needs of EMS providers of all types. Local circumstances will always need to shape training and practice, but the development of a nationally recognized core curriculum would provide a common reference point against which to assess the adequacy of training programs and the adequacy of staff training within an EMS system.

A longer-term benefit of specialized continuing education courses may be the diffusion of pediatric elements into other courses that these instructors teach. As training in EMS-C becomes more common, instructors may be able to overcome the previous omissions of pediatric concerns in many courses. Such a process should complement efforts to incorporate training in emergency care for children into earlier stages of the educational process. Just as the committee looks forward to seeing EMS-C fully integrated into the operation of EMS systems, it believes that expanded training in emergency care for children must become a standard component of the core training that emergency care providers receive.

Drawbacks and Obstacles

Without detracting from the positive aspects of the several outstanding programs now in existence for specialized pediatric EMS training, the committee nevertheless is concerned about several limitations to them. Some

weaknesses are inherent in the nature of competing programs developed by different groups for different audiences; others are intrinsic to the challenges facing all educational endeavors in the health field today.

In the former category lies the issue of lack of coordination among separate courses, which has produced a "patchwork" of training in pediatric emergency care. Coordination may be wanting in at least four ways. First, programs ostensibly attempting to reach the same types of providers and professionals may end up with conflicting elements or significant gaps in topics covered. Second, programs attempting to reach only one type of provider or professional may not dovetail well with programs trying to reach another type of professional—a situation that would be particularly problematic when those separately trained providers are expected to work together as a team in providing EMS or EMS-C care.

Third, further complications and potential for inappropriate duplication and conflict in educational materials or inadvertent gaps in training can arise when local groups attempt to adapt existing courses to local needs. This committee, as noted elsewhere, is sympathetic to the view that practice guidelines attuned to state and local settings can and perhaps should in certain circumstances take precedence over national or federal guidelines; it acknowledges, however, that unreflective local adaptation of guidelines, recommendations, and educational materials can lead to potentially unreliable and inappropriate programs and activities. Fourth, to the extent that developing "add-on courses" diverts attention from incorporating appropriate training into the basic curricula for health professionals, the committee is concerned that long-term training needs will not be adequately addressed.

Regardless of the efforts that these programs might make to coordinate curriculum content among themselves over time, all face a similar need for continuing updates and revision (including withdrawal of obsolete material or recommendations). This poses two related challenges: (1) the need to track the development of clinical practice (treatment) guidelines within one's own particular profession (e.g., trauma surgery, primary pediatric care, EMS at the paramedic level) and (2) the need to monitor changes in recommended practices of related professions that may impinge on one's own practice behaviors. Such guidelines may pertain only indirectly to EMS, they may relate to EMS but not to pediatric issues, or they may be directed specifically at EMS-C issues; this complexity in the evolution of the knowledge base in health care simply confounds the task facing educators.

With respect to clinical practice guidelines (IOM, 1992), attention is increasingly being directed at dissemination and evaluation. These advances may help educators and providers to follow the literature and the field of guidelines development more readily, although doing so will not completely alleviate the coordination problems noted above. In particular, it will do less to ease the problems of keeping "local" curricula and materials current

and appropriate than it will for "national" programs. The experience of the Maine EMS-C Project (1991) illustrates this situation: it chose to support the nationally recognized PALS course to train providers after determining that no organization in the state was able to make a commitment to continue the unique course that had been developed by the project.

The response to increased availability of training in pediatric emergency care has generally been enthusiastic, but providers face demands for additional training in other areas as well. For example, providers in emergency medicine and prehospital care must deal with the rapidly changing features of adult cardiac care, whereas pediatricians must contend with renewed concerns over infectious disease. More broadly, many physician specialties are confronting challenges raised by the growing (and aging) elderly population, acquired immune deficiency syndrome (AIDS), and the unceasing introduction of new health care technologies. Although emergency care providers must be prepared to give essential care to all of their patients, the importance of EMS-C training must be emphasized to those who may not recognize that they are not adequately prepared to care for children.

Trying to obtain all of the "appropriate" training can place a heavy burden in time and expense on individual providers and on the EMS agencies and hospitals that employ them. When courses are not available locally, the costs of travel are added to costs of the courses themselves. In smaller hospitals and communities ensuring adequate staffing can be difficult if some staff members are away for training. The many EMTs and paramedics, especially outside of major metropolitan areas, who provide their services as volunteers find it especially difficult to devote the added time to additional training. They often must bear the cost of training as well. Even in urban areas, staffing and funding constraints in hospitals and EMS agencies may make them reluctant, or unable, to support staff training.

OTHER CONCERNS

Making Education and Training Available

As should be clear from the discussion above, education and training can and is being made available to the EMS community in many ways, both formal and informal. The traditional classroom format, supplemented by "hands-on" skill stations, continues to play a large role. Professional societies may link course offerings with major membership meetings. For example, the Committee on Trauma of the American Pediatric Surgical Association presents courses at the association's annual meeting under the rubric of "What's New in Pediatric Trauma Care?" Some courses require specialized equipment and are most easily offered in a fixed location. For some

students, however, attending courses away from their community (or even place of work) is a serious impediment to additional training.

Emergency care providers in rural areas, who see few seriously ill or injured children and thus have little opportunity to apply their knowledge and skills in this area, have expressed a particular need for periodic access to such training (Henderson and Avery, 1992). They can face considerable difficulty in obtaining it, however. Local training resources are likely to be limited, and staffing shortages and financial constraints can make it difficult to travel to courses that are available but only in relatively distant locations.

Courses that can be brought to providers often reduce burdens in time and costs. Idaho has devoted substantial resources to bring training to health care providers widely scattered in rural areas across a large, mountainous state. In the early 1980s, the statewide communications system was equipped to provide an interactive teleconference capability, which is used to conduct educational programs for providers throughout the state (Anderson et al., 1990).

Another project led to the development of mobile training units, which travel across the state bringing a computer-based training module and materials necessary to provide hands-on training in specific skills (Anderson et al., 1986). The initial focus was on adult trauma for EMTs, but a pediatric training station was added soon after the program began (in the mid-1980s). In addition, the units have been used to train nurses in rural hospitals. Assisted by its EMS-C grant, Idaho has now added interactive videodisc (IVD) training stations to its mobile training fleet (Anderson et al., 1990). The first IVD course addresses pediatric respiratory management.

Other "electronic" options include videotapes, often accompanied by course manuals and other written documents. A "low-tech" approach to providing local training is reflected in the previously noted pediatric emergency nursing course being developed jointly by EMS-C grantees and the ENA (Henderson and Brownstein, forthcoming). The course will use case studies in a self-instruction approach, which will maximize its accessibility to nurses in rural areas and to others who have difficulty attending continuing education courses.

In principle, many different clinical settings should be used as the sites for education and training. These most obviously include hospitals and hospital EDs —not only as training locales for the hospital staff but also as sites for hospital rotations for paramedics and EMTs. Other, less common sites of pediatric emergencies and EMS-C activities (offices and clinics, for example, or airplane or helicopter transport) would be far more difficult to use for educational purposes, owing to the low volume of cases overall and the unpredictability of pediatric cases. Use of "case study" material from these settings as input into quality assurance or educational programs might be practical, however.

A more informal but important source of education is the exchange of information among providers across various stages of care. This feedback is especially valuable in emergency care because of the segmented nature of that care, which often makes it difficult to learn about the outcome of a case. Prehospital providers pass their patients along to EDs, which may then need to transfer a patient to an ICU or other inpatient setting in the same hospital or at a referral center; some patients will eventually move on to rehabilitation services. A child's primary care physician may or may not play a direct role in emergency care but is, nevertheless, an important member of this continuum of care. Without feedback between these stages of care, it is difficult for providers to learn whether their care has had a positive or negative impact on patients. When they have such information they are better able to correct mistakes and learn about alternative approaches to patient care.

Providing the Right Course to the Right Audience

Even with the growing number of special courses on pediatric emergency care, health care providers in various settings may still face difficulties in obtaining the most appropriate training. In fact, the continuing development of new courses often reflects the fact that available options do not meet the needs of specific students or the need for specific kinds of training. Two conflicting concerns surround the development of customized courses, however. The desire to have training resources targeted to the specific needs and circumstances of a particular locality or provider group must be weighed against the resource demands (in staff, time, and money) that are imposed by developing *and maintaining* a high quality educational product for each specific audience.

Use of the PALS course, for example, illustrates some of the concerns that arise. Because it is available nationally, PALS has become widely recognized as a source of training in pediatric resuscitation skills. It is often adapted to meet the needs of specific provider groups such as paramedics, nurses, or physicians. When adapted for one of these groups, however, the course is then not as appropriate for, and often not even open to, other kinds of providers. Where demand is high, it may be difficult to offer enough versions of the course to meet the needs of all providers (Thomas, 1991a).

Taking PALS will still leave providers without training in other important aspects of pediatric emergency care. Emergency nurses have found that PALS is able to provide much needed training in caring for children with life-threatening emergencies, but it does not address the nursing needs of the many moderately ill and injured children who are cared for in EDs (Laurie Flaherty, California ENA, personal communication, March 1992).

The content of the APLS course is broader than that of PALS, but APLS is less widely available. Luten (1990) has commented that, as valuable as PALS is for paramedics, a course specifically designed for paramedic training would be even better. For the many EMTs and other prehospital providers with only BLS skills, the value of PALS and other courses that emphasize more advanced levels of care may be seriously limited.

As EMS-C training programs and materials proliferate, it becomes increasingly difficult to know what is available and to assess the quality of those materials. In the committee's view, a recognized locus of information and expertise in EMS-C is needed. Such an operation would have at least three major responsibilities: (1) to identify training resources, curricular materials, guides, and the like; (2) to review and assess those program materials, course guides, and similar documents; and (3) to serve as a source to which interested groups can turn for references and directions to those in the field who can then provide direct assistance, copies of materials, and other guidance. NERA, currently funded by HRSA's EMS-C grant program, performs similar functions. The committee judges that an activity of this sort is of such importance that it needs to be provided for on a long-term basis. The committee recommends in Chapter 8 of this report that a federal center with responsibility for EMS-C ensure that developing information resources is a high priority.

Evaluating Education and Training Efforts

Even though the development of education and training materials in EMS and EMS-C has been substantial, not enough attention has yet been given to evaluating either the effectiveness of those materials or the teaching methods being used. NERA's ongoing assessment of the prehospital training programs developed by EMS-C grantees makes a contribution on this front. In addition, studies are needed to assess the impact that education and training have on how emergency care providers manage patient care—what knowledge and skills do they decide to use as opposed to how well are they able to perform specific procedures. Evaluation of training programs appears to be needed for EMS in general as well as for EMS-C. In its assessments of state EMS systems, NHTSA (1992) noted that only 7 of 26 states studied evaluate EMS training programs; 11 of these states train EMS instructors and monitor their performance.

A recent review of studies of continuing medical education (CME) suggests greater effectiveness in changing provider practice with CME methods that actively engage the participants (e.g., case reviews or practicing specific procedures) or that make use of feedback or reminders in conjunction with informational approaches (e.g., lectures, printed materials) (Davis et al., 1992). At the most fundamental level, work needs to be done to determine

more clearly what education and training providers actually need in order to provide effective care for their patients. With only limited resources available for education and training, it is important to learn where they are most needed and how to use them in the most appropriate ways.

Retaining Knowledge and Skills

A particular concern regarding EMS-C education and training is that the public and most health care professionals who work outside pediatric specialty facilities will encounter relatively few seriously ill or injured children. This circumstance gives them little opportunity to apply the knowledge and skills that they may acquire; without use, expertise and competence in practical tasks may wither away. A substantial literature exists regarding the rapid decay of CPR skills in the general public and among health care professionals (e.g., Gass and Curry, 1983; Wilson et al., 1983; Kaye and Mancini, 1986; Kellermann et al., 1989; Yakel, 1989; Cavanagh, 1990; Seraj and Naguib, 1990). In the worst case, the EMS system is still left unable to provide adequate care for children and has consumed valuable resources in time and money to train providers.

One key step, therefore, is to determine, across the types of providers, settings, and curricula already discussed, the best means of ensuring long-term retention of knowledge and skills. Attention to both the content of the training and the process of training is needed. Current approaches to teaching these materials need to be studied in order to learn what techniques are most effective. A variety of tactics may be needed to accommodate differences in learning styles and differences in the kinds of students being trained.

Assessments of CPR training in particular and of training more generally in a variety of fields suggest certain factors that tend to enhance long-term retention of skills (NRC, 1991b; Moser and Coleman, 1992). A higher level of mastery of skills during initial training improves retention and can itself be encouraged by sufficiently high criteria for successful performance, by continued practice of skills after performance standards have been met, by distributing a given amount of practice over a longer period of time, by improving the trainee's understanding of a task (rather than simply the sequence of steps to be performed), and by active participation of trainees. Some have suggested that inadequately trained instructors, insufficient practice time, and inaccurate assessment of trainee performance may be contributing to poor retention of CPR skills (Kaye et al., 1991).

Studies specifically related to training emergency care providers are exploring the effectiveness of new technologies that can be used for teaching. One study found, for example, that computer-assisted instruction produced better knowledge retention (over a two-month period) among paramedics than lecture- or video-based instruction (Porter, 1991). IVD instruction

in advanced airway management has also been found to be more effective in improving psychomotor skills than a lecture-demonstration-practical approach (Stoy et al., 1992). Another study found that paramedics trained in endotracheal intubation using only mannequins were as successful in field intubations of adults as were those whose training included experience with human subjects (Stratton et al., 1991).

For providers in all settings, opportunities are needed to practice skills such as CPR. Simple reviews of motor skills can make some contribution. Even more valuable are periodic exercises that simulate pediatric emergencies of various types; such exercises can test the ability of teams of providers to perform specific procedures and to respond appropriately to all aspects of a case. With infant and child mannequins, trainers can even include a certain level of "hands-on" practice for various procedures. Computer-based training systems are another resource for reviewing infrequently encountered pediatric scenarios. The declining cost of personal computers makes it increasingly feasible for EMS agencies and hospitals to provide permanent access to training that was previously available only through instructor-led courses. Optimal intervals for periodic retraining should be investigated.

Providing incentives for Education and Training

Many health care providers have eagerly sought additional training in pediatric emergency care as it has become available. The committee concludes, however, that relying on voluntary responses to ensure that adequate levels of training in pediatric emergency care are achieved across the country will not be prudent. Various incentives and regulations can and should be applied to help ensure that individual providers obtain needed training. Such steps will also be needed to influence the "behavior" of hospitals, EMS agencies, ambulance services, and various other public and private organizations (e.g., community centers or health maintenance organizations) to ensure that they facilitate the development of EMS-C capabilities of the organization and staff.

Financial incentives are often very effective in promoting a preferred course of action. For example, reducing malpractice premiums upon completion of EMS-C training is likely to appeal to individuals as well as institutions. Another approach might be for the federal government to establish EMS-C training requirements as a condition for receiving initial or continuation funds from demonstration or block grant programs. Linking reimbursement levels from Medicaid or other sources to specific training requirements might also be possible.

A "regulatory" approach might be used as well. Specifications for EMS-C training might be incorporated in state and local requirements for

initial provider (or health care facility) licensing or certification and for recertification. Similarly, professional certifying bodies for EMT and paramedic training and for medical or nursing specialties could set requirements regarding training in pediatric emergency care. Although requirements such as these may promote additional training, they also may place serious burdens on providers and on training resources. If these burdens are too great, they may discourage some providers from seeking to qualify, thus defeating the effort to improve their ability to care for children.

Financing Education and Training

Meeting the nation's need for better and more extensive education and training in pediatric emergency care cannot be accomplished without adequate financial resources. Funds are needed to support the staff and activities for both start-up and maintenance of the improvements sought by the committee and others. Start-up costs are associated with developing public education programs, revising curricula for health care providers, conducting initial training for the current provider population, and acquiring necessary equipment to support training efforts. Maintenance costs arise from continuing programs of public education, monitoring and revising provider curricula in accordance with changing practice guidelines, providing continuing education courses needed to maintain provider skills, and maintaining training equipment. Some of these costs are recovered in fees charged for course participants, but those fees must be such that providers (and the public) can afford to obtain the training that is available.

Many EMS systems are based on publicly funded prehospital services, so states and localities facing increasingly severe budget constraints may find it difficult to establish new training programs or fund participation in training elsewhere. Hospitals also may be unable or unwilling to support training for their staff members. Providers themselves can and have absorbed some training costs, but there is a limit, especially for volunteer EMTs and paramedics, to how much expense they are willing to incur. For rural communities, which rely heavily on volunteers for prehospital services, the financial barriers to training can be particularly high. Special community fundraising projects can be used to provide some resources for training but are probably not a reliable long-term funding mechanism.

The committee believes that a commitment is needed at the federal level to ensure a minimum level of funding for training and all other aspects of EMS-C development. Federal funding would not only provide direct financial support but also indicate to states and communities the priority that the government has assigned to this field. Part of the federal funding recommended in Chapter 8 might be targeted to these educational uses.

SUMMARY

This chapter reviews the need for education and training for the public and for health care providers to ensure that children receive high quality emergency medical care. The committee proposes desirable elements of such educational efforts, discusses ways that such coursework is now presented and how it might be enhanced and augmented, and offers several formal recommendations for steps that it believes will improve emergency medical care for children (see Box 4-1).

With respect to education and training for the public, reaching parents and other adults responsible for the care of children must be a first priority; attention to other adults, adolescents, and children should be the second priority. Training should address prevention and safety, basic first aid and CPR, and when and how to use the EMS system. Opportunities for training include health care visits, schools, day-care, recreation, and community programs. A child's primary care provider should play an important role in ongoing education of parents. Public education programs should be designed to meet local needs and take account of local factors.

With respect to education and training for health care professionals, general education and training needs include recognizing characteristic signs of serious illness and injury in children of all ages, rendering essential care for all pediatric patients, and addressing psychosocial aspects of pediatric emergency care. Further training is needed by specific types of providers (including dispatchers, EMTs, paramedics, physicians, and nurses) in specific settings (prehospital, ED, inpatient, and primary care).

The committee takes the view that adequately preparing health care professionals to provide emergency medical care to children will require curriculum changes in several areas. Attention should be given to the initial qualifying training for prehospital providers, to the beginning years of education for other health professionals, to curricula for graduate and residency training programs for physicians and nurses, and to specialized continuing education courses. The current reliance on special courses to enhance the skills of existing practitioners is not sufficient by itself as a long-term approach to providing needed training. Continuing education is, however, an essential component of an overall program of EMS-C training. Because most providers will have limited opportunities to apply the knowledge and skills that are needed in emergency care of children, they need training resources that will enable them to refresh their skills and to learn about current practice guidelines.

Finally, this chapter discusses several other concerns that all parties involved with EMS-C should address. These include evaluating education and training efforts with special attention to the problem of poor retention of CPR and other skills (by members of the public and by health care

BOX 4-1 RECOMMENDATIONS CONCERNING EDUCATION AND TRAINING FOR ADEQUATE EMERGENCY MEDICAL SERVICES FOR CHILDREN

The committee recommends that:

- states and localities develop and sustain programs to provide to the general public of all ages adequate and age-appropriate levels of education and training in safety and prevention, in first aid and cardiopulmonary resuscitation, and in when and how to use the emergency medical services system appropriately for children. It recommends further that:
  - — the content of such programs reflect the particular needs of each community;
  - — the content of such programs reflect the special medical, developmental, and social needs of children;
  - — parents and other adults who are responsible for the care and education of children (e.g., day-care workers, teachers, coaches) receive highest priority in such programs; and
  - — adolescents also be a high priority in this endeavor.
- states and localities develop and maintain specific guidelines or criteria to ensure basic consistency and quality of educational programs across communities and populations reached, including specific content elements that those education programs should cover.
- organizations that accredit training programs for prehospital care providers require that the curricula for EMT-Basic, EMT-Intermediate, and EMT-Paramedic provide training in pediatric basic life support; in the medical, developmental, and social needs of all children; and in caring for children with special health care needs.
- accreditation organizations require that curricula for EMT-Paramedic programs include training in advanced life support for children.
- appropriate accrediting organizations require that the primary curricula for all health care professionals include training in basic resuscitation skills and the use of the emergency medical services system. These curricula must give specific attention to the unique medical, developmental, and social needs of children.
- appropriate accrediting organizations ensure that graduate nursing programs in emergency, pediatric, and family practice nursing include training in emergency care for children, including advanced resuscitation.
- the Accreditation Council for Graduate Medical Education ensure that residency programs for emergency medicine, family medicine, pediatrics, and surgery include training in emergency care for children, including advanced resuscitation.

providers), providing the right course to the right audience, establishing an information resource for EMS-C training materials, and financing education and training.

NOTES

1. The National Center for Injury Prevention and Control in the Centers for Disease Control and Prevention (CDC) was established June 25, 1992; before the creation of the center, injury prevention activities at the CDC were the responsibility of the Division of Injury Control of the Center for Environmental Health and Injury Control. The MCHB effort is funded through Special Projects of Regional and National Significance that include grants on school playground injuries, violence among adolescents, health professional training, and technical assistance to injury prevention coalitions.

2. Unfortunately, some of the reduction in mortality achieved in the early 1980s with the implementation of child safety seat laws has been lost in more recent years. Agran and colleagues (1990) suggest that factors such as misuse of safety seats, higher speeds, and greater numbers of miles traveled (and therefore greater exposure to the risk of injury) may be contributing to the increases in mortality.

3. The committee hopes that legislative efforts to increase the numbers of children using bicycle helmets will meet with less resistance than those aimed at motorcyclists. State laws requiring helmets for motorcyclists remain controversial even with evidence of fewer head-injury-related deaths from motorcycle crashes in those states that require helmet use (Sosin and Sacks, 1992).

4. With respect to anaphylaxis, Yunginger (1992) has noted that in many states nonmedical personnel are not permitted to administer the immediate dose of epinephrine needed to initiate treatment. EMS planners and regulators need to consider carefully how to achieve the best balance between protecting the public from unskilled medical care and providing for immediate access to potentially life-saving treatment administered by informed bystanders.

5. In taking vital signs in pediatric cases, prehospital providers are least likely to take blood pressure measurements, especially among younger patients. Gausche and her colleagues (1990) found that nearly 60 percent of paramedics felt that uncooperative children were frequently an obstacle to taking blood pressure and other vital signs. Only about 25 percent attributed the problem to inadequate equipment or noise levels at the scene of the emergency. Even though only 5 percent believed that inadequate skills frequently prevented them from taking vital signs for a pediatric patient, about 50 percent expressed a lack of confidence in their ability to obtain those measurements for children less than seven months old.

6. The committee noted that dentists also may encounter children requiring emergency care, which makes EMS-C issues relevant for dental education. The dental community has already demonstrated an interest in resuscitation training. Further discussion of EMS-C in dental education was beyond the expertise of this committee; such a topic might more appropriately fall to a new IOM committee that has recently been formed specifically to examine the future of dental education.

7. The literature of the past several decades is replete with studies of undergraduate and graduate training of health professionals. A recent report of the Pew Health Professions Commission, for example, addressed implications of changes in the health care system and in health care needs for schools training health care professionals (Shugars et al., 1991). In 1993, the Institute of Medicine had under way various studies in this area, including ones on dental education, on career paths in clinical research, and on increasing minority participation in the health professions.

8. Training needed to prepare pediatric surgeons and pediatricians for EMS-C was discussed

at a recent conference on pediatric emergency medical services. Training for surgeons (O'Neill, 1989) was envisioned as covering issues such as the epidemiology of injury in childhood; differences in physiology among adults and children of various ages from infant (0 to 6 months old) to older children (12 to 16 years of age); resuscitation; specific injuries (chest, abdomen, central nervous system, head and neck, extremities, and burns); and a broad set of specific techniques (e.g., intubation, tracheostomy, venous and intraosseous access, peritoneal lavage, and use of cardiovascular drugs). Training outlined for pediatricians (Peterson, 1989) includes a long list of elements that ought to be part of their educational experience; in particular, specific instruction should be given on the concept and organization of EMS-C, the available EMS communication and transport systems, differences between pediatric and adult illness, technical procedures relevant to care of injured or acutely ill children in various settings, and data systems in operation.

9. The Accreditation Council for Graduate Medical Educators (ACGME) is the organization through which standards for residency programs and procedures for accreditation of those programs are established. The ACGME promulgates General Requirements applicable to *all* residency training programs. For each specialty field, a Residency Review Committee is charged by the ACGME to establish standards for residency training programs and to evaluate, usually by site survey, the compliance of programs with the requirements. The specific standards for each specialty are published as the Special Requirements for that field.

In 1991, there were some 86 accredited emergency medicine programs with 1,876 residents; 217 programs and 6,233 residents in pediatrics; 393 programs and 6,610 residents in family practice; 281 programs and 7,712 residents in general surgery; and 22 programs and 38 residents in pediatric surgery (AMA, 1992). Eleven combined programs in emergency medicine and internal medicine had 25 residents; 3 combined pediatrics and emergency medicine programs had 5 residents; and 81 combined internal medicine and pediatrics programs had 622 residents (AMA, 1992).

10. Joint residency training in pediatrics and emergency medicine combines in a five-year program the major components of each specialty's three-years of residency. Pediatrics includes attention to ambulatory care, inpatient services, subspecialty experience, weekly continuity clinic, adolescent medicine, and clinic and ED experience in acute illness. Requirements in emergency medicine include ED experience that presents the opportunity to manage patients of all ages and sexes with a minimum of 2 percent of the patient population having critical illnesses or injuries; rotations are to include adult critical care.

11. "Skill stations" connotes an element of emergency care training that involves instructor demonstration and ample student practice of key steps in specific procedures, for instance, bag-valve-mask ventilation and peripheral and central venous cannulation.

5

Being Ready to Deliver Good Care: Putting Essential Tools in Place

Training members of the public and providers of health care how to respond to emergencies in children and how to use the emergency medical services (EMS) system is not enough in itself. Those providers need to have system resources available that enable them to use their training and skills successfully. The committee identified specific areas in which EMS systems warrant redoubled efforts to meet the needs of pediatric patients: equipment, protocols, medical control, categorization of facilities, and regionalization of care. This chapter cites advances that have been made to date, identifies persistent problems, and presents the committee's conclusions about appropriate steps to overcome those problems and to strengthen emergency medical services for children (EMS-C).

DEFINITIONS

Equipment refers to both reusable and disposable items that are used in providing emergency care. It includes supplies such as intravenous (IV) catheters, blood pressure cuffs, endotracheal tubes, medication charts, and field-to-hospital communications devices, as well as medications.

Protocols are standardized sets of procedures or decision algorithms that are developed to guide patient care. They exist, and are generally needed, for all phases of emergency care. In some cases, protocols direct the process of care in the EMS system (e.g., logistics and procedures, such as determining the hospital to which a patient is taken). In other cases, they direct the content of care (e.g., specific interventions and medications). The

concept of protocols overlaps considerably with that of "clinical practice guidelines," which the Institute of Medicine defines as "systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances" (IOM, 1990a, p. 8; 1992). In this report the committee retains the term protocol, which is widely understood in the EMS community.

Medical control refers to physician oversight of care provided by prehospital personnel. That oversight is given in two ways: on-line, that is, directly by a physician (or a designated alternate) to emergency medical technicians (EMTs) and paramedics during their care of individual patients; and off-line, by physicians who participate in developing standardized procedures and planning for and ensuring the quality of prehospital services.

Categorization of facilities and *regionalization of care* are usually closely linked. Categorization refers here to a variety of methods for evaluating and identifying the capabilities of hospitals and other facilities to provide adequate and appropriate care to patients. Because it is impossible for every facility to render the most sophisticated care for all types of patients, the few that can provide those services often become regional referral centers. In this report, regionalization of care refers to deliberate efforts in predetermined geographic areas to identify facilities with special capabilities and to develop relationships between those facilities and the communities and facilities that would look to them as a source of specialized care.

EQUIPMENT

The Right Kind and the Right Size

Emergency care for children, especially very young ones, often requires equipment and medications specifically suited to children. Because of the traditional emphasis in EMS systems on adult trauma and cardiac care, standard equipment and supplies often do not include materials appropriate for treating children. Some adult equipment can be adapted for pediatric patients, but many items are too large or otherwise unsuitable. Other items that are unique in caring for children (such as papoose boards, bulb syringes, pediatric IV equipment, or even cuddly toys) are likely to be missing altogether. The issue of equipment, medications, and supplies is not, however, a simple dichotomy of "adult" and "pediatric." Because children, themselves, vary in size and development, pediatric equipment and supplies need to be available in a range of sizes so that proper care can be provided to all children, from infants to adolescents.

The lesson that "children are not little adults" has been an important one to learn in many aspects of EMS, especially in defining essential equipment. For example, many ambulance units and hospital emergency departments

(EDs) do not have pediatric-sized cervical collars. This leads to children being placed in collars that are too large, often obscuring their faces and even impairing ventilation. Only recently have significant design changes been made by manufacturers, such as producing stiff collars suitable for small children or babies. Lack of appropriate-sized IV needles may preclude obtaining vascular access and thus prevent the administration of a life-saving medication; lack of other pediatric IV equipment to control the rate of fluid administration exposes the child to inadvertent administration of potentially dangerous volumes of fluid; and use of adult bag-valve-mask devices can allow excessive ventilatory volumes and pressures to force air into the chest cavity causing pneumothorax.

Some differences between children and adults are particularly significant (Mellick and Dierking, 1991a,b). The proportions of children's bodies are not the same as adults'. For instance, a young child's head is much larger relative to the rest of his or her body; this increases the risk of head injury and also means that techniques and equipment for achieving proper alignment and immobilization of the head and spine must accommodate these anatomic differences. Important anatomic structures, particularly in the upper airway, are not just smaller in children but are also located differently.

Many medications used in the emergency care of adults are suitable for children, but the doses must be different. Pediatric drug carts are desirable, and when prefilled syringes are used, they should be available in pediatric dosages. Because the appropriate dosage varies across the pediatric age range, having prefilled syringes for *all* needed medications in *all* dosages is impractical. Therefore, personnel need to know how to determine appropriate doses and concentrations of solutions for their pediatric patients. Devices such as the Broselow Tape (used to measure a child's length, from which it provides an estimate of weight and appropriate drug dosage) can help in making those determinations (Lubitz et al., 1988).

Finally, children also differ from adults in the nature of the emergencies they experience. For example, children rarely experience primary cardiac emergencies, but they are very likely to experience severe respiratory distress or hypovolemia, which can lead to cardiopulmonary arrest if an adequate airway, ventilation, and oxygenation cannot be achieved. Thus, it is especially important for emergency care providers to have available equipment and supplies suitable for airway and respiratory management of children.

Lack of Pediatric Equipment

Deficiencies in equipment for treating pediatric patients exist throughout EMS systems and have been documented in various surveys over the past 10 to 15 years. Prehospital providers received some of the earliest attention. In 1978, the pediatric community in Los Angeles began working

with the county EMS authority to develop pediatric equipment standards for county ambulances (Seidel, 1989). In the early 1980s, a survey of 82 EMS agencies across the country demonstrated a widespread need to increase the availability of many kinds of basic equipment (Seidel, 1986a). For example, 79 percent of the responding agencies did not carry complete sets of masks for bag-valve-mask resuscitators. The survey also showed that, even when appropriate equipment guidelines were in place, ambulances did not always carry the recommended items.

Various ED and critical care categorization programs tend to reveal the deficiencies in those settings. A survey by the Maine EMS-C project showed "considerable variation" among EDs in the airway management equipment available (Maine EMS-C Project, 1991, p. 23), and the project's physician advisory board expressed concern over the impact this might have on patient care. A group of hospital EDs in Arkansas proved to be less well prepared for emergency care of newborns and infants than for older children (Scotter et al., 1990). Items not available in some hospitals included infrared warming lights, infant oxygen masks, and tracheostomy tubes (sizes 0 to 5). Some problems with lack of equipment can extend even to the pediatric wards and intensive care units (ICUs).

Emergencies also arise in the office setting, but studies have found deficiencies among adult and pediatric providers in equipment and supplies needed to manage a variety of emergency conditions (Kobernick, 1986; Barth et al., 1989; Fuchs et al., 1989; Altieri et al., 1990; Schweich et al., 1991; Seidel et al., 1991a). A study focused specifically on the preparedness of pediatricians found that those in solo practice had the most limited equipment available, whereas health maintenance organizations (HMOs) were generally the most completely equipped (Schweich et al., 1991). For specific emergencies, the investigators found that all types of practices were best prepared to treat severe dehydration and least prepared to treat cardiopulmonary arrest. Even so, among the solo practice group only 35 percent had all of the equipment deemed necessary to treat severe dehydration, and of the HMO practices only 58 percent were equipped to treat cardiopulmonary arrest. Pediatricians who had basic equipment available were more confident about managing emergencies, regardless of the practice setting, than those who had no such equipment on hand. Some ambulatory (or urgent) care centers also lack appropriate equipment for pediatric emergencies, even though they sometimes treat children for serious conditions such as seizures and anaphylaxis (Seidel et al., 1991a).[1]

What Should Be There?

The supplies needed to care appropriately for children range very widely. They can include standard medications needed for resuscitation that are

packaged in small amounts; infant stethoscopes that are not so large as to cover the entire torso; defibrillation paddles that fit on a child's chest; swaddling devices to keep children still when painful procedures are needed; and toys that can comfort children during transport or emergency room care.

Many lists of pediatric equipment and supplies needed to provide emergency medical care for children exist. Several groups with EMS-C grants from the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (DHHS) developed such lists for a mix of prehospital providers, hospital EDs, and ICUs; a catalog summarizes products produced by the early EMS-C demonstration projects (Shaperman and Backer, 1991). In California, Maine, Washington, Wisconsin, and New York City, those lists have been incorporated into official state or local requirements (California Code of Regulations, Title 13, § 1103.2; Wisconsin EMS-C Project, 1990; Maine EMS-C Project, 1991; Washington EMS-C Project, 1991).

Several professional societies have developed lists of equipment, supplies, and medications for different settings. For example, equipment lists for the ED and the ICU appear in the American Medical Association (AMA, 1990) categorization guidelines. The emergency care guidelines adopted in 1991 by the American College of Emergency Physicians (ACEP, 1990a, 1991) also include a list of suggested equipment for EDs for both adult and pediatric patients, and ACEP (1992a) has also approved guidelines for prehospital pediatric equipment. The Committee on Pediatric Emergency Medicine of the American Academy of Pediatrics (AAP) provides up-to-date suggestions for equipment, supplies, and medications for basic and advanced life support for the pediatric age group and for newborns; the target settings are primary care physician offices, ambulances, and EDs (AAP, 1992e). Equipment lists for pediatric ICUs (PICUs) were published jointly by the AAP and the Society of Critical Care Medicine (SCCM) some years ago (AAP/SCCM, 1983; SCCM, 1983); development of revised standards, which may be available in 1993, is again a joint AAP and SCCM effort.

Mellick and Dierking (1991a,b) review the kinds of pediatric equipment available and factors to consider in selecting specific items for prehospital care; they advocate taking into account significant characteristics of pediatric patients (particularly children under age 10), such as developmental level, basic temperament, health status and underlying conditions, environmental issues, anatomic considerations, and physiologic considerations. The authors argue for identifying "a standard core" (p. 35) of pediatric equipment needed to control airways; support breathing; maintain circulation; accomplish vascular access; monitor cardiac status; and immobilize patients, extremities, and head and cervical spine. They also suggest considering equipment protecting against exposure to infectious diseases as well as other

items, such as obstetric packs, car seats, and a reference card for scoring severity of pediatric trauma.

The lists cited above vary in their details, and many tend to be quite long. Generally, they represent simply opinions of the authors or a body of experts; data to demonstrate the importance of many pieces of equipment are scarce. Readers who wish to have more definitive and comprehensive information might best track the periodic updates of recommendations issued by the major professional societies, such as AAP, ACEP, and SCCM.

Some of this variation in recommendations for equipment and supplies reflects still-reasonable differences of opinion as to what interventions providers with varying levels of training should be allowed to perform as well as unavoidable state and local differences in capabilities of and expectations for providers. For example, controversy still exists as to whether paramedics should be allowed to intubate children or perform needle thoracentesis and whether EMTs can start IV lines. The pediatric equipment available to providers should allow them to perform all authorized procedures. Differences among the lists may also reflect uncertainty among experts about the effectiveness of certain kinds of equipment. Tsai (1990), for instance, points out conflicting views on the safety and effectiveness of prehospital use of four kinds of equipment: endotracheal tubes and supplies, pneumatic antishock garments, intraosseous needles, and pediatric backboards.

Acquiring and maintaining equipment must be an ongoing process. Because many providers will encounter pediatric emergencies relatively infrequently, their equipment, medications, and supplies may deteriorate or become outmoded. Unless such products are monitored on a regular basis, they may be inadequate in the event of a true emergency or induce an inappropriate sense of security among practitioners and institutional providers.

In sum, the committee did not attempt to create a definitive list of equipment and supplies necessary for treating pediatric emergencies in any particular practice setting. Instead, it states the following imperative: Each health care provider or agency must define the emergencies that occur in the patient populations that they serve, define the emergency care appropriately provided in that setting, and ensure that the equipment and supplies needed to provide such care for those emergencies are available and ready to treat critically ill or injured neonates, infants, children, and adolescents.

To make this more concrete in the context of the recommendations in Chapter 8 about state EMS-C agencies, **the committee recommends that all state regulatory agencies with jurisdiction over hospitals and emergency medical services systems require that hospital emergency departments and emergency response and transport vehicles have available and maintain equipment and supplies appropriate for the emergency care of children.** The objective is to repose responsibility and authority for

attention to EMS-C equipment and supplies in at least the prehospital and ED settings in a specific place, to two ends: first, that at least a minimal level of essential equipment is maintained in all hospital EDs and by all EMS systems; and, second, that a desirable level of consistency in requirements is achieved while still permitting appropriate variation and flexibility needed in special (e.g., geographic or financial) circumstances.

Costs

Financial considerations are, of course, a factor in determining what equipment for EMS-C is essential, but in general the cost of basic pediatric equipment and supplies is low. As a rule, the cost of individual items will not be higher for pediatric materials than for adult supplies; it is, however, necessary to maintain a wider variety of sizes owing to the substantial variability of the pediatric patient population. For example, an adult ambulance unit might need to carry only one size of central venous line catheter; a properly equipped unit taking care of children might need to carry four or five different sizes. A similar point can be made about a host of items (e.g., suction catheters, nasogastric tubes, laryngoscope blades) for most of the settings in which emergency care might be rendered to children. Monitoring equipment also needs to have a pediatric capability. For instance, several different sizes of pulse oximetry electrodes may be needed to cover the full pediatric age range, whereas only one size is needed for adults; similarly, monitors used to track the heart rates of infants require special pediatric algorithms in their software.

Nevertheless, even these factors may not raise an insurmountable cost barrier for most systems. An estimate from Memphis, Tennessee, puts the additional cost of pediatric equipment for an ambulance at about $385 (Larry Youngman, City of Memphis Division of Fire Services, personal communication, October 1992). The San Diego Division of Emergency Medical Services estimated that additional equipment for a basic life support (BLS) ambulance would cost about $480; the equipment needed beyond that for an advanced life support (ALS) ambulance would cost about $295. Costs of stocking and replacing appropriate pediatric equipment and supplies also are low in comparison with the costs of similar goods for adults. For instance, Foltin and Cooper (forthcoming) point out that *complete* pediatric equipment and supplies for an ambulance are much less costly than a single semi-automatic defibrillator, which would be used for adult cardiac patients. Altieri and colleagues (1990) estimated that basic equipment to contend with pediatric emergencies in office settings amounted to $1,200. Certainly, the cost of equipment and materials need not be high for EMS systems that already have a solid base from which to work.

Not surprisingly, advanced pediatric emergency care does require more costly equipment than basic emergency services. As with the above discussion, however, these costs (or those for PICUs) need not exceed those for equivalent services to adults. To the extent that outlays for PICUs exceed what can be managed by many different hospitals, the argument for regionalization of that level of service is strengthened.

This committee recognizes that along with costs for equipment and supplies come costs for personnel, special training (as discussed in Chapter 4), and similar "nonhardware" elements of EMS-C. Further, these aspects of financing EMS-C can be significant, especially in situations in which not much progress has been made in building a solid EMS-C element into the existing EMS system.

The argument here, however, is focused on costs of specific equipment and material needed for pediatric care. Because this committee regards the aim of integrating EMS-C into the existing frameworks of EMS and child health care as crucial, it also believes that these costs should be seen as relatively small marginal investments on top of those already being incurred for the basic system. One argument for that view is that the much greater costs of staffing and capital equipment for overall system operation have already been incurred. A second argument is that having the proper equipment reduces the significant cost in morbidity and mortality that children might experience if they *cannot* receive needed care because only adult equipment is available or if they are treated with inappropriate equipment and supplies. In sum, the committee believes that the cost of essential pediatric equipment is minimal; thus, costs cannot and should not be advanced as a justification for depriving children of necessary, basic emergency care.

PROTOCOLS

Value of Protocols

Knowing what to do for each and every patient whom a provider sees is not an easy task. When that patient may be experiencing a life-threatening emergency, the need to make correct decisions quickly places even greater demands on providers. When that emergency patient is a child, much anecdotal evidence suggests that anxiety levels are especially high. Moreover, except for those who specialize in pediatric emergency medicine, providers are likely to see seriously ill or injured children only infrequently, making it difficult for them to remain familiar with the special needs of children. Even more demanding are those emergencies that involve children with chronic illnesses or other special health care needs. Finally, as with equipment, care appropriate for adults is often inappropriate for children.

To address these complexities for EMS-C, the value of reliable and valid protocols cannot be overstated. (The potential value of sound, definitive practice guidelines generally is discussed in two recent reports [IOM 1990a; 1992], and many of the points made there apply equally well to protocols in the EMS context.) The availability of protocols to guide decisionmaking—whether computerized algorithms, flow charts on wall posters, simple narrative guides, pocket-sized reminder or reference cards, or other types of guidelines—allows the provider to benefit from a carefully considered analysis of a broad range of experience. Protocols help ensure that providers examine all important information and perform the appropriate sequence of procedures.

Protocols adopted by an EMS system help to standardize the care given by *all* of the system's providers around a mutually agreed-on set of steps and interventions. A goal might be to have the capability of dealing with 95 percent of the cases seen in typical EMS settings, since no planner or guideline developer could possibly anticipate every emergency or develop defensible guidelines for them. The crucial grounds for developing and applying protocols lie in the area of improving the quality of EMS-C care throughout EMS systems, although ready access to and general compliance with high quality, authoritative guidelines and protocols may also offer some protection from malpractice liability claims as well.

The EMS-C demonstration projects sponsored by HRSA developed various kinds of protocols, including ones concerned with transport, triage, resuscitation, and management of various pediatric conditions (e.g., trauma, cardiac rhythm disturbances or arrest, and suspected child abuse) in the prehospital and hospital settings (Shaperman and Backer, 1991). Some of these guidelines are lengthy and detailed, but they need not be so; protocols (as the term is understood in this field) may, in fact, be simple reminder cards or poster charts. The Washington State EMS-C project (1991), for example, produced laminated information cards for both BLS and ALS personnel to carry in their uniform pockets or in equipment boxes. These provide a rapid reference source for pediatric equipment size, drug dosages, and vital signs, and they are considered to be of special importance for providers and responders whose contact with pediatric patients may be infrequent.

Needs Throughout EMS Systems

Protocols have a role to play in every phase of the EMS system. They help direct decisions about when and where care needs to be given as well as guide what care is given and how it is given. Each phase of care needs specific kinds of guidance, as discussed briefly in this section in terms of dispatch, prehospital services, EDs, and inpatient care.

Dispatchers

Children who enter the EMS system through a call to an emergency response system (often using 9-1-1) receive their first emergency services from the operator or other dispatch personnel answering such calls.[2] The organization of dispatch systems and the training and skills of dispatchers vary widely (see Chapter 4). Many systems and personnel have little or no medical oversight even though they play a critical role in facilitating the delivery of urgent medical care; others may have had training in delivering emergency medical telephone instructions or long-time experience in dispatching ambulances. Regardless of formal training or experience levels, however, dispatchers must be able to evaluate the nature of the problem and determine what sort of response is needed. These triage decisions may determine whether ambulances with ALS or BLS intervention skills are sent, whether air or ground units are used, or sometimes whether any EMS unit is sent.

Protocols exist in some systems to assist dispatchers in making these determinations in a systematic way. Those protocols must incorporate tools to evaluate pediatric cases. In a recent study, Foltin and colleagues (1992) determined from a retrospective evaluation of the appropriateness of ambulance dispatch in New York City that of nearly 100 children triaged by dispatchers as requiring ALS units, 45 percent warranted only BLS response and another 27 percent did not even require an ambulance; conversely, of about 145 children triaged as needing only BLS services, some 60 percent in fact needed ALS response. An assessment has not yet been made of the consequences for the child of these misassignments.

These data do suggest that ALS resources are not being used efficiently. When an ALS unit is used for less serious cases, it will not be available for those who truly require that level of care; if an alternate ALS unit is available, it may have a longer response time to the site of the emergency. The investigators suggest that protocol revisions and more training in the use of triage and dispatch protocols might enable the system to improve allocation of these prehospital resources. Their "Pediatric Ambulance Need Evaluation" (PANE) instrument may be one means of evaluating and identifying problems of both overtriage and undertriage (Foltin et al., 1992). Appendix 7A reviews a variety of scoring instruments that have been devised to aid in triage decisions (in prehospital and other stages of emergency care) and to make retrospective assessments of the appropriateness of those decisions.

Dispatchers also contribute to emergency care through "prearrival instructions" to callers. Such instructions need to be appropriate to the condition of the patient, and they need to be provided in a way that makes them useful to the caller. When the patient is a child, dispatchers often must deal with any special anxieties of their own *and* with the distress of the parent or other caller. Clawson and Hauert (1990) emphasize the need for guidelines

designed specifically for dispatchers, describing the unique conditions under which dispatchers provide BLS services: "Thrust in the role of 'instructor,' the dispatcher must teach the caller (an unwilling student) a physical procedure in a matter of seconds, without visual aids of any kind or even any opportunity to practice" (p. 84). Kellermann et al. (1989) have demonstrated the efficacy of dispatcher-assisted cardiopulmonary resuscitation (CPR), at least for adults.[3]

Prehospital Personnel

Assessment and Initial Treatment Until the emergence of courses such as Pediatric Advanced Life Support (PALS), Advanced Pediatric Life Support (APLS), and those developed by HRSA's EMS-C grantees, most EMTs and paramedics had little access to training in the care of children. Most also have little opportunity to gain hands-on experience because of the relatively small number of children cared for by the prehospital system. Protocols that guide EMTs and paramedics through the assessment and care of children can, to some extent, lessen the effect of these limitations.

Protocols for prehospital care of children need to reflect sound medical judgment regarding the best forms of care, the levels of training among providers, and the setting in which the EMS system operates. They should be jointly developed by physicians and others with expertise in both emergency medicine and pediatrics. They should guide care given under an EMS system's standing orders (a product of off-line medical control) and specify when on-line direction from a base hospital or other medical control point is required. Medical control is discussed further in the next major section of this chapter and in Chapter 6.

Protocols may be relatively easy to devise for "extreme" situations. As a case in point: In an urban area where rapid access to sophisticated hospital care is possible, a system can emphasize quick transport to specific EDs and BLS-level care en route rather than extensive ALS care at the scene. New York City, for example, follows such an approach with provisions for ALS procedures in the event of delays in reaching the hospital (Foltin et al., 1990). By contrast, protocols for EMS systems serving rural areas need to accommodate longer transport times and distances, various forms of transport (including helicopters, airplanes, intensive-care vans, or other means), and the problems posed by the relative scarcity of hospitals and the more limited resources of hospitals that are available. Thus, more ingenious solutions may be needed (e.g., a predesignated rendezvous-hospital ED) (Johnston, 1989).

These locale-specific policies may be easy to understand, but a large gray area exists in determining the appropriate choice between providing more extensive treatment at the scene and rapidly transporting a child to an

emergency facility after providing only minimal on-scene treatment (Border et al., 1983; Pepe et al., 1986; Gold, 1987). The decision may depend on specific circumstances such as the nature of the child's injury or illness, the skills of the prehospital providers, and the transport time to reach definitive care. Even when time is taken to achieve initial resuscitation at the scene, other problems may arise if the team transporting the child is not well versed in maintaining resuscitation during the trip. Because the available data do not clearly indicate which approach leads to better outcomes or which circumstances call for which approach, the committee urges further research on the optimal balance between on-scene treatment and more rapid transport to definitive care.

Pediatric transport is one area, therefore, where local circumstances and resources, as well as situation-specific extrication time and assessment of a child's condition, all play a role. Guidelines appropriate for adults may not be entirely applicable, because of the greater number of different problems throughout the pediatric age range. For example, McCloskey and Orr (1991) cite "the 2-week-old with a cardiac defect, the 2-month-old with near-miss sudden infant death syndrome, the 2-year-old with epiglottitis, the 4-year-old with meningitis, and the 10-year-old with multiple trauma" (p. 476). Ramenofsky and his colleagues (1983) raised the possibility that non-EMS transport might be appropriate when transit time to the ED is less than the time needed for an EMS unit to arrive at the scene. Further investigation is needed on the merits of such non-EMS transport. This committee did conclude, however, that parents and others with responsibility for children generally need better education on "when and where to go" in emergency situations involving young persons (as already discussed in Chapter 4).

Although national guidelines for transport, developed by personnel with formal experience in pediatric critical care or EMS, will be helpful, hard and fast rules for every situation and locale may not be feasible. The aim should be protocols that emphasize patient and transport team safety, that are based on appropriate processes of care that have been demonstrated to lead to good patient outcomes, and that are in accordance with current medico-legal requirements and common sense. Additional research is needed to establish what approaches are best in what circumstances.

Field Triage EMTs and other prehospital personnel must be able to determine rapidly the hospital destination and mode of transport appropriate to the patient's condition. Triage guidelines should prevent both *under*triage (directing seriously ill or injured children to too low a level of care) and *over*triage (directing them to a higher level of care than their condition requires). Developing guidelines and decision tools that can successfully achieve this balance is difficult for pediatric and adult cases (Kane, 1985; ACS, 1990, Chapter 3). In San Diego County, for example, triage efficiency

for trauma patients has not been optimal owing to the system's reliance on "absolute" triage; directing virtually every injured patient to a trauma center to minimize undertriage resulted in a 35 to 40 percent overtriage rate (McArdle et al., 1990). Kane and colleagues (1985) found in a systematic assessment of optimal components of trauma triage tools that no one tool or set of components could successfully identify at the same time a large proportion of those patients who needed trauma center care and those who did not.

Triage decisions can be based on various criteria that relate to physiologic disturbances (e.g., altered level of consciousness, cyanosis, respiratory distress), anatomic disturbances (e.g., facial burns, penetrating thoracic wounds), or the origin of the disturbance (e.g., specific mechanisms of injury such as a fall from more than 15 feet or signs of a specific illness such as meningitis) (California EMS-C Project, 1989; ACS, 1990; Emerman et al., 1991). Such variables can be dealt with singly or in combinations (e.g., with checklists).

More complex, formal scales that summarize several factors are also used to triage patients. Most relate directly to trauma, some to illness, and most are based on adult experience. In applying these measures to children, several factors must be taken into account: the effect on the variables and on the scoring criteria of differences between adults and children in physiologic response to illness and injury; the neurologic and psychological development level of a child (e.g., assessment of very young children cannot rely on a variable such as verbal response); and tendencies for EMS personnel not to collect complete data on pediatric patients (e.g., blood pressures for very young children).

Some groups have developed child-specific trauma scores—for example, the Pediatric Trauma Score (Tepas et al., 1987; Tepas, 1989), the Children's Trauma Tool (Kitchen and Haubner, 1989), and the Triage-Revised Trauma Score (Eichelberger et al., 1989b)—although all need additional reliability and validity testing insofar as field triage is concerned. Adequate scoring systems specifically for field triage for pediatric illness have not yet been developed; some experts believe, therefore, that a criteria-based approach (as mentioned just above) is the most feasible at the moment (Gioia et al., 1989). The Maryland EMS-C Project (1992) is attempting to address the triage of illness as well as injury with a new scoring system—the Pediatric Severity Assessment Tool (PSAT)—intended to be suitable for use by prehospital, ED, and primary care personnel. The PSAT appears promising, but further testing and evaluation are needed to confirm its usefulness.

Emerman and colleagues (1991) argue that trauma systems might do better to educate prehospital personnel in recognizing when a patient should be transported to a trauma center (e.g., "patients with evidence of physiologic derangement, penetrating truncal injuries or…more than a trivial

risk of death" [p. 1374]) than to require them to calculate trauma triage scores in the field. In the context of decisions about invoking a special transport team for severely injured or ill children, Orr and colleagues (1992) describe a "common sense" approach based on whether the patient will be admitted to a PICU; has a high potential to develop significant respiratory, cardiovascular, or neurologic deterioration during transport; or has multiple injuries and has not yet been stabilized in a trauma center.

To be useful in the prehospital setting, scoring systems must allow paramedics and EMTs to calculate a score easily and reliably. In many programs, however, prehospital personnel do not do the actual scoring of such scales in the field; rather, they provide the data to medical control personnel, who calculate the scores and then decide on the appropriate destination for the patient. To the extent that this off-the-field triage scoring preempts decisionmaking by experienced EMTs or delays appropriate action, the advantages of using such scales at one remove remain to be demonstrated. Clearly, the simpler such scoring systems are, the better, if they are to be useful in determining where the injured child should be taken for definitive resuscitation and hospital management. Most scoring systems, however, are multifactorial and are more useful in predicting outcome than in directing field triage of the injured child. Chapter 7 (and its Appendix 7A) presents a further discussion of scoring systems, particularly their use in assessing inpatient acuity and predicting mortality risks, and also takes up the problems of collecting reliable data to use in calculating scores.

ED Staff

It is critical for an ED to be able, at a minimum, to assess and stabilize pediatric patients and to facilitate their access to definitive care. That is, EDs face at least two major triage decisions: one involves priority for treatment; the other the criteria and procedures for referring patients to higher levels of care. Most children who receive care in an ED will be seen in a general hospital where the staff are unlikely to be pediatric specialists and must treat patients of all ages for an extensive array of conditions. Various kinds of protocols can help ED staff recognize the urgency of conditions in children and treat them appropriately, including transfers to specialty centers as needed (Foltin and Fuchs, 1991). Insofar as possible, triage tools applicable in the prehospital setting should be the same as, or consistent with, those used in the ED to help decide whether the child needs to be transferred to a higher level of care.

Medical Control In many EMS systems, the ED begins participating in the care of patients before they arrive at the hospital through radio or telephone contact with prehospital personnel. This on-line medical guidance

may provide authorization for specific procedures or for deviations from standard practice. Because children generally will account for relatively few of these cases, the ED staff providing on-line direction are less likely to remain familiar with the details of pediatric care. Protocols can help ensure that consistently appropriate medical control is provided when no unusual care is indicated. Centralized on-line medical control with one or a small number of hospitals responding to calls can concentrate the number of pediatric cases managed and help maintain the skills of the medical direction staff.

Triage Decisions Involving ED Care Busy EDs must have a means of identifying patients who have the most immediate need for care.[4] Trauma patients arriving by ambulance are readily recognizable; however, seriously injured infants and children can be harder to identify than adult patients. Triage algorithms and other guidelines, often based on scoring systems or on specific mechanisms of injury, have been developed for use by a variety of ED personnel (Wiebe and Rosen, 1991).

Seriously ill infants and children can be more difficult to identify than those presenting with injury or trauma. For example, missed meningitis is commonly listed as one of the leading causes of medical malpractice suits for emergency physicians, and some serious clinical entities (e.g., intussusception) can have a very subtle presentation. One unique pediatric phenomenon is the "quiet blanket," in which an arrested or agonal child can be completely obscured by wrappings. Severity of illness measures for children are far less common than are trauma measures, and the challenges of developing them are greater than for adults, in part because children, especially younger children, may not manifest classic clinical findings of the illnesses they do in fact have. Chapter 7 presents a brief discussion of certain measures that have been proposed for children.

Long waits for care in urban EDs, which are increasingly used for treatment of minor illness or are overstretched with patients presenting with severe problems related to urban violence, make this initial triage especially important for infants and very young children. As Wiebe and Rosen (1991, p. 496) observe: "[S]erious morbidity can result from delays in recognition of illness severity. It is this same group of very young children that differs the most from adults in terms of physiology and behavior, making their evaluation particularly difficult and anxiety provoking for the staff of general EDs. The signs and symptoms in this group are particularly subtle and difficult to recognize." Because many of the indicators of illness in infants are subjective, Wiebe and Rosen have suggested that EDs that see relatively few children should triage all infants less than six months old to the highest priority category.

In contrast, some EDs may develop policies that will help triage nurses

and other personnel refuse care in specified circumstances (Rivara et al., 1986; Derlet and Nishio, 1990). They may refer patients to more appropriate settings such as offices of primary care providers, community health centers and clinics, hospital outpatient clinics, or a special service in the ED for minor emergencies, perhaps using an "assistance desk" or a room adjacent to the emergency room itself. These referrals are made when vital signs (temperature, respirations, blood pressure, and pulse) fall within acceptable limits or when the presenting complaints are relatively minor. In other approaches, a primary-care management program may include a pediatrician-gatekeeper empowered to authorize ED care (with unauthorized care permitted in life-threatening situations); one experience with this approach, however, seemed to result in a large fraction of pediatric patients with "urgent" conditions being seen neither by the ED physician nor by their primary care gatekeeper (Shaw et al., 1990).

Finally, by virtue of long waiting times, children may experience *de facto* triage and leave without treatment. Generally, this situation involves children who clearly were not emergency cases, but in some small fraction the problems will turn out to be urgent or emergent (see, e.g., Dershewitz and Paichel, 1986). Among adult patients leaving an ED without being seen, serious conditions were common; 46 percent were judged to have been in need of immediate care, and 11 percent were hospitalized within the next week (Baker et al., 1991). Even absent serious adverse sequelae to such a "triage" mechanism, this is not a desirable approach to rationalizing the use of EDs and reducing inappropriate use. Pressures continue to mount on EDs to be sites where many children seek primary as well as emergency care—well beyond the capacity of better triage systems to handle. In Chapter 9, this report returns to the question of the future of EDs.

Triage Decisions Involving More Complex Care At its second triage point, the ED must be prepared to identify those children who need care beyond the capacity of the local hospital. Many children can, of course, be successfully treated in the EDs of smaller community hospitals that lack extensive pediatric specialty services. Definitive care for more seriously ill and injured children, however, may require transferring them to referral center hospitals. Guidelines to identify those patients should be available. Factors such as transport time and available methods of transport (e.g., air or ground) may need to be considered as well as the severity of the illness or injury (Harris et al., 1992).

Guidelines for the transfer process itself should be available as well (AAP, 1986; ACEP, 1991; Seidel and Henderson, 1991). These should ensure compliance with existing laws for the transfer of patients, particularly the Consolidated Omnibus Budget Reconciliation Act (COBRA) of 1985 (Public Law [P.L.] 99-272) (see also the discussion in Chapter 9).

COBRA 1985 holds transferring hospitals (or physicians) responsible for the appropriateness of a patient's transfer, the suitability of the type of transport used, and the "medical integrity of the receiving hospital" (Orr and Kennedy, 1991, p. 35). Preexisting transfer agreements between community hospitals and referral centers facilitate the movement of patients and define the responsibilities of sending and receiving hospitals. Patient transfer is discussed further in the section below on regionalization of care and in Chapter 6.

Response to Crisis Finally, protocols are needed to guide care for patients with major trauma, cardiopulmonary arrest, or similar life-threatening conditions that call for nearly instantaneous response and often for mobilization of large numbers of health care professionals for a single case. Seizures and upper airway obstruction are among the more common conditions among critically ill children for which clear protocols can facilitate prompt appropriate care (Kissoon and Walia, 1989). For pediatric resuscitation, a protocol for establishing emergency IV access (involving increasingly invasive techniques within approximately 5 minutes of an unsuccessful attempt to insert a catheter into a peripheral vein through the skin) has been reported (Kanter et al., 1986). Disaster preparedness protocols should exist for unusual conditions or mass casualty incidents involving large numbers of patients (Holbrook, 1991).

Child abuse and sexual assault also should receive attention in ED protocols. These cases require a careful and systematic response to ensure that the child receives proper medical and psychosocial care and that appropriate legal and administrative steps are taken. The ED staff (and others who care for these children, such as primary care providers) must be alert to those cases in which the true nature of the problem is not reported to medical personnel, as may happen if a family member is the abuser.

Inpatient Hospital Staff

An immensely varied set of hospital units and personnel may be called upon to provide further care for children whose emergency care needs extend beyond its ED. These range from ICUs, PICUs, and special care units (e.g., for trauma or burns) to various types of wards and services including children's floors.[5]

The value of protocols in these settings lies in enabling clinicians and providers to make appropriate decisions in two situations: responding to immediate crisis and deciding when and where to refer patients for other or later care. In the first situation, transfer protocols can be important when the facility cannot provide the needed care. The AAP (1986) adopted guidelines for the transport of children in 1986; revised guidelines are expected to be

issued in 1993. Orr and colleagues (1992) also have developed advice on transportation of critically ill children. In the second situation, referrals may be made to other programs or services in the same institutions, to services in community hospitals more appropriate or convenient for the particular patient, or to rehabilitation services outside the acute care setting.

Facilities that care for few seriously ill children face special challenges. For them, practice scenarios allow ED and inpatient staff to reacquaint themselves with the specifics of pediatric care and to test their readiness to follow existing protocols (Reder, 1991).

Personnel in Outpatient Settings

Pediatric emergencies are also encountered in outpatient settings, and providers in those settings must be able to ensure adequate interim care. Training (e.g., in PALS or APLS) and equipment need to be accompanied by office preparation (Ludwig and Selbst, 1990). These settings have limitations like those noted above for other locations. In a study in the Washington, D.C., area, only 50 percent of the pediatric practices surveyed had formal plans for managing emergencies in the office and only 25 percent had some member of the staff certified in advanced cardiac life support (Altieri et al., 1990). Other studies of pediatricians and family practitioners have found that no more than half routinely used ambulances to transport ill children in their offices to the ED (Baker and Ludwig, 1991; Schweich et al., 1991). The findings for life-threatening illnesses are striking—64 percent of children with epiglottitis and 70 percent of patients with meningitis were transported from the physician's office by private automobile rather than by EMS vehicles (Baker and Ludwig, 1991). To address the implications of these and other factors involving outpatient settings, the AAP (1992e) has produced a manual containing recommendations about preparing the physician office for emergency settings and about the relationships among the primary care provider, the family, and the EMS system.

Comment

As noted, this committee elected not to develop or endorse any specific set of guidelines or protocols for equipment, personnel, supplies, or other elements of parts of an EMS system. In the committee's view, many useful protocols are available to national, state, regional, and local organizations; adopting, monitoring, or enforcing conformance with such guidelines is regarded as a responsibility of those entities. This committee does take the stance, however, that adopting and implementing *some* authoritative protocols is crucial to the successful incorporation of EMS-C into broader EMS systems throughout the nation and, ultimately more importantly, to good

patient outcomes. It also expresses its view that state EMS agencies may be in the best position to balance local circumstances against the requirements or expectations of authoritative protocols and guidelines and to ensure appropriate pediatric input into guidelines ultimately adopted at the local level.

MEDICAL CONTROL

Extending the Physician's Care

The prehospital care provided by EMS systems is intended to bring essential medical treatment to patients as quickly as possible. Because most prehospital agencies operate independently of hospitals or other medical facilities and with relatively few physicians among the providers, they need to incorporate into their operation medical control mechanisms that can help to ensure the appropriateness of the care they provide. More broadly, physician input into the design and operation of EMS systems across the range of services and agents typically involved (from prehospital through definitive treatment and rehabilitation) is essential. One authoritative statement defines three basic functions for medical control: "to ensure that field personnel have immediately available expert direction for emergency care"; "to ensure continuing high quality field performance"; and "to provide the means for monitoring the quality of field performance and medical control itself" (Holroyd et al., 1986, p. 1027, citing NRC, 1981).

As stated earlier, medical control operates in two main ways. On-line control involves direct communication (voice and telemetry) with EMTs and paramedics to authorize and guide their care of patients at the scene and during transport to a hospital ED; it is largely but not exclusively a local function. Off-line control focuses on shaping the overall operation of the EMS system, often with special attention to the prehospital elements of the system; it operates through ongoing planning, training, and evaluation activities, ideally at the local, regional, and state levels of EMS systems. Some experts distinguish three forms of medical control: prospective (e.g., development of guidelines, protocols, procedures, and policies); on-line (as described above); and retrospective (quality assessment review and improvement of performance) (Holroyd et al., 1986). Conceptually, prospective and retrospective medical control correspond directly to the notion of off-line control, as used in this report.

The need for medical control was initially recognized as paramedics and other prehospital providers were trained to perform invasive ALS procedures such as endotracheal intubation and IV administration of fluids, irrespective of the age group involved. Both the ACEP and the National Association of EMS Physicians (George Foltin, Bellevue Hospital Center, personal communication, March 1992) advocate the extension of medical

control to BLS care as well. Increased attention to the care of *pediatric* patients and to the use of invasive procedures on patients in that age range has highlighted the need for pediatric expertise in all forms of medical control.

On-Line Control: Immediate Care

Prehospital personnel provide medical care, especially ALS procedures, under the authority of a responsible physician. Some EMS systems embody that authority in official standing orders that specify the actions authorized in the prehospital setting. Other systems require direct communication with a medical control point on every ALS case. Many lie in between, using standing orders as authorization for some procedures and requiring on-line approval and direction for others. On-line guidance also can aid in triage and destination assignment and assist on-scene personnel in managing such problems as patients who refuse care.

In the committee's view, much stricter on-line medical control is needed in pediatric cases than in adult cases. Owing to the limited experience and assessment skills that prehospital care providers typically have in pediatrics, allowing such personnel wide latitude to initiate treatment without contacting medical control can be unwise. Prehospital care protocols often identify the point at which the prehospital provider must contact medical control personnel before starting any additional therapy (given that they are already proceeding under a specific protocol). This point may be reached much sooner in protocols for pediatric patients than in those for adults. Adopting on-line medical control for BLS providers may bring a special benefit to pediatric patients because most of the prehospital care that children receive is at the BLS level. These providers are likely to have even less pediatric training and experience than the ALS providers for whom medical control is stressed (Foltin and Cooper, forthcoming).

The personnel who provide on-line guidance should have special training and should themselves have protocols to guide their actions (Holroyd et al., 1986; Foltin and Cooper, forthcoming). They, too, are likely to have only limited experience with pediatric cases. Because of the differences between children and adults in the kinds of emergencies they experience and in their physiologic responses, it is essential that these personnel have adequate training in pediatrics or ready access to sources of pediatric expertise. (Further discussion of the organization and operation of on-line medical control appears in Chapter 6; education and training needs are discussed in Chapter 4.)

Although comprehensive on-line control is preferred by many, others support much more selective use. They question whether it makes a significant contribution to the patient's care beyond what good written protocols

provide. For example, studies have found that on-line contact resulted in few deviations from standard care and led to longer time at the scene of the emergency (e.g., Erder et al., 1989; Hoffman et al., 1990). Furthermore, many EMS systems do not have the financial or staff resources to provide on-line medical control, and these services are not reimbursed by insurers. Some experts, however, support extending on-line medical control to include BLS providers because, as pointed out above, they are responsible for such a substantial portion of prehospital care (Henry and Stapleton, 1985; Holroyd et al., 1986). Further studies should specifically examine the effectiveness of on-line control in improving outcomes of emergency care for children.

Off-Line Control: Planning and Management Functions

Any decision to limit on-line medical control emphasizes the importance of off-line control because it becomes an even more vital channel through which medical judgment can be brought to bear on emergency care. Like on-line control, the involvement of professionals with pediatric experience is crucial. In contrast to on-line control, however, the off-line role cannot be delegated to nonphysicians; it is the responsibility of physicians who serve as medical directors and advisors to EMS systems.

Shaping the EMS System

Off-line medical control contributes medical judgment to several processes that prepare an EMS system to provide care and to monitor and improve the quality of that care. One important function is to ensure that treatment protocols and equipment standards are consistent with the needs and capabilities of the system and with the current state of medical knowledge. By developing and conducting training programs, medical control physicians help to define a common knowledge base for a system's providers and have an opportunity to work directly with prehospital staff. Medical judgment also should be reflected in the standards that states or localities establish for licensure, certification, scope of practice, equipment, and treatment protocols. Finally, any quality assurance or continuous quality improvement program put in place for an EMS system must be able to draw on sources of medical expertise, including pediatrics.

Need for Pediatric Input

Because off-line medical control has such extensive influence on EMS systems, pediatricians and pediatric specialists must be involved to ensure that the special needs of children are considered. Planning for the care of

children with disabilities or chronic illness is especially important, particularly for predictable emergencies; similarly important is planning for those whom geography or culture separate from the mainstream. Communities and regions that are beginning to address pediatric concerns, especially places with little or no immediate access to pediatric expertise, need a way to draw on the resources of the larger pediatric community.

More extensive regionalization of care (discussed later in this chapter), which could make the resources of specialty centers available to a larger population, might be one approach. Professional associations and individual institutions also have developed useful resources, particularly concerning pediatric aspects of prehospital care (Seidel and Henderson, 1987; Hemby Pediatric Trauma Institute, 1989; AAP, 1990b; Eichelberger et al., 1992). In addition, products developed by EMS-C demonstration grant projects can serve as a guide for other systems; further information on these materials is available from EMS-C resource centers and catalogs of grantee products (Shaperman and Backer, 1991; NERA, 1993).

Comment

This committee strongly endorses the value of medical control in both its on-line and off-line applications. With respect to on-line operations, the committee reiterates its commitment to state and local decisions and procedures, believing that the relationships and reciprocal obligations built over time will be a significant positive factor in integrating EMS-C into EMS systems across the nation. With respect to off-line operations, the committee views appropriate pediatric training, informed development of sound protocols and equipment standards, and evaluation as the major routes for ensuring adequate pediatric capabilities in EMS systems. In support of sound on- and off-line medical control for EMS-C, the committee strongly endorses the development, implementation, testing, and refinement of national guidelines for adoption and implementation by regional and local EMS systems.

CATEGORIZATION AND REGIONALIZATION

A major theme of this report is that optimal emergency medical care of children requires systematic attention to the special needs of a complex patient population that ranges from infants through adolescents. Hospitals, EMS agencies, and individual emergency care providers must recognize both what they can do to provide needed care and what they cannot do. Many children can receive the care that they need from local providers and hospitals, but some will require the more advanced care available only at regional specialty centers.

To know where children can receive appropriate care, EMS-C systems need to make use of processes known as categorization and regionalization. Categorization encompasses two elements. First, qualifying criteria for a set of categories representing varying capabilities must be defined. The requirements must be balanced between being so stringent that they discourage hospitals from trying to meet them and being so lax that they do not ensure adequate care. Second, some process must be used to identify the category into which a facility falls. Options range from completely voluntary compliance with criteria for a specific category to strict assignment to a category by official agencies.

Regionalization makes use of this information about the capabilities of local and regional facilities to make specialized services available to more patients and to limit inefficient duplication of services. This kind of organized regional planning may develop successfully through the efforts of individual hospitals and EMS systems but often requires more formal oversight to ensure that the needs of all communities are met, to balance competing interests among hospitals, and to overcome jurisdictional disputes among communities (e.g., regarding care for Medicaid or uninsured patients).

In the committee's view, categorization and regionalization are essential for full and effective operation of EMS-C systems, but these processes cannot be left to evolve on their own. To ensure that children's needs are accounted for, categorization and regionalization must receive active attention from the state EMS-C agencies that the committee proposes later in this report (see Chapter 8). The remainder of this chapter examines categorization and regionalization, how they have been applied, and issues that they raise.

Categorization: Identifying Appropriate Providers

Categorization is essentially an effort to identify the readiness and capability of a health care facility (typically a hospital) and its staff to provide optimal emergency care (AMA, 1989). Over the past 20 years, three broad approaches have developed for defining categories of capabilities (Bern, 1987; AMA, 1989). The first (described as horizontal categorization) emphasized assessing broad capabilities for providing appropriate care "for any and all emergencies" (AMA, 1989, p. 1). The second (vertical categorization) focused on capabilities for specialty care, such as for trauma, poisoning, or acute medical conditions. The third to emerge (circular categorization) emphasizes arrangements for transferring patients among facilities that have differing levels of capability to provide comprehensive care, especially for transfers to referral centers following initial stabilization in another facility (Bern, 1987).

Once categories are created, they must then be applied to specific hospitals. The AMA's Commission on Emergency Medical Services (1989) cites four processes for doing this. First, *categorization*, which in addition to its use as a generic term is used to describe a specific process, refers to completely voluntary participation; facilities choose to comply with criteria, which qualifies them as providing a specific level of service. *Verification* also allows for voluntary participation but adds a process for confirming that the hospital complies with the criteria for its declared capabilities. *Accreditation* allows voluntary participation but requires that a hospital apply to and receive approval from a certifying group to qualify as a provider of a specific category of service. *Designation* is typically the most restrictive approach. Facilities are selected to provide a specific level of care, often on the basis of formal evaluations by state or local governments. Some trauma systems use designation to restrict the number of trauma centers so that each center can be expected to serve a certain minimum number of patients.

Thus, the idea of categorization *for pediatrics* is not especially new or unique. It is widely used for trauma systems and neonatal intensive care in a mix of voluntary and mandated programs. The committee notes that deciding which approach is best depends on a variety of political and organizational factors as much as on the strengths and weaknesses that any given approach might have. Some believe that a voluntary identification process that is carried out on a noncompetitive basis, such that any facility that can meet the criteria will be so classified, encourages both participation in the local EMS system and improvement in existing services. For some situations, more restrictive or demanding approaches may be appropriate. Regardless of the level of care a facility is capable of providing or the approach used to determine that capability, a strong commitment to provide that care is vital.

Capabilities for Emergency Care for Children

Various schemes for classifying capabilities have been proposed (Bern, 1987; AMA, 1989; ACS, 1990; Seidel and Henderson, 1991). The AMA (1990) has developed, and the AAP has endorsed, guidelines for a three-tiered categorization of pediatric emergency services, specifying which elements are essential for each level of care.[6] The guidelines include criteria for staffing, equipment, and auxiliary services for Des, ICUs, and operating rooms. They also address quality assurance, community programs, and research activities. The Committee on Trauma of the American College of Surgeons (ACS, 1990) has established additional criteria to be met by Pediatric Trauma Regional Resource Centers and those adult trauma centers making an explicit commitment to care for pediatric patients. Specific

concerns include ED and ICU staffing and resources, composition of trauma teams, quality assurance, research, and injury prevention programs.

These and other guidelines must be monitored to determine if they can be applied successfully in various settings and if they are effective in improving care. Periodic reviews should assess whether modifications are necessary. For example, requirements that call for a pediatric surgeon will prove difficult to meet because of the limited numbers of pediatric surgeons in the country. One trauma center has turned, with apparent success, to committed adult surgeons and pediatric intensive care specialists to provide trauma center care for children (Fortune et al., 1992). An assessment of hospital capabilities in Maine based on the AMA categories found that some hospitals that provide essential pediatric care in rural areas would have difficulty meeting the requirements for the lowest AMA level (Maine EMS-C Project, 1991). In addition, none of the hospitals in the state was likely to be able to meet the criteria for the most sophisticated level of pediatric care. That knowledge, however, makes clear that Maine is likely to need linkages with hospitals in other states that can offer more advanced care.

In designing its new trauma system, Washington State used the three ACS categories and created two additional categories for facilities with more limited capabilities (Esposito et al., 1992). Bringing these additional facilities into the trauma system recognizes the role they play in primary stabilization of patients, makes them eligible for grant funds for education and equipment, and imposes a requirement that they meet system standards and report data to the state trauma registry. In addition, the trauma system will provide for designation of three levels of pediatric and adult rehabilitation facilities.

Implementing Categorization: One Approach

One early program to categorize the pediatric capabilities of hospital EDs was implemented in Los Angeles County in 1984 (Seidel, 1989). Two kinds of facilities are identified: emergency departments approved for pediatrics (EDAPs) and pediatric critical care centers (PCCCs). EDAPs, approved to provide basic emergency services, agree to meet standards involving professional staff (physicians, nurses), policies and procedures, and equipment, trays, and supplies on hand. PCCCs, which can provide more specialized care, agree to meet requirements that include standards for prehospital EMS, EDs, consultation and interfacility transfer, access to a broad spectrum of specialized pediatric services and professionals, various support services, and educational programs for professionals and the public.

Participation in this system is voluntary and open to any hospital meeting the minimum system standards; an application process and site surveys

are used to verify compliance with those standards. Currently, about three-quarters of the county's hospitals are EDAPs (Seidel, 1989). The participation of many organizations in the development of the EDAP-PCCC system has produced widespread acceptance and support. The pediatric transport protocols of the Los Angeles County EMS system, for example, are built around the hospital categorization. Implementing the system has also increased awareness in the county of the needs of pediatric patients.

This approach can be adapted to meet the needs of smaller or more rural areas, as other counties in California have done. For example, some hospitals may serve as "satellite EDAPs" by meeting a smaller set of requirements in collaboration with a hospital categorized as an EDAP. It has also been used in other states. The Arkansas EMS-C grantees, for example, introduced to the hospitals in their largely rural state a program for voluntary adoption of EDAP-type guidelines (Scotter et al., 1990). Even with the conclusion of the HRSA grant program and the lack of any formal adoption by state agencies, the EDAP activities continue to contribute to improving hospital readiness to provide basic pediatric emergency care.

Comment

In the view of this committee, improving ways to categorize the pediatric care capabilities of hospitals and other EMS system components is especially important. Such categorization schemes should have a direct influence on protocols for triage, transport, referral, and similar patient management processes at national, state, and local levels. Because these standards can have significant implications for both financial and human resources, better data are needed to show what resources are truly required to improve outcomes at each level of care.

As with other elements of EMS-C systems, what seems to work best for the regional, state, or local professional, provider, and policy communities may be the best guide to *which* categorization approach to take. As indicated earlier, however, the committee recognizes a need for some oversight of categorization programs to ensure effective implementation. For example, it values the inclusivity of voluntary categorization programs, but it also recognizes that a voluntary program allows facilities to choose not to participate, which may, therefore, leave them inadequately prepared to care for children. Categorization programs also must guard against authorizing an excessive number of advanced care facilities such that no one center has sufficient numbers of patients to maintain staff expertise or to allow for efficient use of resources. Finally, the committee underscores the need to link categorization efforts with organized strategies for regionalization, which is the topic of the next section.

Regionalization: Making Effective Use of Pediatric Resources

Relatively few patients (of any age) need the most sophisticated forms of medical care. Concentrating resources for such care in regional centers has long been proposed as the way to use those resources most efficiently and to provide patients with the services of the most highly skilled providers. Regionalization of services has developed in various areas of health care for some patient populations and treatments, particularly high-technology invasive procedures such as heart, liver, and lung transplants. Access to appropriate transport to these regional centers from local hospitals becomes an important concern. Where these centers serve regions that span state boundaries, administrative or jurisdictional barriers that might impede access to appropriate regional centers may need to be resolved.

For EMS, many states have developed regional areas to support coordination of referral, transport, and resource allocation. Regionalized services can include ground and air transport systems, ICUs, trauma centers, burn centers, and the like. Thus, the ways in which regionalization might be applied for *EMS-C* are, in principle, well understood in the professional and policy communities. The discussion that follows addresses elements of regionalized care of particular importance for EMS-C.

Role of Regional Referral Centers

Referral centers are often the focal points of regionalized systems of care. As such, they have a responsibility to develop good relationships with the community hospitals and EMS systems in the region and to promote the enhancement of community pediatric emergency care. Important roles for referral centers include consultation (including feedback to originating units and referring physicians), training, and similar activities. (Consultation and transfer agreements are discussed in more detail in Chapter 6.)

Consultation services through telephone access to specialists at referral centers can provide community hospitals with essential information necessary to manage some pediatric emergencies. Some patients may then be able to receive the definitive care they need at the local hospital; others can be stabilized sufficiently that they can be transferred to the referral center for further care. When children are transferred, the referral center must ensure that appropriate information is made available to those remaining behind (e.g., family members) and to those who initiated the child's care (e.g., primary care provider, hospital ED).

Formal transfer agreements between referral centers and community hospitals facilitate the expeditious transfer of seriously ill or injured children who require more extensive care. Referral centers and community hospitals should work together to implement such agreements. They should

make clear the rights and responsibilities of both institutions, including costs and liability, and, as noted elsewhere, comply with federal regulations. A model transfer agreement for PICUs in northern and central California, covering PCCCs and pediatric trauma centers (PTCs), illustrates the elements that need to be taken into account (Seidel and Henderson, 1991, pp. 42-48). Models such as this can be adapted by other hospitals to meet their specific requirements.

Referral centers also should contribute to education and training for emergency care providers in community hospitals and EMS agencies. Programs, such as courses on pediatric resuscitation, can be offered at the referral center or even in local communities. In addition, referral centers can serve as sites for more specialized training either through medical residency and fellowship programs or other special clinical training programs for EMTs, nurses, and physicians. Referral centers also have an important role to play in education and training for the general public, including promoting an understanding of the emergency care capabilities of community and regional hospitals.

Intensive Care Services

In the 1970s, many states successfully developed regionalized perinatal services (Meyer, 1980; Stiles et al., 1991; AAP/ACOG, 1992), but PICU services have not received similar attention. According to the American Hospital Association (1991), about 2,900 dedicated PICU beds are available across the country. Data on the demand for these beds are limited, however; the experience of the Pediatric Intensive Care Network of Northern and Central California suggests that annually 240 children per 100,000 will require intensive care (Pettigrew et al., 1986). According to Cuerdon and colleagues (1991), PICU beds are not evenly distributed across the country—the number of beds per 100,000 children in each state ranges from 0 to 13.2, and half of the states have no more than 2.6 beds per 100,000 children. These authors argue that, unlike adult ICU or neonatal ICU beds, the availability of PICU beds does not appear to be related to the health status of the state's population. With intensive care a major component of EMS-C systems, these extreme regional variations in availability of PICU beds may not be desirable. Research is needed to determine whether the numbers of existing PICU beds and their distribution are adequate to meet the intensive care needs of children in communities across the country.

Pediatric Trauma Systems

Efforts over the past 20 years to develop regionalized systems for trauma care have had mixed results. As of the late 1980s, only Maryland and

Virginia were recognized as having effective statewide or near-statewide systems (Mendeloff and Cayten, 1991), although in other states, city-or county-based systems are succeeding. Strong public controls over trauma center designation and prehospital services appear to contribute to trauma system success. Working toward trauma center designation (here meaning state selection of facilities, hospital request, or a combination of both) is a complex matter for the hospital and its staff. Meeting state and professional requirements can pose considerable challenges especially for community hospitals, which generally lack the organization, staffing, and other resources that university hospitals are likely to have (Clancy et al., 1992).

Trauma centers have proved effective in reducing mortality among adult patients. About 370 of some 6,600 hospitals in the United States function as trauma centers; they are concentrated in urban areas and serve only about one-quarter of the population (Champion and Mabee, 1990). In recent years, however, individual trauma centers, and therefore systems of which they are a part, have faced serious problems from factors such as growing financial losses from unreimbursed costs and disruption of other hospital care by the unpredictable and immediate demands of trauma cases (see Champion and Mabee, 1990; GAO, 1991b). For some hospitals, these problems have led to a decision to withdraw from the trauma system.

Experience with PTCs is more limited, chiefly because they are newer and far fewer in number. The earliest PTCs were established in the 1970s (Harris, 1989). Specific principles of pediatric trauma care advanced by the American Pediatric Surgical Association call for designation of PTCs by appropriate government authorities (Harris et al., 1992). Vane (1993) emphasizes the value of a regional perspective in establishing PTCs; natural referral patterns can be identified and appropriate roles can be determined for all facilities in the area.

Harris (1989) stresses that a regional *pediatric* trauma system must be "carefully tailored to respond to regional needs, be medically sound, well-organized, and have a solid fiscal base" (p. 149)—all steps that require appreciable public education and involvement, financial support, and sustained commitment. Clearly, all the challenges facing, and pressures on, trauma centers and trauma systems in general afflict pediatric services as well; to the extent that EMS-C is de-emphasized relative to EMS generally, development of PTCs is likely to be impeded.

Specialized Transport Resources

Successful regionalization will depend heavily on the availability of high quality transport to referral centers. Because the patients who need to be transported are generally the most severely ill and injured, they require highly skilled care during the transfer to ensure that their condition does not

deteriorate. Well-equipped vehicles (air or ground) with specially trained staff can make it possible to provide some advanced care even before reaching the destination hospital. Pediatric transport teams have generally included physicians, but it may prove possible to provide essential care with teams relying on other personnel (McCloskey et al., 1989). Not all transfers to referral centers can be made by highly skilled and well-equipped transport teams, however; this fact makes it essential that local hospitals and ambulance services be able to provide the minimum level of care necessary to maintain a patient's condition until more advanced care can be brought into play.

Under the auspices of the AAP (AAP, 1986; Day et al., 1991), guidelines are evolving to address training needs, transport team composition, and medico-legal issues. No one transport system will be appropriate for every setting or every case. Factors such as weather, geography, patient condition, and costs will affect the choice of vehicle (e.g., ground ambulance, helicopter, fixed-wing aircraft). Even more complex are decisions about aeromedical EMS programs, staffing, costs, and relationships to hospitals and trauma centers (Freilich and Spiegel, 1990). McCloskey and Orr (1991) and Orr and Kennedy (1991) both provide definitive overviews of pediatric transport issues. As in much of emergency medicine, research studies are needed to answer many questions about the effectiveness of transport practices, such as whether physicians are needed as members of transport teams and the relative value of rapid transport and arrival versus allowing greater time for on-scene stabilization.

Improving Outcomes of Care

A leading argument for regionalization of pediatric emergency services is the belief that children receiving care in a PICU or PTC will have better outcomes than those cared for in adult trauma or intensive care units, but few studies have been done to demonstrate differences in outcome. In one of the first such studies, Pollack and colleagues (1991) did find higher-than-expected mortality at nontertiary hospitals than at tertiary hospitals among children less than 18 years old who were "receiving care for head trauma, or who required intubation for respiratory support (for >12 [hours] if post-operative)" (p. 151). Another recent study compared children treated in PTCs, urban nonpediatric (general) trauma centers, and rural nonpediatric trauma centers (Nakayama et al., 1992). The investigators found higher mortality rates in the rural trauma centers, but no significant differences remained when comparisons were based on the probability of survival. They surmised that these data reflect an informal system that tends to direct younger children and children with head and neck injuries who are at greatest risk to the specialized care available at the PTC. Cooper and colleagues

(1993) concluded from analyses of New York data that patients with either brain or internal injuries and moderately severe skeletal injuries had better survival rates when they were treated in PTCs than when they were not; the investigators believe that triage of moderately to severely injured children to trauma centers with appropriate pediatric capabilities is not only practical and effective but also likely to increase survival of children with significant skeletal, brain, and internal injuries.

Additional studies are needed to verify these results and to identify factors that appear to make PICU or pediatric trauma care critical to better patient outcomes. In the meantime, this committee takes the position that when specialized pediatric centers are available, the most seriously ill and injured children should receive care in those centers.

Special Concerns in Regionalization

Implementing a system of regionalized services for pediatric care raises a number of concerns. Transferring children to regional centers removes them from relationships with the network of providers (e.g., pediatricians or family practitioners) from whom they and their families usually receive care (which should constitute a medical home). Thus, continuity and coordination of care for these children must be given special attention. Such transfers and shifts in the site of care, particularly to distant locations, can also cause substantial disruptions in the lives of children and their families. Efficiencies and costs in the system as a whole must also be considered. In particular, the likely volume of patients, especially transfers, must be considered in the development of regional centers.

Other, more political, issues must also be addressed, particularly resistance from hospitals to categorization and regionalization efforts. Resistance can occur for several reasons: if such programs are nonparticipatory (i.e., nonvoluntary), if they are heavily oriented to designation, if they might harm hospital reputations (by categorizing one hospital at a lower level than a competing hospital), if they might cost hospitals their patients (by hurting the hospital's reputation or by directing patients to other hospitals), or if they might impose an unacceptable financial burden (by increasing the number of uninsured patients requiring costly but unreimbursed care). No single response to these concerns is possible; specific local circumstances must be considered.

Triage protocols that call for bypassing one hospital for another may be very difficult to develop and implement because of the need to coordinate plans with both the EMS agencies providing prehospital services and the hospitals in the area. Even when hospitals agree to bypass plans, EMTs may still take patients to the closest hospital. In some cases that decision may reflect parents' desires to have a child taken to a familiar local hospital

rather than a more distant regional center. Thus, successful regionalization (or categorization-plus-regionalization) requires cooperation and collaboration across a wide set of professional, public, and policymaking entities—more so, perhaps, than for action involving equipment, guidelines and protocols, or medical control. It calls also for mobilizing the political will to create a system based on a reasoned assessment of needs and capabilities, not one that is based exclusively on "self-naming."

Finally, the scarcity of pediatric resources and experience make regionalization more critical in pediatrics than in many other areas of medicine. Even pediatricians well-trained in taking care of many acute and critical situations can experience, with time and lack of exposure, erosion in critical care skills; this problem may be compounded by lack of resources and experience among other physicians, nurses, or support personnel at the hospital level. Although good undergraduate and graduate training and continuing education efforts for all emergency care providers may ameliorate some of these problems (as discussed in Chapter 4), the solution to providing definitive care for pediatric emergency patients may always lie more with regionalization.

Interstate Issues

Because some geographic areas do not have reasonable access to children's hospitals or PICU resources within their own state, natural referral patterns may cross state lines; this situation makes it necessary to consider issues of interstate coordination and cooperation if emergency medical care for children is to be successfully regionalized.[7] Interstate issues also arise for metropolitan areas that serve more than one state. In some cases, interested parties may be able to develop official agreements under the auspices of state or local government agencies. In other cases, contractual or informal relationships develop between referral centers and community hospitals and EMS systems. The stability of both official and informal arrangements depends on meeting the needs of all groups involved and on addressing several key issues.

Coordination of Professional, Legal, and Regulatory Requirements Neighboring states often differ in such matters as certification and licensing requirements for institutions or practitioners, procedures that providers are authorized to perform, and guidelines for triage. In working out interstate transfer or other arrangements, states must address these differences to ensure that consistent and acceptable levels of care are rendered and that providers do not face liability risks from differences in practice standards. The liability risks for interstate transport services must also be addressed.

At some level of complexity in working out interstate arrangements, a

threshold may be reached that argues for generalization beyond individual states to national standards. The immense variation in Medicaid services and regulations, and the resulting extreme unevenness in even basic care available to mothers and children, is poignant evidence of this point.

Medicaid Reimbursement Medicaid policies and reimbursement levels are a concern for all providers; in the EMS context, hospitals may face the biggest problems. When care is provided to Medicaid patients from other states, hospitals must contend with several factors: the inadequacy of existing Medicaid reimbursement levels *per se*, the unevenness of reimbursement levels across state lines, the willingness (or lack of it) of Medicaid agencies to pay for out-of-state care, and the possibility that a hospital may not be an approved Medicaid provider for other states or may be unaware of other states' Medicaid policies, such as prior authorization requirements, that affect eligibility for reimbursement.

Where hospitals often serve a multistate population, considerable anecdotal evidence of Medicaid payment problems exists. Those problems may be sufficient to discourage some hospitals from accepting out-of-state patients or may, at least, lead them to consider how they might want to proceed with such a step, as some District of Columbia hospitals have done for patients from Maryland. Problems similar to those that arise between states can also be found between cities and counties within states (e.g., New York City and Westchester County).

Other complexities can arise when managed care programs for Medicaid patients exclude nearby, but out-of-state, facilities that otherwise would provide considerable amounts of care, as happened when the Illinois I-Care program excluded children's hospitals in St. Louis, Missouri (Ron Morefeld, St. Louis Children's Hospital, personal communication, December 1992). Long-standing subspecialty referral patterns for southern Illinois residents were disrupted, diverting them to other institutions as far away as Chicago. After termination of the program in 1991, a coalition of five children's hospitals in Chicago and St. Louis began working together with state governments on pediatric and Medicaid issues.[8]

These financial barriers to care make it difficult, if not impossible, to ensure that all children will have access to the care that they need. As part of their efforts to further the development of EMS-C programs, states and the federal government need to consider how to overcome reimbursement problems, especially for children who are uninsured or are covered by Medicaid. This committee acknowledges the major shortfalls in insurance coverage for children that are now part of a significant debate about health care reform at the state and national levels. Broad questions of Medicaid or insurance reform are a significant backdrop to the EMS-C discussion; although extensive examination of these issues was clearly beyond its purview,

the committee briefly returns to them again in Chapter 9. Generally, however, the committee confined its discussion to interstate reimbursement issues that directly relate to EMS-C.

Rural Issues

Issues of categorization and regionalization are crucial for many rural providers, particularly in the hospital sector. Many providers fear that they will be bypassed in the process of providing emergency care to patients. The key element in the entire system is the appropriate and adequate education that is provided to emergency personnel both on the emergency transport team and in the initial emergency room setting. If these individuals have been trained to handle pediatric (and adult) emergencies and have demonstrated this capability, the issue of categorization becomes less threatening and somewhat less of a concern in the process. Categorization and regionalization must continue to be pursued vigorously, but in the rural setting these factors need to be considered with appropriate sensitivity for the concerns of the parties involved.

Encouraging Categorization and Regionalization

As noted at the outset, categorization and regionalization are linked activities that, when pursued collaboratively, can make EMS-C, as part of larger EMS systems, more efficient as well as more effective. This committee believes that they are critical elements in the development of EMS-C systems. It also believes that strong leadership from the federal and state governments, health departments, and professional societies will be needed to bring these many interests together successfully.

Providing appropriate care for seriously ill and injured children requires special expertise and special commitment. The committee recognizes that ensuring the availability of expertise and commitment in pediatric care and access to that care will require a formal mechanism to identify facilities that can provide needed care, to develop protocols and other procedures to direct children to appropriate facilities, and to verify that those procedures are working successfully. The specific mechanisms may vary across EMS systems and states (some may emphasize voluntary participation whereas others may choose to designate specific facilities), but the result should ensure that appropriate care is available to children who need it.

Therefore, **the committee recommends that all state regulatory agencies with jurisdiction over hospitals and emergency medical services systems address the issues of categorization and regionalization in overseeing the development of EMS-C and its integration into state and regional EMS systems**. Beyond this, the committee explicitly refrains from

proposing specific steps to achieve categorization and regionalization because of the diversity of approaches that states might want to use.

Because of the range of interested parties—professional groups, individual practitioners and institutional providers, public and patient advocacy groups, local and state governments, to name a few—the special complexities of these efforts need to be appreciated. This committee believes that steady, cooperative steps must be taken to establish a firm base for improved EMS-C programs.

SUMMARY

Despite impressive progress in recent years, EMS systems have particular weaknesses in their ability to meet the needs of pediatric patients in five major areas: equipment, protocols and guidelines, medical control, categorization of facilities, and regionalization of care. This chapter argues, first of all, that more investment in supplies and equipment appropriate for children (across the entire pediatric age range) would significantly improve the capacity of EMS systems to discharge their responsibilities to children; the marginal cost (to the system) of having durable and disposable materials and supplies suitable for pediatric cases is quite low and should not be accepted as a reason for not providing those materials. The committee did not create definitive lists of equipment and supplies necessary for treating pediatric emergencies for various settings; rather it called for each health care provider and agency to define the emergencies that occur in the patient populations that they serve and to ensure that the necessary and proper equipment is available to treat critically ill and injured neonates, infants, children, and adolescents.

To this end (and in line with later recommendations about the responsibilities of state agencies), the committee formally calls for all state regulatory agencies with jurisdiction over hospitals and EMS systems to require that hospital EDs and emergency response and transport vehicles have available and maintain equipment and supplies appropriate for the emergency care of children (see Box 5-1). The objectives are to ensure that (1) at least a minimal level of essential equipment is maintained in all hospital EDs and by all EMS systems and (2) consistency in these requirements be appropriately balanced with the flexibility needed in special circumstances (e.g., geographic or financial).

Second, protocols have a solid place already in many areas of health care, including EMS for adults. What is desirable now is the development, dissemination, application, and evaluation of guidelines and protocols with tested pediatric elements and components. Such guidelines are needed for the full range of EMS-C activities—dispatch, transport, prehospital care,

ED services, hospital inpatient care, and emergency care in outpatient settings.

BOX 5-1 RECOMMENDATIONS CONCERNING AVAILABILITY OF PEDIATRIC EQUIPMENT AND SUPPLIES AND ATTENTION TO CATEGORIZATION AND REGIONALIZATION IN EMS-C SYSTEMS

The committee recommends that:

- all state regulatory agencies with jurisdiction over hospitals and emergency medical services systems require that hospital emergency departments and emergency response and transport vehicles have available and maintain equipment and supplies appropriate for the emergency care of children.
- all state regulatory agencies with jurisdiction over hospitals and emergency medical services systems address the issues of categorization and regionalization in overseeing the development of EMS-C and its integration into state and regional EMS systems.

Third, medical control (physician oversight, directly or indirectly, of the care provided by prehospital personnel) warrants attention. On-line medical control, which implies real-time direction of care for seriously injured or ill children, requires reliable input from personnel (particularly physicians) with experience and training in caring for infants, children, and adolescents. Local practices, personnel, and financial resources influence whether and how on-line medical control is implemented. Off-line medical control also requires active participation and leadership from health care professionals with pediatric expertise to ensure that children's needs are considered in an EMS system. It involves designing and implementing policies, training programs, quality assurance efforts, and the like. It is broader in scope and setting than on-line control and relates more to the long-term development of guidelines and protocols (to be used, often, in on-line situations).

Categorization of institutions and regionalization of specialized services, often linked conceptually and practically, are the remaining areas in which this committee believes stronger involvement and investment are warranted. Although "local" as contrasted with "national" decisionmaking and solutions are generally preferred in thinking about steps to incorporate EMS-C into existing EMS systems—and thus to categorize facilities accurately and designate regional referral centers for pediatric cases—some guidance may be needed at the national and state level to foster appropriate identification and classification of referral centers and to overcome difficult interstate

questions of legal and regulatory matters, transfer policies, and reimbursement. The committee found these issues of sufficient significance to the successful development of EMS-C in EMS systems that it formally recommended that state EMS-C agencies (proposed in Chapter 8) address categorization and regionalization for EMS-C.

NOTES

1. Information on physician offices in general is no more encouraging. For instance, a study in Dallas found that 25 percent of offices administering aerosols or epinephrine for asthma or allergic episodes did not have oxygen available, and nearly 20 percent of offices administering parenteral anticonvulsants did not have oxygen or bag-valve-mask capability (Barth et al., 1989). A survey of Michigan physicians (mainly those in family practice and secondarily in pediatrics) determined that only 11 percent had adequate equipment to manage common office emergencies such as chest pain and dyspnea, seizures, syncope, anaphylaxis, and behavioral emergencies (Kobernick, 1986).

2. The discussion about protocols for dispatchers is oriented toward EMS personnel. Brodsky (1990), however, calls attention to the problem of calls concerning fatal road accidents being directed first, or simultaneously, to police. Such practices result in delay before EMS services, such as an ambulance, are dispatched; in perhaps 15 percent of fatal accidents, a communications officer has made the wrong decision by failing to notify an EMS program immediately. Some experts thus apparently believe that EMS dispatchers should be notified of all road accidents and have the responsibility of deciding whether ambulance rescue should be attempted based on the description of the crash. Such a policy might benefit from protocols for communications personnel and dispatchers that have been developed on the basis of information about the characteristics of road accidents and injuries in various geographic locales.

3. Dispatcher-delivered instruction in CPR by telephone has been proposed for at least 20 years as one approach for helping family members or bystanders cope with a victim of cardiac arrest. Although its utility has been demonstrated for adult patients (Kellermann et al., 1989), little if anything is known about such approaches when the patients are children. Dispatcher assistance to callers in situations involving airway emergencies and ingestions also warrants examination. Issues of telephone assistance, advice, and communication are taken up in Chapter 6.

4. "Emergent" and "most urgent" are not equivalent concepts in ED triage. Emergent requires the highest priority of care, for conditions that are life-threatening or will cause serious permanent physical impairment if not treated immediately; urgent cases may require rapid response (e.g., within 30 to 120 minutes) but not the highest priority interventions.

5. As noted elsewhere, this committee did not address questions of perinatal or neonatal emergencies. Generally, the same points concerning the utility of good guidelines and protocols will be true for those problems and settings.

6. The AMA (1990, p. 880) classifies pediatric emergency care facilities in three levels. Level I: "An institution capable of providing comprehensive, specialized pediatric care to any acutely ill or injured child. Usually a children's hospital or a large general hospital with a pediatric division providing comprehensive subspecialty pediatric medical and surgical services." Level II: "A hospital with a pediatric service capable of caring for the majority of pediatric patients, but with limited pediatric critical care and subspecialty expertise." Level III: "A hospital with a functioning Emergency Department capable of evaluation, stabilization, and transfer of seriously ill and injured pediatric patients. Such facilities should have formalized transfer agreements to higher levels of pediatric care. They should provide a vital service

in stabilization and transfer in areas where level I and level II facilities are not readily accessible."

7. The discussion of interstate problems in regionalization focuses on one manifestation of broader problems of interjurisdictional cooperation and coordination. Intercounty difficulties can arise, for instance, if various county or other "local" governments cannot agree on funding responsibilities or other policies. At an even more disaggregated level, concerns on the part of incorporated cities or intercity rivalries can disrupt EMS programs within a single county. Committee discussions returned repeatedly to experiences in which a child's care was compromised by administrative and bureaucratic complications. McArdle and colleagues (1990) discuss the strengths and limitations of a county-based EMS and regionalized trauma care system in San Diego, California, and provide useful lessons for other programs based at the county level or in a county department of health.

8. The consortium of children's hospitals that was formed after the I-Care program ended includes three Chicago hospitals (Wyler's, Children's Memorial, and LaRabida) and two hospitals in St. Louis, Missouri (Cardinal Glennon and St. Louis Children's).

6

Connecting the Pieces: Communication

Communication is a critical element in the successful operation of *systems* of emergency medical care. The many separate parts of these systems—individual health care providers, emergency medical services (EMS) agencies, emergency departments (EDs), critical care units, and various others—must each perform their roles well, *and* they must also be able to work together. Communication, through formal and informal channels and through high-technology equipment and simple face-to-face conversations, is the thread that ties the separate pieces into a system.

This chapter views communication from several perspectives. First, the context in which communication takes place creates special (perhaps even unique) communication needs. Delivery of services to specific patients raises different issues than do planning and information exchange that are independent of patient care. Second, the mechanisms by which communication is achieved raise special questions. Some forms of communication—enhanced 9-1-1 emergency access systems and statewide microwave radio networks are cases in point—depend on the application of particular technologies or equipment. Often, however, ordinary telephone calls can meet important communication needs. The third important factor is the participants in the communication process. Patients and their families (or other bystanders), providers, and administrators need to interact in various combinations and for various purposes. Fourth, better communication among all the providers who care for a patient is a special concern. "Follow-up" on patient outcomes and further care and "feedback" from other providers characterize two important forms of that communication. Through follow-up

efforts, providers actively seek information on the condition of patients whom they have treated and on whether recommended care has been received. Feedback gives providers valuable information on the consequences of their care.

This chapter reviews the communication links that the committee views as most important for emergency medical services for children (EMS-C) and discusses ways in which those links should be strengthened. Several issues addressed in the previous two chapters (e.g., education in how to use the EMS system; the special training and guidance that dispatchers should have; on-line medical control; the interhospital links needed for regionalization of services) receive further attention here. Although the issues raised in this chapter are framed in terms of emergency care for children, they are not unique to children. The committee's observations point to ways to help make good emergency care available for all patients.

PUBLIC ACCESS TO THE EMERGENCY CARE SYSTEM

To benefit from the services of an EMS system, children who are ill or injured must first of all gain access to it. Many children initially receive such care at a hospital emergency room, where their parents have taken them without any prior contact with the EMS system. For children who need urgent care but not any of the services available in the prehospital setting, this can, in fact, be an appropriate way to reach emergency services.

For many other children—those with major trauma or serious respiratory distress, for example—prehospital care from trained providers may be essential for a good outcome. The telephone (or equivalent media such as Citizen's Band radio) is the usual means of contacting the EMS system to obtain such assistance. Adoption of a universal emergency access number—namely, 9-1-1—is widely supported, to make it as easy as possible to request EMS assistance.[1]

Sometimes it may not be clear whether emergency care is needed; in these situations, advice provided by telephone may help clarify what steps to take. Poison control centers are well-recognized sources of specialized information regarding situations that may range from harmless to life-threatening. Parents also seek advice from staff at EDs or from primary care providers on the care their children need. Although many in the medical community find this telephone advice valuable, sometimes in averting unnecessary ED visits, others are concerned that this indirect assessment of a child's condition may miss serious disorders.

The discussion that follows reviews basic and augmented features of 9-1-1 telephone systems and the added features of enhanced 9-1-1 and presents the committee's recommendation supporting universal adoption of the system. Following the examination of points relating to 9-1-1, this section

presents a brief overview of the operation of poison control centers and discusses some issues related to other forms of telephone advice.

Universal Access Through 9-1-1

For a quarter-century, nationwide adoption of a universal emergency access number such as 9-1-1 has been recommended or endorsed by many groups (e.g., NAS/NRC, 1970a, 1972, 1978a,b; Brinegar, 1973; Whitehead, 1973; ACEP, 1976; AHA-ACEP-AMA, 1988; National Committee for Injury Prevention and Control, 1989; NHTSA, 1990b; Seidel and Henderson, 1991). Throughout much of the country today, a telephone call to 9-1-1 provides access to police, fire, and EMS services. Table 6-1 presents recent estimates of the proportion of each state's population covered by 9-1-1.

Communities began working with their local telephone companies as long ago as 1968 to implement 9-1-1 service (Whitehead, 1973).[2] According to the Advisory Commission on State Emergency Communications (unpublished tables, August 1989), about 20 years later more than 40 states had legislation either authorizing or mandating adoption of 9-1-1. Various approaches are used to fund these systems, including state or local telephone subscriber fees (especially the latter) and state or local taxes. Implementation generally must be managed by individual counties or other local governmental units that can coordinate the interests and resources of the public, the public safety agencies, and the telephone company for financing and operating the system.

Substantial progress has thus been made toward the goal of universal access—enough that a National Emergency Number Association (NENA) was founded in 1982 to further the mission of "One Nation, One Number." As of mid-1992, NENA had nearly 2,000 members across all regions of the country; the association issues a quarterly magazine (*NENA News*, now in its tenth year of publication), offers an 800 number for updates and information on legislation and issues affecting the 9-1-1 field, and holds an annual conference. The Associated Public-Safety Communications Officers (APCO) organization also gives considerable attention to 9-1-1 issues (partly in collaboration with NENA); for instance, its journal (*APCO Bulletin*) publishes an annual issue on 9-1-1 topics.

Typically, more than 80 percent of the calls handled by 9-1-1 systems are for police services and about 10 percent are for EMS. For instance, NENA cites information from Orange County, Florida (population over 430,000), suggesting that of nearly 294,000 sheriff, fire, and rescue calls, 87 percent were to the sheriff and 11 percent were "medical patches"; for the city of Kissimmee (population 30,300), 66 percent of about 16,700 calls were for police, 17 percent were for the EMS system (*NENA News*, 1992). Nevertheless, it is the EMS community that is working through the American

TABLE 6-1 Percentage of Population Covered by a 9-1-1 System, by State

State	Percent	State	Percent
Alabama	60	Montana	—
Alaska	90	Nebraska	65
Arizona	—	Nevada	95
Arkansas	25-50	New Hampshire	10[b]
California	100	New Jersey	35[b]
Colorado	85	New Mexico	75
Connecticut	100	New York	80
Delaware	100	North Carolina	76
District of Columbia	100	North Dakota	33
Florida	99	Ohio	60
Georgia	76	Oklahoma	80
Hawaii	95	Oregon	95
Idaho	68	Pennsylvania	60
Illinois	64	Rhode Island	100[c]
Indiana	49	South Carolina	72
Iowa	—	South Dakota	70
Kansas	80	Tennessee	83
Kentucky	56	Texas	97
Louisiana	[a]	Utah	85
Maine	25	Vermont	25
Maryland	100	Virginia	75
Massachusetts	38[b]	Washington	40
Michigan	60	West Virginia	43
Minnesota	100	Wisconsin	78
Mississippi	60	Wyoming	97
Missouri	62		

NOTE: —, not reported.

[a]Extent of coverage is unknown.
[b]Statewide implementation of enhanced 9-1-1 is under way.
[c]9-1-1 or similar access number.

SOURCE: *Emergency Medical Services* (1992).

Society for Testing and Materials (ASTM, 1991) to develop national consensus guidelines for planning and developing enhanced 9-1-1 systems. The National Highway Traffic Safety Administration (NHTSA, 1990a) also participates in the ASTM guidelines effort.

Benefits of 9-1-1

Standard Capabilities The 9-1-1 systems provide a simple, easy-to-remember telephone number that callers, including young children, can use to make quick contact with emergency services of all kinds. A common

number across the country eliminates the need to learn separate numbers for specific emergency services or in various communities. With such a system, callers do not waste valuable time trying to determine what number to use or waiting for a telephone operator reached through "0" to provide appropriate information about the correct agency (and relevant local telephone number) to contact. (To illustrate the profusion of numbers that has existed, in the early 1970s, a 21-county area in Nebraska had 184 separate ambulance service phone numbers [NAS/NRC, 1978b].) In short, the local benefits of a single, easy-to-dial telephone number for access to emergency services are multiplied in our highly mobile society, because people can rely on being able to use that same number no matter where they are *and* be confident that it will be answered by an "emergency-oriented" individual.

The benefits of 9-1-1 and enhanced 9-1-1 do not accrue solely to the health field. Reduced response times are very important, for instance, in law enforcement and firefighting. A functioning 9-1-1 system can also be important in disaster situations, such as tornados. More generally, the financial, psychological, and public relations benefits (in terms of public regard for a "public good" agency) of simply having a more efficient, more cost-effective system of emergency services should not be underestimated.

New Capabilities Certain new features have been developed to augment standard 9-1-1 capabilities (other than enhanced 9-1-1 described below). A TDD keyboard (i.e., Telecommunications Device for the Deaf) has been developed that will meet the requirement of the Americans with Disabilities Act (ADA) that telephone emergency services provide direct access for persons with speech or hearing impairments (Lopez and Dion, 1991; Suchat, 1992); with related advanced computer technologies, TDD calls can be displayed on a computer screen, enabling the call-taker to communicate with the individual calling in.

Another advance for 9-1-1 lies in helping those who do not speak English to use the 9-1-1 system successfully. EMS agencies can, by subscribing to a telephone interpreter service available through AT&T ("Language Line Services"), obtain real-time access (all day, every day) to interpreters who can assist operators to communicate with callers in as many as 140 different languages (Moedinger, 1992). This kind of service makes it possible to handle some calls strictly by telephone and to send response units (fire, police, *or* EMS) appropriate to the situation instead of every type of unit because of lack of understanding of the actual emergency.

Enhanced 9-1-1

The original 9-1-1 service provides the benefit of simplified access to emergency services. Newer, enhanced 9-1-1 systems (E9-1-1) offer the ability to draw on computerized databases to identify automatically the

telephone number and location of the caller—respectively, Automatic Number Identification (ANI) and Automatic Location Identification (ALI). The automatic availability of that information means that the EMS system can route calls to appropriate jurisdictions, when that is important in the particular area. More significantly, it enables the EMS system to send assistance even if callers cannot speak English or communicate effectively because of their condition or for other reasons. All these factors mean that response times can be reduced, with presumably improved levels of intervention and, ultimately, of patient outcomes. The TDD and translation services noted above for standard 9-1-1 are also available for enhanced systems.

New radio devices now make it possible for children or adults with chronic illnesses or other high-risk conditions to transmit a call to 9-1-1 by pressing the radio transmitter (Keller, 1992). Some "Lifeline" systems based on radio transmitter systems are more complex. They are often monitored by hospitals, alarm companies, and other third parties, which keep data on subscribers' medical history and conditions and persons to reach in an emergency; when the subscriber triggers the transmitter, monitors call the residence or nearby family or friends before a call is initiated to 9-1-1 or the relevant EMS agency. Although such systems have obvious advantages, they also have some drawbacks. For example, if there is no answer, all resources and equipment may be sent to the home, for what often turns out to be a false alarm. Moreover, use of an intermediary may in fact delay entry into the EMS system.

Important Considerations for 9-1-1 Systems

Despite progress in 9-1-1 technologies and as valuable as 9-1-1 systems are believed to be, some obstacles to complete adoption and implementation of these systems remain. Not all of these relate to EMS *per se*, and certainly not to EMS-C, but they must be understood if the EMS and EMS-C fields are to be persuasive in arguing for comprehensive adoption of 9-1-1 and successful in helping to devise ways to bring that about.

Installation and Operation Implementing an ALI component of an E9-1-1 system can require additional work in local areas, especially rural areas, that do not have "city-style" addresses. Converting to such addresses in various municipalities requires close collaboration with the U.S. Postal Service. The Postal Service has jurisdiction over the city, state, and ZIP code parts of a mailing address; a municipality has responsibility for street names and house numbers. The Postal Service believes that its guidelines on good addresses can be helpful to localities that are moving toward E9-1-1 but currently lack appropriate addresses to use in such a system (Pensabene,

1991). The increasing use of mobile cellular phones poses its own technological challenge to the locator aspect of enhanced 9-1-1 since no fixed address is associated with them.

The cost of installing and operating a 9-1-1 system, especially E9-1-1, may be an obstacle, especially given the current financial constraints that many states and localities face. Old telephone switching equipment may need to be replaced to accommodate 9-1-1; additional and/or different personnel may be needed; and stand-alone databases may be required for E9-1-1 capabilities. Further, the costs of an E9-1-1 system will depend heavily on the amount of mapping and numbering that must be done for locations without street addresses. Developing and maintaining the database for telephone numbers and addresses will also contribute to installation and operation costs. Patsey et al. (1992) report installation charges in North Carolina ranging from $18,000 to $160,000 for basic and enhanced 9-1-1, respectively, and monthly operating charges of $4,000 (basic) and $8,000 (enhanced). One county in Iowa estimated that implementing an E9-1-1 system (for about 16,000 persons) would cost about $280,000 initially and require about $30,000 annually to operate (Petricca, 1992). There are clear justifications for enhanced 9-1-1 in rural areas—more rapid call-taking, better response times, better assistance for children who need emergency assistance but cannot describe where they live—but the cost and logistical requirements lead some experts to question whether the benefits are sufficient to warrant outlays such as those quoted above.

Some communities for a variety of reasons continue to rely on seven-digit phone numbers; further, they may have separate numbers for police, fire, and EMS. These arrangements continue, in some cases, because jurisdictional disputes have made it impossible to implement 9-1-1—a political factor that this committee finds unpalatable when public and patient safety is at stake. Communities may be unwilling to work together if doing so requires giving up local control of their public safety agencies. New call-routing technologies, however, now generally make it possible for a 9-1-1 system to direct calls to specific communities based on where the call originates. Communities or public safety agencies themselves may resist giving up the separate phone numbers that provide direct access to each agency; one compromise position is to require such agencies to participate directly in the 9-1-1 system and also operate a separate phone number if they choose to do so, but experts worry that two separate phone numbers might be more confusing than helpful.

Call Answering and Dispatch Services Once calls to 9-1-1 are placed, the EMS system needs to be prepared to answer them. Various approaches are used, depending on the particular needs of each system. All 9-1-1 calls are received at a public safety answering point (PSAP). In some systems,

individual communities within a 9-1-1 area will maintain independent PSAPs, with calls routed to the appropriate point based on the caller's location or telephone exchange. The PSAP determines the kind of service needed (e.g., police, fire, medical) and either directs the call to the appropriate agency's dispatch center or performs the dispatch function itself.

Because most 9-1-1 calls are police-related, dispatch functions for all emergency services are frequently handled by employees of the police department who may have little or no EMS training. All dispatchers who handle EMS calls should have minimum levels of training and access to medical guidance. (The committee's views on the training and protocols needed by dispatchers are presented in Chapters 4 and 5.) Some commercial programs are available, such as "Medical Priority Dispatch," that use set protocols to give police department employees appropriate questions to ask and appropriate responses to caller inquiries or statements. Finding that 80 percent of the paramedic runs dispatched in one-year were for "false alarms" (essentially all calls, including bogus ones, in which paramedics did not evaluate or treat a patient at the scene) led Ramenofsky and colleagues (1983) to conclude that better dispatch criteria were clearly needed.

Brodsky's (1992) study on road accident reports points up some of the difficulties in making dispatch decisions. If callers do not provide specific information about the need for an ambulance, police dispatchers must decide whether to alert EMS, and those decisions may be delayed or incorrect. For example, although most highway collisions do not require ambulance service, in nearly 20 percent of fatal crashes in Missouri, the delays in notifying EMS were 5 minutes or longer. Brodsky also notes that specific policies on notifying EMS varied across the state; some local EMS systems believe that they, not the police, should determine whether to send an ambulance. He concludes that greater efforts should be made to link information on police dispatch with that on collisions to learn more about the impact of specific dispatch policies on morbidity and mortality.

The impact of 9-1-1 systems on morbidity and mortality has not been adequately assessed. An analysis of trauma death rates in North Carolina counties before and after implementation of 9-1-1 showed that counties with 9-1-1 had a lower average trauma death rate than counties without 9-1-1, but the presence of 9-1-1 could not account for the difference after controlling for other factors (Patsey et al., 1992). More significant than the absence of 9-1-1 was the fact that those counties were more rural, less likely to have a trauma center, and less likely to have advanced life support (ALS) services available. These results suggest that a 9-1-1 system cannot by itself ensure better outcomes for trauma; other pieces of the EMS system must be available as well. This study does not, however, provide any insight into benefits that 9-1-1 might bring in other kinds of emergencies, perhaps by facilitating speedier response to cardiac emergencies or by providing access to prearrival instructions for first aid.

Public Access and Use One very practical concern, in both rural and urban areas, can be availability of telephone service. Some people in rural or remote areas may rely on radio communications, but others may have no local telecommunications resources at all. Factors that account for the lack of telephone services—sparse population, terrain, poverty—are likely to be of a long-standing nature and are unlikely to succumb to remedial efforts based solely on arguments about 9-1-1 service. Even in urban areas, some households have no telephone service. One study found that families of 9 percent of the patients in a public assistance managed care plan who were seen in the pediatric ED of a major city hospital did not have a telephone (Glotzer et al., 1991). Such families are likely to rely on neighbors' telephones or on nearby public telephones. Either way, some of the benefit of rapid access to EMS that 9-1-1 is intended to provide is compromised by delay in reaching a telephone, and the locator benefits of enhanced 9-1-1 are reduced because the caller is not at the scene of the emergency.

Installing even the most sophisticated 9-1-1 system will not guarantee that the public will use the EMS system appropriately or that the EMS system will provide an appropriate response. Public education efforts are needed to prepare parents and others responsible for the care of children to recognize emergency conditions and to know how to respond, including how to contact the EMS system. (See Chapter 4 for a more extensive discussion of public education needs in this area.) As is the case with all emergency services, attention also must be given to when 9-1-1 should *not* be used. Inappropriate calls make it more difficult for those who really need emergency care to reach the EMS system; unnecessary dispatch of equipment risks squandering scarce staff and ambulance resources. Some inappropriate calls may, however, signal a need for other kinds of information and transportation services to assist people in getting to doctors' offices, clinics, and pharmacies for nonurgent medical care. In these situations, having a "municipal services" or other nonemergency number may be useful.

Managed Care Guidelines for Using 9-1-1 Efforts to promote use of 9-1-1 have received limited support from many managed care programs or health maintenance organizations (HMOs). Members of such programs may be requested, or required, to telephone the HMO offices first—before calling 9-1-1—except in *obviously* life-threatening emergencies. Such policies are intended as an administrative mechanism to reduce unnecessary ED visits, which are a serious burden for some EDs and are costly for insurers. Given the difficulty with which parents or other responsible adults (or adolescents, siblings, or younger children) might have in discerning what is a life-threatening emergency in a child and what is not, requirements to contact the HMO first can pose problems if the definition of "emergency" is too narrow or too rigidly enforced.

A study in the Chicago metropolitan area found that 15 of 16 large HMOs (accounting for 95 percent of HMO enrollees in the area) advised their members to contact the HMO (or gatekeeper physician) first in the event of an emergency; one advised going to the nearest hospital (some advised this as a secondary response in the most serious emergencies); none advised calling 9-1-1 as the first response (Hossfeld and Ryan, 1989).[3] Similar policies were found among a representative sample of federally qualified HMOs (Kerr, 1989). The vast majority allowed enrollees to proceed to a hospital ED without permission when the problem was life-threatening and required permission when it was not; the mechanisms for acquiring permission from a gatekeeper by telephone varied across the HMOs. In some cases, patients would be allowed or directed to go only to a hospital in the HMO network (and not necessarily to the nearest one). If a true emergency exists, such policies run counter to EMS guidelines.

Kerr (1989, p. 276) notes that some "medical directors believed that telephone triage systems introduce undue delay in ED access and for that reason were not used by their HMOs," and he goes on to comment on the dearth of information about the safety of telephone gatekeeping systems of this sort in the EMS context. Others, however, have reported on advantages of a well-developed HMO telephone triage system (Daley et al., 1988; Leaning et al., 1991). HMO staff have access to patient records during a call, can advise callers unaware of the seriousness of a condition how and where to seek appropriate emergency care (especially if no 9-1-1 system is available), and can summon emergency transport for patients who might otherwise avoid seeking such assistance. The experience of the Harvard Community Health Plan suggests that the participation of emergency physicians in HMO plans can provide greater appreciation within the organization of the need for efficient access to the EMS system (Daley et al., 1988).

Knopp (1986) argued for HMOs to take four steps to improve access to emergency services: (1) base reimbursement decisions on review of the *initial* presentation of the patient to an appropriate emergency facility or physician, not on the final diagnosis; (2) develop a cooperative relationship with the local EMS system, including providing enrollees with information on how to use it; (3) instruct HMO physicians and nurses to "err on the side of patient care, not cost containment" in making telephone triage decisions; and (4) develop better triage methods so that potential life-threatening situations can be appropriately identified and the EMS system called into play in a timely fashion.

Legal and Ethical Issues Privacy and confidentiality issues may become a concern precisely because of the caller identification capabilities that are at the heart of the E9-1-1 system. In principle, it does not seem reasonable to expect callers into an EMS system to object to this feature, as

it arguably is always in their best interests. In practice, however, fears about invasion of privacy and breaches of confidentiality relating to sensitive medical information have reached quite high levels (as briefly explored in Chapter 7). Such concerns may trouble even those who do not make direct use of the system because of the need to maintain a comprehensive database of telephone numbers and addresses for an entire service area.

Another question that arises with E9-1-1 is whether there is an obligation to dispatch response personnel or equipment (police, fire, or EMS) in response to very brief calls in which the location of the call is known but the caller has seemingly deliberately hung up before completing the call. In these situations, when the call-takers may suspect but not be certain that the call is a hoax, a decision must still be made as to whether to respond and, if so, with what kind of service. Frequently, 9-1-1 centers will call the number back and send police to ensure that no emergency exists.

Recommendation for 9-1-1

This study committee strongly believes that universal adoption of 9-1-1 must be a national goal. It recognizes that 9-1-1 systems in themselves cannot ensure that efficient and effective emergency services will be available in response to a call; 9-1-1 systems are, instead, one part of the EMS *system* that needs to be in place to make such care available, and the capabilities of E9-1-1 make it especially valuable. Successful adoption of 9-1-1 is not necessarily simple; it will require communities to address a variety of interlocking challenges. In the committee's view, however, 9-1-1 is an *essential* EMS system element, for all the reasons and benefits offered above. Therefore, **the committee recommends that all states ensure that 9-1-1 systems are implemented. The 9-1-1 system must be universally accessible and effectively linked to the emergency medical services system. Communities with 9-1-1 systems in place should move toward enhanced 9-1-1 capabilities. Communities with no 9-1-1 system should move directly to an enhanced 9-1-1 system.**

More specifically, the committee advises that the federal center and state agencies described in Chapter 8 make the 9-1-1 issue one of their key priorities. For example, smaller communities that have not yet implemented 9-1-1 at all may need encouragement and assistance from federal or state bodies to overcome financial and administrative obstacles to adopting 9-1-1, and this help should be forthcoming at the earliest possible moment. Localities that wish to move from standard to E9-1-1 capabilities should also receive high priority attention or assistance. In all cases, attention should be directed at understanding and overcoming the various impediments to 9-1-1 and enhanced 9-1-1 outlined above. The committee also believes that attention to these issues should proceed on a broad front relating

to other parts of the EMS system, such as the education and training of dispatchers.

Telephone Advice

Poison Control Centers

Poison control centers fill a unique niche in pediatric emergency medical care, providing the public and emergency care providers with telephone access to specialized information resources on treatment of poisonings. They are especially valuable for the pediatric population, which is the age group at greatest risk of unintentional poisonings. Data from 73 centers show that, in 1991, children under the age of 13 accounted for 66 percent of the reported cases; 54 percent were for children under the age of 4 (Litovitz et al., 1992). Fortunately, only a few of these cases proved fatal: children under the age of 13 accounted for only 6 percent of deaths recorded by the centers. Deaths to adolescents (ages 13 through 19) were, however, 8 percent of the recorded deaths.

These centers are an important adjunct of the EMS system. They reduce the burden on EDs and the 9-1-1 system by handling the large number of calls about children who can be treated safely at home. One study compared rates of ED visits and home management of poison exposure between one state with no poison control center available and one with toll-free access to a center; the former had a much higher rate of unnecessary ED visits, resulting in nearly $1.4 million in unwarranted ED costs in less than one-year (King and Palmisano, 1991).

Poison control centers and EMS systems generally maintain close ties: emergency services can be activated quickly for calls that require them, and poisoning calls to 9-1-1 can be transferred to poison control centers. The centers also respond to calls from EMS systems and hospitals, which generally involve the most serious cases. In some locales, EMS dispatchers will connect callers with poison control centers and stay on the line to act on the advice of the center (e.g., to trigger an EMS response if one is needed), rather than activate ambulance services immediately.

Poison control centers are not available in all parts of the country. Of the 104 operating in 1990, 36 had been certified as regional centers by the American Association of Poison Control Centers (AAPCC) (Kearney, 1992). Only a few states have established their own standards or oversee the operation of centers. Centers that have not met the AAPCC standards should, however, have sufficient oversight to ensure that they are giving sound guidance to the parents and health care providers whom they are serving. Poison control centers need reliable access to up-to-date information on both substances produced for a national market and specific local resources

for managing individual cases. (Kearney [1992] provides a comprehensive overview of the origins and operations of poison control centers.)

Hospital ED and Other Providers

Telephone advice in pediatric and emergency medical care has been a subject of attention for at least 20 years (see, generally, Ott et al., 1974; Greitzer et al., 1976; Perrin and Goodman, 1978; Brown, 1980; Schmitt, 1980; Shah et al., 1980; Fosarelli, 1983; Knowles and Cummins, 1984; Selbst and Korin, 1985; Verdile et al., 1989; Kosower et al., 1991, forthcoming; Avner et al., 1992; Isaacman et al., 1992b; Yanovski et al., 1992). It appears to be widely available from EDs and primary care physicians and is a specific component of the services of some HMOs. Only 8 of 61 EDs contacted in one study did not provide telephone advice services (Isaacman et al., 1992b). In another study, a group of pediatricians and family practitioners reported a weekly average of 45 telephone contacts for pediatric patients and an average of 65 office visits (Yanovski et al., 1992). Accurately assessing the nature and severity of a child's condition on the basis of information obtained from parents or other untrained observers (and even from other medical personnel) can prove difficult, however. Furthermore, giving advice without examining a child directly may pose increased liability risks (Murray and Templeton, 1993), although few malpractice claims have been made (Avner et al., 1992).

Calls do provide an opportunity to identify cases that do not require emergency attention and thus reduce the number of patients that crowded EDs must handle; moreover, telephone advice is valued by the community (Shah et al., 1980; Troutman et al., 1991). One HMO has found that only about 10 percent of calls to their after-hours line result in ED visits; for these callers, the HMO is able to direct them to an appropriate hospital and can arrange for emergency transport if necessary (Leaning et al., 1991; Wilkinson et al., 1991). Clear protocols and thorough oversight help ensure that patients are receiving sound advice.

Others, however, express concern that inappropriate advice may lead to a worsening of a child's condition and create a liability risk for the ED (Greitzer et al., 1976; Selbst and Korin, 1985; Verdile et al., 1989; Murray and Templeton, 1993). Recent studies have found that both office-based physicians and ED personnel frequently provided inappropriate advice in response to calls on separate test scenarios for serious illness: about 55 percent of the physicians (Yanovski et al., 1992) and about 40 percent of the EDs (Isaacman et al., 1992b) failed to recommend the urgent attention deemed necessary by the researchers. In a similar study of freestanding urgent care centers, 83 of 100 centers contacted failed to provide advice deemed appropriate by the investigators (O'Brien and Miller, 1990).

The American College of Emergency Physicians (ACEP, 1990c) and the Emergency Nurses Association (ENA, 1991) have both issued position statements discouraging ED staff from offering diagnoses and recommending treatment over the telephone. If a life-threatening condition exists, directions regarding first aid and on seeking medical assistance are considered appropriate. Both organizations recognize, however, that telephone advice is often requested from and provided by ED staff. They urge, therefore, that clear policies and protocols be developed to guide these activities, that all advice be documented, and that quality assurance programs be used to monitor the soundness of the advice given.

Appropriate training and guidelines should be provided to physicians and nurses who are expected to respond to telephone calls for medical advice. Because they cannot observe the child directly, they must know what kind of descriptive information is essential and how to elicit it from the caller. Perrin and Goodman (1978) found, for example, that pediatric nurse practitioners with specific training in interviewing skills obtained more complete information from callers than practicing pediatricians who had little training of this sort. Some pediatric residency programs now include training in communication process skills (e.g., Kosower et al., 1991).

In its discussions the committee noted both benefits and risks associated with telephone advice and understands that it will be offered as a service in some hospitals. Consequently, it adopts the stance that all health care personnel who provide telephone advice should receive appropriate training for this task. Furthermore, the unevenness of telephone advice needs to be brought more forcefully to providers' attention; care must be taken to document and monitor all such calls when hospital EDs or others actually provide advice beyond simply telling the caller to seek care for the child. The committee also endorses the position of those in the health care field who advocate further development of guidelines for use by all clinical staff faced with making triage decisions over the phone.

PREHOSPITAL COMMUNICATION

Provided here is a brief discussion of some technical issues of concern in prehospital communication. Factors such as the nature of the information to be transmitted (e.g., voice, data, telemetry), the physical environment, the numbers of transmissions expected, and the time frame within which contact and response are needed will influence the configuration of communications systems and the means of communication chosen in specific instances.

One distinctive aspect of prehospital communication—on-line medical control—is examined in somewhat more detail, since it is critical, yet only poorly understood and carried out. As in the related discussion in Chapter

5, the committee seeks here to make clear the appreciable complexity of this aspect of EMS, in that systemwide and local issues surface in addition to those related simply to an individual emergency medical technician (EMT) or paramedic asking for and receiving medical guidance in the field.

Communications Technologies

EMS systems rely heavily on their communications networks in all phases of prehospital care. In the early 1970s, heightened concern over deficiencies in EMS communications capabilities led the Robert Wood Johnson (RWJ) Foundation to establish a grant program intended to support the establishment of regional emergency communications systems (NAS/NRC, 1978b). As noted in Chapter 3, the RWJ efforts had appreciable impact, for instance in establishing 9-1-1 systems. Since that time, considerable technical progress has been made, but the basic needs remain similar and some gaps persist. For example, NHTSA's (1992) assessments of state EMS systems documented the need for more systems to develop up-to-date communications plans, to secure adequate funding so that old communications equipment can be replaced and additional equipment can be obtained to reduce coverage gaps, and to require training for dispatch personnel.

Once notified that ambulance service is needed, EMS systems must be able to provide communications among the dispatch center, units dispatched on a specific call, other ambulance units, a base hospital or physician for medical direction, receiving hospitals, and other transport services. Additionally the EMS system should be able to maintain voice contact with the originating caller, to provide instructions for cardiopulmonary resuscitation or other advice while the EMS units are en route.

Communications capabilities allow ambulance units to request assistance from additional ground units or to request and communicate with air transport services. Receiving hospitals that are notified that a patient is on the way can prepare for any special services that might be needed. Small hospitals can alert appropriate physicians and other staff that they will be needed in the ED or begin arranging for a transfer to another hospital.

Separate communications channels should be available to EMS to maintain contact with fire and law enforcement services, which may need to respond to the same calls as EMS units. In some of these situations, the safety of EMS responders themselves is a concern. More generally, the point is that EMS personnel must function in joint response and incident command structures, so the availability of communications channels for contact with these other responders is important.

Most prehospital communication is based on radio systems with equipment that can include fixed, mobile, portable, and hand-held radios; pagers also may be used. The specific frequency ranges available for EMS communications

have varying capabilities for distance and strength of signal (Keller, 1992). Radio communication over large areas may require additional equipment to boost signals to reach all the necessary locations. In urban areas, the concern is likely to be more with congestion of available frequencies than with communicating over substantial distances. New frequency ranges recently made available by the Federal Communications Commission (FCC) may help relieve some of the congestion.[4]

Radio frequency ranges are, however, finite, which argues for maximizing efficient use of available communications channels. Efforts are being made to have the FCC designate the Emergency Medical Communications Service as a public safety communications service comparable to police or fire services (Ryan, 1992). EMS would then be in a better position to participate in the development of consolidated public safety communications services that can make efficient use of the newly released frequencies and the digital technologies designed to operate at those frequencies. For EMS, steps such as limiting or adapting on-line medical control protocols or using alternatives to voice communication (such as packet data transfer) may be needed.

Radio systems also can be linked to telephone and microwave systems to extend the communications range. Microwave networks are used in states such as Idaho (Anderson, 1981a) and Wisconsin (Wisconsin EMS-C Project, 1990)[5] to provide wide-area communications capabilities across large rural and remote areas. To illustrate, the communications center for Idaho's statewide network assists units that cannot make needed radio contact because of distance or interference. It can also serve as a dispatch center for special units in remote areas and can help coordinate transport services for patients needing transfers to specialty centers. Wisconsin was prompted to seek a more effective communications system because it found that rural EMS providers were often unable to establish medical control contact and thus lacked authorization to initiate important treatments.

Other developments include the addition of cellular telephones to prehospital communications resources. This equipment offers two particular advantages: first, these phones can be used while in transit or at the scene of an emergency; second, because they can make connections with regular telephone lines, EMS personnel can reach a wider range of answer points than they can with radio alone. However, cellular communication depends crucially on system coverage, which can be spotty and unreliable even in urban areas and essentially nonexistent in many rural areas.

In short, several technologies are needed to meet the communication demands created by regional variations in geography and operating conditions. Technologies suitable for the plains states of the Midwest may be ineffective for the mountainous states of the West. Localities will of necessity continue to adapt various methods—such as microwave linkages, repeater

schemes, and digital trunking—to their particular circumstances; in sparsely populated rural areas, financial and technical support may be especially critical. If the diffusion of high-capacity digital communication technologies and infrastructure (e.g., fiber-optic telephone lines) is allowed to rest with market forces, poor and rural areas may be left without access to a valuable resource (O'Connor, 1992). At the federal level, goals may include ensuring universal access to such technologies or developing mobile satellite communication systems that can overcome many of the constraints of conventional radio systems.

On-line Medical Control

On-line medical control depends on EMS communications capabilities to make direct medical guidance available to prehospital personnel caring for patients at the scene of an emergency and en route to an ED. In Chapter 5, on-line medical control was discussed principally in the context of applying sound protocols to guide prehospital personnel in caring for children *and* to guide hospital personnel in directing that care. The discussion here addresses the organization and operation of communications systems to provide on-line medical control.

In general terms, on-line medical control is provided to prehospital personnel via radio or telephone contact with designated personnel at a "base hospital." Many EMS systems rely on physicians, typically with emergency training, to provide this on-line direction. Communications mechanisms exist that can bring an attending physician on-line very rapidly, no matter where he or she is in the hospital at the time. In some systems, nurses, paramedics, or other personnel are authorized to respond to calls while acting under the supervision of a physician who retains the ultimate responsibility for medical control (Holroyd et al., 1986; Dieckmann, 1992b). Nurses who specialize in providing base hospital services are known as mobile intensive care nurses (MICNs) in some EMS systems.

Medical control for a transport team moving a critically ill or injured child from a referring hospital to a receiving hospital is a special case, in that the goal for interhospital transport is to provide care that resembles, as much as possible, the care expected from the *receiving* hospital. In this case, some experts recommend that the medical control director be a physician trained in either pediatric emergency medicine or critical care medicine; be experienced in fielding transport calls and suggesting treatment until the patient and team arrive at the receiving hospital; and be able to direct training programs, develop guidelines and protocols, and provide or facilitate follow-up exchange of information between the receiving and the referring hospitals and physicians (Orr et al., 1992).

In all cases, meeting the needs of pediatric patients requires that on-line

medical control reflect input by professionals with some training and experience with pediatric patients. Until recently, only limited attention has been paid to developing specific guidance for treating pediatric patients, and participation by physicians with pediatric expertise in on-line direction has been similarly limited. Most prehospital providers have had only fairly narrow training or experience in using ALS procedures with children; they may, therefore, tend to use only basic life support (BLS) procedures, for which EMS systems generally do not require on-line direction. Even in an urban EMS system (Los Angeles) with strong emphasis on on-line guidance, paramedics made contact with the base hospital for only 28 percent of the pediatric cases (Seidel et al., 1991b). The same study observed that, in more rural parts of California, base hospital contact ranged from 15 percent of pediatric cases (in a county that requires contact only for ALS procedures) to 89 percent.

Direct physician-guided communication is the ideal but may not be feasible for all settings. In deciding how to provide medical control (e.g., standing orders versus direct communication or physician only versus physician supervision of nurses or other surrogate personnel), EMS systems need to consider several factors: availability of qualified staff and staff costs for operating a base hospital communications center, complexity of care that prehospital providers are authorized to deliver, and perceived need by the medical community and the EMS system for direct medical oversight of prehospital care (Dieckmann, 1992b). Use of MICNs, for example, can reduce personnel costs and improve protocol compliance but does not provide immediate access to physician guidance. In rural areas, limited ED staffing and lack of expertise in emergency medicine among physicians in the area may make it especially difficult to provide on-line medical direction of any kind (OTA, 1989). Communications systems that facilitate contact with more distant hospitals could provide rural areas with greater resources for medical direction.

Two basic models are used to organize on-line medical control. Under one model, field personnel receive guidance directly from the hospital to which they expect to take their patient. Thus, each hospital operates its own communications center. An alternative approach is to centralize medical control. In such a model, a small group of "base-station" physicians provides medical control for an entire region. EMS programs in cities such as Seattle, Dallas, and Houston employ this model, and it has been incorporated into state regulations in California (State of California, Health and Safety Code, Division 2.5). Clearly the centralized model can be extended to EMS-C efforts. An EMS-C variant is to have a regional tertiary center (e.g., children's hospital) monitor instructions between a receiving hospital and the prehospital EMS providers; if those instructions are inappropriate, ED staff at the monitoring (base-station) hospital can supersede or countermand them.

Centralized or regionalized on-line control permits standardization of instructions to paramedics and EMTs and some quality control over that guidance. It also makes more efficient use of scarce pediatric expertise in at least some areas of the country (both urban and rural). It may, however, create tensions between hospitals if non-base-station facilities come to believe that base-station hospitals are interfering in the management of patients or are overtriaging them to their own institutions. Good communication between receiving hospitals and base stations, including perhaps independent review of triage decisions, is needed to limit such problems.

As the need for specialized pediatric prehospital care has become more widely recognized, the participation of children's hospitals in on-line medical direction is being considered. They have the potential to bring the most extensive range of pediatric expertise to on-line medical control. Dieckmann (1992c) suggests that well-established tertiary-care children's hospitals might successfully provide such services if they already function as major referral centers and have a knowledgeable full-time ED staff, and if other base hospitals in the system do not have strong pediatric resources.

In whatever configuration an EMS system provides on-line medical control, it is critical that knowledgeable base-station physicians be available to provide guidance for care of pediatric patients. The pediatric community must help develop the system's resources for guiding the care of children. The committee here emphasizes its strong commitment to the creation, dissemination, and evaluation of pediatric guidelines for prehospital and base hospital providers.

COMMUNICATION IN HOSPITAL CARE

Hospital-based emergency care for children generally starts in the ED; successfully treating patients in this setting may ultimately require a variety of other services within the hospital or even at other hospitals. Good communication channels between EDs and those other hospital services play an important role in getting children the care they need in a timely way. Often, a centralized communication service within a hospital may be an asset, by enabling ED staff to contact other hospital resources quickly and reliably through "fast-track" high-priority calls that are isolated from usual ED communications.

In its discussions the committee focused on two specific concerns in this area: consultation to obtain advice from specialists (e.g., communication between ED staff and internal hospital specialists, or between hospital staff and distant specialists), and contact between community hospitals and referral centers for patient transfers. For the most seriously ill and injured children, successful communication between these groups and facilities can be critical. For the many other children with less serious conditions who

are treated in EDs, these communication needs may be less urgent, but they remain an important part of the overall care of those children.

Consultation by the ED Staff

Local Consultation

An ED confronts a wide variety of illnesses and injuries. The special knowledge and skills that the ED staff bring to the care of these patients must be complemented by access to other services and sources of additional expertise. The extent of these resources beyond the ED will vary widely.

EDs at the most sophisticated pediatric specialty hospitals will have available subspecialists in surgery, critical care, and a full range of medical fields (e.g., cardiology, neurology, pulmonology, infectious diseases) and the inpatient facilities to provide extensive and complex backup care. Many other hospitals can rely successfully on a less extensive array of specialists to provide essential assistance in pediatric emergency care. Physicians and other ED staff need to recognize when to seek assistance from these specialists.

Regardless of the size of the hospital or the community it serves, the ED needs to establish good working relationships with other parts of the hospital. The radiology department and laboratory services, for example, are two areas on which emergency care depends heavily. Access to surgical and inpatient services is needed for more serious cases. In the many hospitals with no special expertise in pediatric emergency care, advice and assistance from the hospital's pediatric staff will often be valuable.

In the committee's view, two areas of consultation should receive special attention. The first derives from the concept of the "medical home" described in Chapter 1. That is, every child should have a source for primary care that is geographically and financially accessible, offers continuity of care and comprehensive care, and organizes proper use of and linkages with community support services. Thus, the ED should be in contact with a child's primary care provider, because this physician will have the most extensive knowledge of the child's medical history and the responsibility for future care. Establishing this contact helps maintain the continuity of care that should ensure attention to all of a child's health needs (Seidel and Henderson, 1991).

For children with chronic illnesses or other special health care needs, involving primary care providers is even more important, for two reasons. These children are likely to require urgent care more often than other children, and treating them may be especially complex. Without such contact, important aspects of their care may easily be overlooked.

Second, insofar as resources and time allow, emergency care providers

should give early attention to their patients' rehabilitation needs. Early participation by physiatrists and other specialists, for instance, can reduce the disabling impact of some conditions and can facilitate planning for longer-term rehabilitation needs (NRC/IOM, 1985; IOM, 1991b). Trauma care guidelines call specifically for this early integration of rehabilitation into patient care (ACEP, 1987a; Haller and Beaver, 1989; Harris et al., 1992). The continuum of care for EMS-C must extend beyond acute care to ensuring that children receive appropriate rehabilitation services.

Reaching Regional or National Specialists

In cases where local expertise is inadequate to guide children's emergency care, some patients should be transferred to other hospitals with more extensive capabilities, a topic addressed below. Other patients can be treated successfully without being transferred when emergency care providers can draw on the expertise of specialists beyond the local community. Some of the sources of such guidance are described here.

Regional Poison Control Centers These centers can provide telephone access to extensive toxicological expertise. Centers certified by the AAPCC are expected to serve a regional population of 1 million to 10 million people (Kearney, 1992). Although many suspected poisonings in children can be managed without specialized care, the poison control center provides valuable assistance to the ED staff in treating more serious cases and identifying children who require care beyond local capabilities.

Pediatric Referral Centers Telephone access to a broad range of specialists is often possible through major pediatric referral centers. Providing consultation services is an explicit component of some guidelines for critical care services—see especially work by the Commission on Emergency Medical Services (AMA, 1990), the Pediatric Emergency Medical Services Advisory Board (1988), and the Pediatric Intensive Care Network of Northern and Central California (PICN, 1990). The PICN provides 24-hour consultation services to the large area of California that it encompasses (Pettigrew, 1989).

Where such referral centers are the focal point for specialized care in a particular region, outreach programs can make regional medical communities more aware of the resources available to them through the center. It still falls to local providers to recognize when to call upon those resources for consultation or transfer. Guidelines for critical care consultation or interfacility transfer may aid the many hospitals that rarely care for seriously ill and injured children. With funding from the federal EMS-C program, the California EMS Authority (1992) is working with the California Pediatric Emergency and Critical Care Coalition (PECCC) to develop guidelines

of this sort that can be used by hospitals and EMS systems throughout the state. As part of a regional pediatric critical care system development project funded by the California EMS Authority, the Sierra-Sacramento Valley Emergency Medical Services Agency (1992) assembled consultation guidelines that use specific physiologic criteria such as cardiac arrhythmias or evidence of shock (e.g., heart rate greater than 180 for a child two-years old or younger), anatomic criteria or types of injury (e.g., spinal cord injury, burns to more than 15 percent of the body), and certain other indicators (e.g., severe electrolyte imbalance or metabolic disturbances, near-drowning).

Telephone Hot Lines Some major hospitals across the country have encouraged telephone consultation with specialists on their staffs by developing special telephone hot lines with toll-free numbers. Consultation is provided for emergency assessment and treatment of patients whether a transfer is necessary or not. The EMS-C demonstration grant project in Rochester, New York, specifically included development of such a telephone hot line at the children's medical center at Strong Memorial Hospital (Shaperman and Backer, 1991). In Florida, a network of five major pediatric referral centers is being created to provide telephone consultation services to physicians across the state.

Facsimile Communication Facsimile (FAX) communication has proved to be a valuable addition to voice communication for EMS-C systems and emergency care providers (Yamamoto and Wiebe, 1989; Keller, 1992; Snyder, 1992). It permits rapid transmission of written or graphic information and reduces errors that can arise from inaccurate recording of information transmitted orally. Cardiologists can, for example, view a patient's electrocardiogram directly rather than rely on the caller's description of the tracing or delay treatment until it can be viewed in person. The ability of FAX technology to transmit medical records between hospitals can be particularly valuable in providing consultants with more complete information for evaluating a patient's condition and in ensuring that records for patients who must be transferred reach the referral hospital in a complete and timely manner. The Hawaii EMS-C project encouraged the installation of ED-based FAX equipment in hospitals throughout the state (Yamamoto and Wiebe, 1989). Even within a hospital, FAX has proven useful for such tasks as transmitting medication orders to the pharmacy or sending laboratory results to the ED (Yamamoto and Wiebe, 1989; Snyder, 1992). More complex computer-based technologies are making it possible to use telephone lines to transmit radiographic images (e.g., from computerized tomography scans) to distant sites for interpretation by experts or in preparation for patient transfer (Yamamoto, 1992).

Transfers to Other Facilities and Referral Centers

Some seriously ill or injured children need care that is beyond the capabilities of the local hospital. Scientific evidence indicates that children with the most serious conditions have the best outcomes when they are cared for in tertiary critical care facilities (Pollack et al., 1991). To get children to those facilities, the local hospital and its medical staff must arrange an expeditious transfer to a referral center or another, more fully equipped facility with appropriate specialty and critical care capabilities. General medical principles guiding transfers include attention to the health and well-being of the patient, clear accountability on the part of physicians responsible for the patient, and transfer of necessary medical record documentation (ACEP, 1990b). It is also necessary to comply with the growing body of federal and state law and regulations regarding patient transfers.[6]

When a child needs to be transferred, communication between the sending and receiving hospitals must be clear. The transferring hospital must establish where the child can be sent. It must provide enough information about the child's condition for the receiving hospital to determine the appropriate form of transport and to advise on further care until the referral center is reached. If a critical care transport team is dispatched to collect the patient, the transferring hospital needs to be prepared to work with team members to assure that the patient's condition is sufficiently stable to permit safe transport.

Once the patient reaches the receiving hospital, information about the patient's condition and care should be sent back to the transferring hospital. This may be especially important when parents or other family members cannot immediately accompany the child during the transfer or reach the receiving hospital area promptly. McCloskey and Orr (1991) emphasize the need for all parties in the transfer process to communicate clearly and fully to avoid misunderstandings that might adversely affect a child's care. Beyond information made available to a child's family, the receiving hospital should also inform the staff of the transferring hospital about the child's status and about the appropriateness of the care rendered, the timeliness of the referral, and any communication problems that occurred. Information should be provided in a constructive manner that will encourage a transferring hospital to provide the optimal care possible within the context of its capabilities.

Written Transfer Agreements

Referrals can always be arranged on a case-by-case basis. In the most serious cases, however, when there may be considerable urgency in getting the patient to a higher level of care, addressing the administrative and financial

aspects of a transfer can be both time-consuming and distracting (McCloskey and Orr, 1991). The committee agrees with many others that community hospitals and referral centers should have *written* transfer agreements in place before the need for transfer arises (ACEP, 1987a, 1990b; Pettigrew, 1989; AMA, 1990; Foltin and Fuchs, 1991; McCloskey and Orr, 1991; Seidel and Henderson, 1991; AAP, 1992e). It also endorses the view that community hospitals can and should establish agreements with more than one referral center when availability of beds or specialty services cannot be ensured by a single facility. As one variant on this point, guidelines for trauma systems call for trauma centers to establish written transfer agreements with rehabilitation facilities (ACEP, 1987a; Harris et al., 1992), a stand with which the committee concurs.

In California, a model transfer agreement was originally developed by the PICN; it has been the basis for agreements put in place by various EMS systems in the state and has itself been revised on the basis of experience of some of those systems (Sierra-Sacramento Valley, 1992). The California EMS Authority (1992) and the PECCC are developing a model transfer agreement that will be made available throughout the state. Hospitals can use these agreements to allocate responsibilities between the two facilities and to formalize arrangements for consultation, transport, payment, and liability. Arrangements for transferring patients back to their local hospital can be included as well. These agreements are not intended to govern medical decisions regarding patient care; community hospitals should have sound medical criteria for initiating the transfer process. (Chapter 5 includes additional discussion of issues related to transfer agreements and protocols.)

Centralized Communication System for Transfers

In arranging to transfer children, physicians in community hospitals may need to rely on their personal knowledge of the capabilities of various referral centers or on working relationships developed with individual members of the medical staff. Even when a community hospital has standing transfer agreements, it must still establish in each individual case that a receiving hospital is willing to accept the patient. If space in pediatric intensive care units (PICUs) is limited or if a patient needs a special kind of care, staff at the original facility may need to contact more than one potential receiving hospital. The process can be time-consuming and may not produce the optimal match between the needs of the patient and the resources of the referral center.

To facilitate the transfer process, some regional systems have established centralized communication services; these maintain information about the availability of beds in area referral centers and can assist in arranging

patient transport (Seidel and Henderson, 1991). The committee believes that the merits of this type of service should be investigated. It might give hospitals some of the same benefits in ease of system access that 9-1-1 systems provide to the public. By simplifying the process of arranging patient transfers, such a service might also save time that the medical staff of a local hospital could use more appropriately to care for seriously ill or injured patients. Further, centralized access to regional information on the availability of PICU beds and other services might make more efficient use of regional hospital facilities.

A lengthy list of implementation issues would have to be considered: Would such a system be organized and operated by state or local governments? Would regional referral centers establish voluntary networks? Can effective plans for patient referral be made when multiple centers are competing for business in the same geographic area? Are there situations in which facilities should, or should not, be bypassed? How would a system be financed? Who would have access to the system? Would the system handle patients of all ages? Would an interstate system be possible? Is such a service cost-effective? Given the diversity of local and regional needs and resources, no one answer to such questions is likely to be appropriate everywhere. Nevertheless, the committee believes that the experience of existing systems should be examined and their appropriateness in other parts of the country considered.

FOLLOW-UP: ENHANCING CONTINUITY OF CARE

An EMS-C system has within its scope services that reach from prevention to acute care and on to rehabilitation. This span is intended to ensure that the most seriously ill and injured children receive the full range of services needed to produce the best possible outcome. Because it focuses on providing speedy care for unanticipated problems, however, such a system is not designed to facilitate the continuity of care between patients and providers that is available in a well-functioning primary care setting. In fact, a successful outcome from emergency care may depend on ensuring that children reach those settings where longer-term care is available and that primary care providers participate in managing that care.[7]

Because emergency care, especially for children, should not be provided in isolation from a patient's overall health care needs, an emergency care system must emphasize to its providers the importance of follow-up care. ACEP (1991) guidelines for emergency care establish a minimum level of responsibility. They call for identification of specific physicians who will accept responsibility for additional inpatient or outpatient care once patients are discharged from the ED. The interhospital transfers discussed above create special follow-up obligations for both hospitals involved

to ensure that the shared responsibility for immediate care of these patients does not allow needs for short- or long-term care to be overlooked. The committee argues that, in addition to interhospital transfers, EMS-C systems must give special attention to follow-up in three areas: primary care, post-ED care, and rehabilitation.

Primary Care

Ideally, children have access to a regular source of health care that can ensure the continuity and coordination of care embodied in the medical home concept. That health care provider should also be able to facilitate access to and to monitor the progress of other, more specialized care. Treatment through the EMS system for sudden illness or injury should not occur in isolation. As noted above, primary care providers should be an important consultation resource in emergency care for children. It is equally important for the EMS-C system to ensure that primary care providers are kept informed about the care that children have received, the outcome of that care, and any need for further outpatient care related to the emergency. Mechanisms for communicating with primary care providers should be an integral part of the EMS-C system so that contact is made at every stage of care, from the ED to intensive care to general inpatient care to rehabilitation.

Primary Care in the Emergency Department

EDs provide care for children whose conditions could, in fact, be successfully and appropriately treated in a primary care setting. Many of these children reach the ED because primary care services are not available at all. Other children who have a regular source of care use the ED when those primary care services are unavailable (or perceived as unavailable) because of factors such as long waits for appointments, limited office or clinic hours, and insufficient coverage during those off hours. This committee is not comfortable with the extent to which so many children must rely on hospital EDs for routine care, but addressing this critical issue of access to health care in-depth was beyond its charge. The committee does, however, return to some of these issues in Chapter 9, particularly as they relate to the future of EDs.

Managed Care Plans and Medicaid

A different form of communication with primary care providers is becoming more frequent with the growth of managed care health insurance plans: securing approval from an appropriate representative of the plan for

a child to be treated in the ED. Managed care plans generally require that patients pick a primary care physician who then serves as a gatekeeper to other forms of care, including ED care. Care received without prior authorization from this gatekeeper-physician or other designated representative may not be reimbursed. Under most plans, however, "unauthorized" ED care will be covered in the event of a serious emergency (as defined by the plan). (See also the discussion earlier in this chapter on HMO policies on use of 9-1-1.)

Managed care plans serve families with typical employer-based insurance and are covering increasing numbers of families participating in Medicaid or other publicly funded health care programs. Implementation of these public programs is intended to provide low-income families with better access to more comprehensive services, particularly primary care. The focus on primary care may, however, be unfamiliar to many of these families. The ED has traditionally been their most accessible source of unscheduled care, and some may continue to seek care there rather than from more appropriate primary care providers. When emergency care *is* needed, contact with the primary care provider may give the ED better access to information about the patient and facilitate arrangements for appropriate follow-up care.

Communication with a primary care provider or other plan representative is a major feature of managed care plans. For some participants, particularly in public assistance plans, this element may create problems in using services in intended ways. They may, for example, have difficulty contacting their primary care physician or using after-hours advice services if they lack reliable access to telephone service or cannot speak English well. One study found that the ED could reach by telephone only 21 percent of the families of a group of children whose publicly funded managed care plan had denied approval for ED care (Shaw et al., 1990). Also worrisome was evidence that only 60 percent of parents kept appointments that had been scheduled for their children when ED care was denied.

Because families such as these can be difficult to contact and may not obtain the care recommended for their children, a decision to deny approval for ED care must be based on reliable communication between the ED and the primary care provider. On both sides, the responsibility for these communications should rest with personnel qualified to assess the clinical significance of information about the child's condition. Some observers have expressed concern that denying approval for ED care during hours when clinics and other primary care sites are not open may increase the possibility that serious problems will be missed (Glotzer et al., 1991). Both EDs and managed care plans should ensure that their mutual communication responsibilities receive serious and sufficient attention and that they are alert to lapses that may occur.

Improving Follow-up Care

Most children treated in EDs do not require admission to the hospital, but many do need further care at home or from a primary care provider. Too often, however, ED recommendations for such care are not followed (Jones et al., 1988; Nelson et al., 1991). Several factors appear to contribute to this failure to comply with instructions. Jones and her colleagues (1988) found that patients who had no regular health care provider or who had difficulty arranging for temporary care of their children were significantly less likely to obtain recommended follow-up evaluations. For low-income families, the recommended treatment may prove too costly. Investigators in Boston found, for example, that the quantity of a commercial oral electrolyte solution needed to treat a seriously ill child would cost nearly 5 percent of a family's monthly grant from the city's Aid to Families with Dependent Children program (Meyers et al., 1991).

Patients and their families may also fail to remember or to understand the instructions given to them in the ED. A recent study found that, on leaving the ED, parents in the control group could recount accurately as little as 5 percent of the guidance they had received on "worrisome signs" that should prompt them to contact the ED again (Isaacman et al., 1992a). Language and cultural differences between patients and providers may make it notably difficult for ED physicians to communicate successfully with their patients. Interviews with Hispanic patients in one emergency room revealed that misunderstood instructions resulted not only in failure to seek recommended care but also in occasional adverse effects from mistaken care (Narita, 1991).

EDs and other parts of the EMS-C system need to explore ways to achieve better compliance with the care that they recommend. Compliance would be a chapter, if not a book, in itself, and communication skills of the health care provider are probably the most important factor. Nonetheless, the various parts of the EMS system can take positive steps.

For example, mechanisms for routine follow-up contact with patients can be instituted or expanded. Telephone calls within a week of an ED visit have helped to increase the proportion of patients who seek recommended care (Jones et al., 1988; Nelson et al., 1991). Standardized delivery of simplified instructions has been shown to improve parents' ability to recall correctly the information they were given on medications and on positive and negative signs in their child's recovery (Isaacman et al., 1992a). Formal programs have been developed by some pediatric EDs—for instance, Bronx Municipal Hospital Center in New York and Children's Hospital of Philadelphia—to follow-up on children about whom they are worried, such as those with abnormal laboratory results or those who failed to return for follow-up examinations. Such programs, successfully staffed by nurse practitioners

and physician assistants, can help foster compliance with treatment recommendations as well as identify possible deterioration in a child's condition before a crisis develops.

EDs and other emergency care providers that serve a culturally diverse population may need to offer services such as trained interpreters. Staff may need better training in cultural differences related to expectations and understandings regarding health care. One model effort is the cultural diversity training manual that the EMS-C demonstration program in Washington State developed for use in a course for ED staff (Washington EMS-C Project, 1991). It has received support from the state's hospital community and has generated interest in similar training for prehospital and primary care providers.

Rehabilitation Services

As improvements in EMS-C, including trauma centers and critical care facilities, lead to increased survival of more seriously injured children, the need for rehabilitation services increases. Children with spinal cord injuries and traumatic brain injuries account for a large portion of the patients needing rehabilitation; neurologic damage secondary to other injuries and illness adds to this population (IOM, 1991b). Burns may require substantial long-term rehabilitation and plastic surgery. Twenty percent of hospital admissions for burns involve children, most of whom are 2 to 4 years or 17 to 25 years of age (CDC, 1992b). Rehabilitation may benefit other injured children as well; fractures and other nonneurologic injuries can leave functional limitations for as long as six months after discharge from the hospital (Wesson et al., 1989).

The value of early and well-integrated rehabilitative care is supported by the success of the regional pediatric trauma program at Johns Hopkins University Hospital in Baltimore, Maryland; among the children more than 2 years of age, 88 percent have recovered without major motor or intellectual deficits (Haller and Beaver, 1989). Operational configurations for pediatric rehabilitation programs can differ; for instance, they can be based in a freestanding facility, a hospital-based freestanding program, or an integrated inpatient program. These differences can, in turn, lead to differences in the timing of rehabilitative interventions and in the mix of providers (acute care, primary care, outpatient specialists) who participate in managing a child's care (Quint, 1992).

Regardless of the specifics of a particular program, a child's acute care providers must take into account the need for longer-term rehabilitative care. Early planning for such care and coordination between acute care services and rehabilitation providers will help ensure that a child gets appropriate care. The District of Columbia EMS-C Project (1991) focused on

the residual effects of traumatic brain injury and developed tools to assess the rehabilitation needs of these children. This project also developed a guide that nurses and other case managers can use in arranging transfers of children to rehabilitation programs (Wright, 1990).

Physical rehabilitation may be the most obvious need. Nevertheless, children need access to other services to address the psychological and behavioral consequences of injury. Social services that can assist families in managing the additional demands placed on them are an important adjunct to care of the child (Quint, 1992).

In sum, the range of services that contribute to rehabilitation is quite broad. Unfortunately, these services are often poorly coordinated, making it difficult to determine what resources are available and to realize the most effective use of them. Again, this may be an arena in which a federal center and, especially, state agencies (see Chapter 8) can play a helpful role.

FEEDBACK

Very early in its discussions, the committee agreed that more and better feedback throughout EMS and EMS-C systems would promote optimal patient care and effective linkages between system components. Feedback takes many forms. Information on performance and patient outcomes should flow within the various components of these systems as well as between them. Communication needs to occur as an individual patient progresses through the system components; it also needs to take place in a more systematic and comprehensive manner to address the overall aspects of system performance in the care of all patients. Feedback should reach individual providers and the organizational entities in which they work, and the child's private physician should not be overlooked in the feedback loop. It should be informative and constructive; successes should be acknowledged as well as problems.

EMS-C systems should seek to develop a systemwide expectation for feedback. Within parts of the system, activities that can meet this need, such as hospital quality assurance or quality improvement programs, may already exist. Systems may, however, have to work at developing channels through which information can flow routinely from one part of the system to another—between EDs and EMS agencies or between referral centers and community hospitals, for example. It is important that these information flows be seen as an integral part of the operation of an EMS-C system, not simply as a professional courtesy or an opportunity to assign blame.

Feedback and systematic data collection are synergistic. For example, learning the frequency with which patients seek care for various conditions can help planners identify training or equipment needs; it can also help health care professionals target prevention activities more efficiently. In

turn, being able to collect good data may depend on feedback: when data produce information that is useful to the people who collect it, they have a greater incentive to ensure that those data are accurate and complete. Issues such as these are discussed more extensively in Chapter 7.

OTHER IMPORTANT FORMS OF COMMUNICATION

Important communication about EMS-C takes place separately from the process of delivering care to children. Planning for and managing EMS-C systems need to bring together providers, administrators, and government officials to ensure that important issues are recognized and competing needs balanced. The participants in EMS-C should also have a good working relationship with the community in which they provide services. Good communication within the EMS-C professional community deserves attention as well.

System Planning and Coordination

Providers with expertise in EMS-C should play an active role in the organization and operation of EMS systems. They also need to develop working relationships with other influential individuals and organizations whose primary focus is not EMS, such as hospital boards, regional planning groups, and local and state legislators. Only if EMS-C providers do so can they influence system policies and priorities, make people aware of EMS-C concerns, and thus ensure that adequate attention is given to the needs of children.

Vocal support for and involvement in the activities of the national and state EMS-C agencies proposed in Chapter 8 may help foster improved system planning and operations. Participation in advisory groups is another avenue at, say, the local or regional level; involvement in EMS councils will influence development of pediatric medical control guidelines, encourage pediatric equipment purchases, and generally raise the level of understanding about EMS-C issues. Closer to home, participation on hospital committees enables EMS-C advocates to assemble a "code team" that comprises the best specialists from key departments in the institution and can respond quickly to an intrafacility crisis. Providing pediatric EMS training programs is often a useful "foot in the door" insofar as it influences the development of pediatric protocols and enhances awareness of special needs of pediatric patients.

Communication with the Community

Public education efforts are one of the more important forms of communication between the EMS-C system and the community it serves. Such

programs should try to reach a broad audience so that they can educate the public about the need for an EMS system, use of the system, and implementation of the system, as well as develop support for EMS-C activities *per se*. These efforts vary widely: for example, pediatricians teach parents about steps to prevent injury; EMS agencies promote the appropriate use of 9-1-1; and local EMTs, paramedics, nurses, and physicians teach CPR courses. Specific topics that public education should address are discussed at length in Chapter 4. Here, the committee's point is that public education is a significant form of communication that should be an integral part of the activities of EMS and EMS-C systems.

An annual event such as National Emergency Medical Services Week, which has been held for several years and recognized by presidential proclamation since 1990, provides a valuable opportunity to focus broad community attention on EMS and EMS-C issues. With federal agencies and professional organizations as sponsors, this program has received recognition from state and local governments and has encouraged individual EMS agencies, fire departments, ambulance services, and hospitals to organize community activities. In addition to providing information about child safety to adults, many activities are designed for direct participation by children themselves (ACEP, no date).

Injury prevention work with the community should receive an especially high priority. The EMS-C system sees a broad range of injuries; it can identify those that occur most frequently and those that are especially serious. Providers can contribute their expertise and perspective to community efforts to reduce a variety of injury risks such as those related to automobiles, bicycles, residential hazards, and sports (Stevens, 1992). As was cited in Chapter 4, for example, Harlem Hospital in New York City studied data on its admissions of injured children to develop an injury prevention program that targeted the specific risks that children in that community face (Barlow, 1992). Their emphasis has been on improving pedestrian and bicycle safety, upgrading playground equipment, and reducing violence. An earlier program in New York City—Children Can't Fly—substantially reduced falls from windows by promoting the use of window guards and supporting the passage of legislation requiring their installation (Speigel and Lindaman, 1977).

One approach to linking prehospital providers with injury prevention is participation in programs such as the National SAFE KIDS Campaign, which has local, state, and national activities. A directory of violence and unintentional injury prevention projects funded by the Maternal and Child Health Bureau of the Health Resources and Services Administration, Department of Health and Human Services (DHHS), offers other models (NCEMCH, 1991). For example, a New York State Department of Health project aims to reduce morbidity and mortality from childhood home injuries (falls, scalds, burns,

and poisonings) by training EMTs in primary prevention and encouraging their participation in community efforts. Contact with the National Center for Injury Prevention and Control at the Centers for Disease Control and Prevention in DHHS will also be helpful.[8]

Professional Communication

Opportunities for valuable communication among providers exist through various professional activities. Practitioners who are already active in EMS-C can make use of conferences and publications for the EMS-C community to share information in areas such as clinical observations in caring for children, EMS system planning and operation, and results of research. Conferences and publications with a broader focus offer the opportunity to bring EMS-C issues to the attention of colleagues who are not familiar with them.

As the historical discussion in Chapter 3 emphasized, professional organizations such as the American Academy of Pediatrics, American College of Emergency Physicians, American College of Surgeons, Emergency Nurses Association, and National Association of Emergency Medical Technicians have been important channels for informing providers about EMS-C. Other organizations whose efforts in this area must not be overlooked include the Ambulatory Pediatric Association, American Association of Critical Care Nurses, American Academy of Orthopaedic Surgeons, American Trauma Society, Association of Air Medical Services, National Association of EMS Physicians, and Society of Pediatric Nurses. Local and regional chapters of national organizations or other groups formed around a common interest give providers a more immediate chance to become acquainted with each other, perhaps facilitating cooperation when future cases require access to outside resources. Public safety and related organizations (such as NENA or APCO, and groups such as the International Association of Fire Chiefs)—even though their concerns extend beyond emergency *medical* services—should also be seen as useful partners in communication about EMS and EMS-C to other groups, health care professionals, and the community at large.

One collaborative effort that has developed is the Children's EMS Alliance, which began in 1990 as the Year of the Child in EMS. It brings together professional organizations and hospitals to inform the professional community and the public about EMS-C issues (Luten, 1991). The program seeks to educate the membership of participating organizations and to enhance the operation of EMS systems by fostering cooperation among medical and administrative organizations.

The EMS-C demonstration grant program has placed particular emphasis on information exchange among grantees and with other audiences as

well. National conferences have brought grantees together periodically to share the results of their work. For a major conference in 1991, the grantees prepared a report, *Emergency Medical Services for Children: A Report to the Nation*, which presents their conclusions and recommendations regarding areas where further work is needed (Seidel and Henderson, 1991). One project (the National EMS-C Resource Alliance, or NERA) publishes *EMSC News* on a quarterly basis to bring information about EMS-C projects and innovations in pediatric emergency care to a broad audience. Another EMS-C effort (the EMS-C National Resource Center) provides information to grantees on legislative activities and possible funding sources.

Many EMS-C projects have distributed samples of training materials and other grant products to other grantees, and catalogs of the materials produced by the grantees have been published (Shaperman and Backer, 1991; NERA, 1993). For many of the projects, however, once EMS-C grant funding ends no other source of funds may be available to continue producing copies of these materials; some materials may remain available if they have been adopted by state or local government or another sponsor such as a medical school. Even when materials continue to be available, organizations may not be able to support the "marketing" necessary to make the EMS community aware of them or to undertake the appropriate updating as information increases and technologies change.

The committee believes that post-EMS-C-grant difficulties such as these—for instance, in producing materials and informing people of their availability—argue for ongoing federal support for an organization that can provide clearinghouse services; these might include collecting and evaluating products developed by the demonstration grants and by other groups. This work might be based within a federal agency such as the EMS-C center that the committee proposes in Chapter 8, or it might be performed by other organizations (public or private) under a federal contract or grant. (A variant on this idea is the creation of one or more "national resource centers"; for simplicity the term "clearinghouse" is retained here.) A clearinghouse might also help develop new materials that facilitate provider communication. For example, a prehospital resource guide produced by the AAP (1990b) and a recently published directory of injury prevention professionals (Children's Safety Network, 1992) might serve as models for other EMS-C publications.

As proposed in Chapter 8, a federal center as well as state agencies might support other types of consultation. For instance, the federal office directly or indirectly could make materials or advice available to various community organizations and professional associations that wish to establish EMS-C coalitions. Guidelines and consultation for public policy activity at the state level are also needed, so that the public can be mobilized to support needed changes in EMS-C through legislation and regulatory change. Finally, a clearinghouse or resource center activity might be helpful in generating

advice about long-term funding options, so that coordination of EMS-C activities does not falter upon the termination of the EMS-C demonstration projects.

SUMMARY

This chapter explores the critical role that communication plays in the successful operation of *systems* of emergency medical care. It devotes considerable attention to issues of public access to the EMS system, especially through promotion of 9-1-1 and E9-1-1 emergency response systems. The committee's firm belief in the advisability of universal adoption of 9-1-1 or E9-1-1 led to a formal recommendation that each state ensure implementation of such systems (see Box 6-1). Telephone access to poison control centers, especially those certified by the AAPCC, fills a need among the public and emergency care providers for specialized guidance for managing the care of children exposed to potentially toxic materials. Parents also seek telephone advice from hospital EDs; this service can provide benefits, but it also poses risks because no direct assessment of a child's condition can be made. The committee strongly advocates appropriate training, clear protocols, careful documentation, and routine monitoring in ED programs offering telephone advice.

Prehospital services employ a range of communications technologies (e.g., standard telephone links, radio systems, microwave networks, and satellite links). On-line medical control requires direct communication between designated medical personnel and prehospital providers. It is used for authorizing ALS procedures and advising on other aspects of prehospital patient management. EMS systems vary in the extent to which they use on-line medical control.

In the hospital setting, good communication is critical. Emergency care may require ED consultation with specialists in the hospital or in the community

BOX 6-1 RECOMMENDATION CONCERNING COMMUNICATIONS AND 9-1-1 SYSTEMS

The committee recommends that all states ensure that 9-1-1 systems are implemented. The 9-1-1 system must be universally accessible and effectively linked to the emergency medical services system. Communities with 9-1-1 systems in place should move toward enhanced 9-1-1 capabilities. Communities with no 9-1-1 system should move directly to an enhanced 9-1-1 system.

as well as a child's primary care provider. Consultation with regional or national experts at pediatric referral centers or poison control centers may be needed and is facilitated by mechanisms such as telephone hot lines and facsimile communication. When children must be transferred to referral centers, clear communication between hospitals and health care providers involved is essential to ensure that vital clinical and administrative information is exchanged. Here the committee believes that written transfer agreements between hospitals make an important contribution to speeding the transfer process by settling many procedural and administrative matters in advance. Development of centralized communication services also may ease transfer arrangements and help make efficient use of regional resources.

Communication plays an important role in ensuring that an ill or injured child obtains the full range of services, from prevention to acute care and on to rehabilitation, that comprise EMS-C. The committee thus argues that EMS-C systems must give special attention to follow-up in three areas: primary care, post-ED care, and rehabilitation.

More and better feedback is needed throughout EMS and EMS-C systems to promote optimal patient care and effective linkages between system components. Information regarding care for individual patients and regarding the overall pattern of care is needed. EMS systems may have to work at developing channels through which information on system performance and patient outcomes can flow routinely. Feedback needs to reach individual providers as well as managers and administrators and may require systematic data collection.

Important communication *about* EMS-C should occur independently of the delivery of care to children. Providers with pediatric expertise need to be active in the organization and operation of EMS systems, and public education should be an integral part of the activities of EMS and EMS-C systems. Public safety organizations, even though their concerns extend beyond EMS *per se,* should be viewed as useful partners in communication about EMS and EMS-C to other public agencies, health care professionals, and the community at large. The EMS-C demonstration grant program and the efforts of individual grantees have encouraged communication across the country. In the committee's view, the need to maintain and build on these activities argues for creation of a national EMS-C clearinghouse that can collect and evaluate EMS-C materials and serve as a focal point for information exchange.

NOTES

1. Some experts in the public safety community argue that 9-1-1 should be thought of as a "response" number rather than an "emergency" number, for at least two reasons. First, many people have difficulty distinguishing an emergency from a nonemergency (i.e., they make

erroneous distinctions about "real" emergencies); second, 9-1-1 is intended to provide access to potential dispatch of any type of public safety response unit (not just medical services). In certain situations, however, this can be problematic, as when the public uses 9-1-1 to access *any* city service and thereby clogs the telephone system with nonemergency calls. A single, communitywide seven-digit phone number, perhaps available 24 hours a day, should be established to handle the calls for nonemergency services.

2. One advantage of 9-1-1, apart from being easy to remember, is that it meets requirements for numbering plans and switching configurations of the telephone industry; 9-1-1 is unique, for instance, in that it has never been authorized as an area code or a service code (NENA, no date).

3. The potential dangers when HMOs do not properly advise members about 9-1-1 are illustrated by Kerr (1986). He reports on three adult HMO enrollees with severe cardiac symptoms who followed HMO procedures to call the triage physician and were directed to distant EDs; all patients endured considerable delay in reaching appropriate emergency and definitive care and suffered more serious sequelae than might otherwise have been the case. A later article (Kerr, 1989) gave the following examples of life-threatening events in the HMO context: heart attack, stroke, loss of consciousness, poisoning, uncontrolled bleeding, acute allergic reaction, shock, convulsions, and the like; non-life-threatening cases included rash, minor chest pain, high fever, vomiting, asthma, allergic reaction, and gas pains. Exactly where the main problems accounting for emergency situations for children would fit is not clear.

4. EMS communication systems are currently confronting limitations in the availability of radio frequency spectra. At present, eight med-channel pairings are allocated for regional EMS systems. Operating at frequencies in the 460 megahertz (MHz) range of the ultra-high frequency (UHF) spectrum, these channels are subject to significant "channel crowding" and "bleed over," especially in urban areas. Along the border with Mexico, some EMS radio systems encounter interference because allocation of frequencies is not covered by enforceable treaties with Mexico. Additional frequency spectra, dedicated to EMS use, must be authorized by the Federal Communications Commission (FCC); the FCC has recently released new 800 MHz and some 900 MHz spectra.

5. The EMS-C projects cited in this chapter are those of the federal demonstration grant program supported by the Maternal and Child Health Bureau, Health Resources and Services Administration, U.S. Department of Health and Human Services.

6. In addition to the medical considerations in patient transfers, hospitals must be aware of legal obligations. Federal legislation—the Consolidated Omnibus Budget Reconciliation Act of 1985 (P.L. 99-272) and the Omnibus Budget Reconciliation Act of 1989 (P.L. 101-239)—established regulations designed to ensure that patients receive appropriate assessment and stabilization before any transfer is made, to ensure that transfers are made in appropriate vehicles and to facilities that are able to provide necessary care, and to deter "dumping" of patients from one hospital to another on the basis of the patient's ability to pay.

7. Care for children with severe burns and the use of burn centers illustrate the critical need in EMS-C for attention to optimal sites for care and to long-term follow-up. Burn centers might, for example, have direct linkages with emergency departments and community hospitals, so that children in this situation would be triaged directly to them rather than to the hospital's intensive care unit. EMS-C systems should promote early planning for the extended follow-up care that many of these children will need for procedures such as plastic surgery. Ideally, this planning should look to a medical home or other source of primary care to assure continuing attention to the special health care needs of children with severe burns. (We thank one of our anonymous reviewers for elucidating this particular example.)

8. The National Center for Injury Control and Prevention was established at the Centers for Disease Control and Prevention in June 1992. Previously, injury prevention activities were the responsibility of the Division of Injury Control of the National Center for Environmental Health and Injury Control.

7

Knowing What Is Happening and What Is Needed: Planning, Evaluation, and Research

The goal of emergency medical services for children (EMS-C) is to achieve the best possible outcome for all acutely ill and injured children by rapidly and accurately assessing their medical needs and then providing access to the appropriate care. Those services have to be effective from both a medical and a cost perspective to ensure that the available resources can support the maximum amount of care. The three previous chapters have identified steps that the committee believes must be taken regarding education and training, organization and delivery of care, and communication to ensure that children across the country have access to optimal emergency care. Those steps are, however, only part of what needs to be done.

There is widespread agreement that more and better EMS-C data and data systems are needed. The information resources that are currently available are too limited, scattered, and unconnected to support the planning and evaluation that EMS-C needs. Without a broad and reliable base of information, it is hard for anyone—emergency care providers, administrators, parents, policymakers—to determine in any systematic way how successful EMS-C systems are in providing appropriate, timely care or what they ought to do to improve performance and patient outcomes.

This committee believes that not all children are getting the emergency care that they need, but that the full extent and nature of the problem is not known. Assembling descriptive data that will make it possible to answer basic questions about EMS-C systems, patients, and care and to provide accountability for EMS-C system functions must, therefore, be a high priority. In addition, research is needed to establish sound clinical and organizational

principles for the care that children are given and the ways it is provided. Since routine information gathering appropriate for planning and evaluation activities often is not sufficient to meet the needs of research activities, special data collection efforts are needed to add to the knowledge base for EMS-C.

This chapter addresses issues of the collection, analysis, and use of data for planning and evaluation. It discusses actions recommended by the committee to improve the quality and comprehensiveness of EMS-C data and gives special attention to creation of a national uniform data set for EMS-C. The chapter closes with recommendations for key elements of a broad research agenda in this field.

UNDERSTANDING THE INFORMATION GAP

Information gathering for planning and evaluation purposes ideally would be aimed at EMS-C *systems*, but the initial step is to compile data on the particular role that individual system components play in emergency care. When it is possible to take the next step of linking those data, a much more comprehensive picture of emergency care will emerge. The following questions reflect the committee's central concerns:

- *What is the structure of the system?* Data on the numbers and characteristics of the facilities, emergency care providers, and services available in the system establish the context in which a system provides emergency care.
- *Who uses the system?* Data on the demographic characteristics of the patient population such as age, sex, and residence (or location of emergency) are essential for understanding who needs care.[1]
- *For what is the system used?* Data on the illnesses and injuries that bring children into the emergency medical services (EMS) system and on their condition (e.g., level of consciousness) establish the epidemiology of pediatric emergencies.
- *What services or procedures are provided to a patient?* These data are the basis for describing the process of care in an EMS system.
- *When are services provided?* In the EMS context, time intervals in various stages of care can be significant elements of the process of care.
- *What are the outcomes of using the system?* Clinical outcomes based on functioning, patient well-being, morbidity, and mortality are of interest; so are process outcomes, such as hospital admission or referral to a tertiary care facility.
- *What are the global costs of the system?* Both the direct and indirect economic costs of operating EMS-C systems, as well as the monetary savings over time that may be realized by successful expansion of EMS-C and integration into EMS systems, are of interest.

With good descriptive data, planners, evaluators, and researchers can begin to answer the more significant question: *How well does the system perform?* Performance can be judged on the basis of outcomes or processes of care for individual cases and for populations. Clinical outcomes can be assessed across a broad spectrum (from basic physiologic and biologic measures through health-related quality of life), ideally with severity or acuity adjustments using appropriate tools such as those discussed in Appendix A at the end of this chapter. Various elements of the process of care such as appropriateness of triage, timeliness of treatment, or completeness of documentation can be evaluated. Compliance with structural guidelines, such as provider qualifications or equipment available, is another evaluation criterion that can be used. Cost-effectiveness must be a consideration as well. The assumption in evaluating system process and structure is that deficiencies in those areas are likely to have an adverse impact on the ultimate results of the care that children (or adults) receive. Even this assumption can be tested only when data exist.

The need for more and better data on the volume, nature, and outcomes of emergency care and the operation of emergency care services has been widely recognized for many years (NAS/NRC, 1970a, 1978a, 1980; MacKenzie, 1989; Eisenberg et al., 1990; Lescohier et al., 1990; IOM, 1991b; Seidel and Henderson, 1991; CDC, 1992b). Progress in improving data resources has been limited, however. As was noted in Chapter 2, much of what has been learned about EMS-C, including the work discussed in this report, is based on one-time studies or studies in a single institution or community, which raises problems of external validity and generalizability of the results. Nevertheless, conclusions and policies are based on these studies simply because more broadly based information on the structure and operation of EMS systems, and especially on outcomes of care, is not widely available.

Some individual hospitals, state and local EMS agencies, and emergency dispatch centers that are parts of EMS systems do have sophisticated data collection and analysis programs that generate valuable information. EMS systems, however, depend on successful coordination of services from many separate components; only rarely are these individual components able to link their data together to learn more about the complete course of a patient's emergency care. By contrast, trauma registries are able to compile detailed information on all phases of patient care but only for a small portion of the patient population cared for by EMS systems; they too may lack certain elements such as linkages with autopsy reports or rehabilitation facilities. Even comparisons among similar kinds of system components are difficult because little or no consensus exists on how important concepts are defined or on what data are needed to operationalize those concepts. Furthermore, data that might already be deemed appropriate are not routinely compiled or published.

Efforts to ensure the best possible outcomes for children are also hindered by limitations in the clinical and health services research base. In EMS, much research is still needed to understand the clinical merits of various current practices and to develop better ways to apply what is known. Much of the needed research demands specialized data, but some work might be done with better EMS and EMS-C data on system structure, operational processes, and patient outcomes.

Assessing the costs and cost-effectiveness of emergency care and EMS systems must be a priority in times of fiscal constraint, but accurate, comprehensive, and meaningful data are difficult to obtain. Billing information, for example, can be obtained from hospitals and insurers, but the charges assessed for services are not equivalent to the cost of providing that service. Furthermore, system costs extend far beyond the immediate care of individual patients to the overall operation of EMS agencies and hospitals. With services provided by widely varying combinations of public and private sector organizations, ways are needed to aggregate highly diverse forms of cost data.

Four aspects of this information gap can be singled out for special emphasis. First, to use a conceptual framework from the health care quality assurance field, information on "*structure, process, and outcomes*" for EMS-C systems is critical.[2] Second, ways to use information about EMS to highlight *prevention* needs and target related activities efficiently must be devised. Third, questions about *individual components of an EMS system* and about the *system as a whole* must be addressed. This in turn implies that information on individual patients must be available across settings and providers; thus, being able to link records is a significant requisite. Fourth, EMS-C data are needed at the *local, state, and national level*; the particular kinds of data needed at each level may vary, but in all cases, data collected for one level (e.g., national) should be useful at every level below that (e.g., states and localities). These points should be kept in mind in reviewing the strengths and weaknesses of current data systems discussed later in this chapter. To answer the questions and fill the information gaps posed above, three activities must receive attention.

PLANNING, EVALUATION, AND RESEARCH

This committee regarded *planning* and *evaluation* as lying at the heart of effective implementation: planning is required to determine how the health care system can best meet children's needs for emergency care, and evaluation is needed to assess how well that care is being delivered. It also regarded *research* as essential to validate the clinical merit of care that is given, to identify better kinds of care, to devise better ways to deliver that care, and to learn where best to direct prevention activities.

This chapter discusses the importance of planning and evaluation with a particular emphasis on matters related to data and data systems. The committee is not aiming to address here the details of specific data collection technologies. Rather, it is looking more broadly at the need to assemble a core of nationally comparable data on pediatric emergencies and emergency care and at special concerns about the content, reliability, and validity of information derived from data collection and analysis efforts; as a part of this topic, the committee advances ideas for a uniform national EMS-C data set. It then turns to research, outlining priority issues for a comprehensive research agenda. The underlying theme is that all three tasks—planning, evaluation, and research—require access to data, analytical resources to transform those data into meaningful information, and ways to use and disseminate the information to improve the care that children receive.

Planning

Planning is a crucial step and cannot be completely divorced from either research or evaluation. Planners need up-to-date descriptive information about the current state of affairs (together with a sound idea of where they want to be in the future) in a number of areas. Among these areas are epidemiology of injury and illness in the geographic area and population for which the EMS system is responsible; facilities, agencies, services, and related equipment and personnel; financial and other resources to support and maintain those providers and programs; and EMS training and retraining needs. Planners need information that will help them improve the use of available resources (hence the link to evaluation), often in fairly short time frames; taking a longer perspective, they must develop sound arguments to justify requests for increased resources.

Evaluation

Evaluation is concerned with understanding whether value has been received for the resources expended on an enterprise; more formally, evaluation determines "what outcomes—desired and undesired, anticipated and unanticipated—have occurred as a result of a policy or program" (IOM, 1990a, p. 91). This encompasses assessments of quality of care, efficacy and effectiveness, efficiency, and new program directions and practices.

EMS-C evaluation must address at least three concerns. First, it should seek to know whether the system is "doing things right": for example, whether the existing full range of services, from prehospital care through definitive inpatient and outpatient care through rehabilitation and counseling, as well as prevention, has been of high quality and whether certain practices or interventions could be improved. This essentially involves a

series of quality-of-care questions (IOM, 1990b): Have all appropriate and necessary services been provided, and inappropriate and unnecessary services *not* provided? Have the technical and interpersonal aspects of care been adequate? These questions can be addressed through assessments of both the process and the outcomes of care, and problems can be tackled through formal programs of quality assurance and improvement.[3]

A related question is whether the system is "doing the right things." This in turn calls for directly assessing the effectiveness (if not the efficacy) of services and interventions and using sound practice guidelines, protocols, and criteria to determine the appropriateness and necessity of care. It also may involve eliminating unnecessary processes and practices. Effectiveness must be assessed from a cost standpoint as well as from a clinical one.

Second, evaluation should be concerned with how efficiently services are being provided. Here questions might focus on whether various operations—dispatch, transport, patient transfer, communications and medical control, and so forth—are functioning optimally, without undue duplication or wasted effort and without significant gaps or lapses.

A third area of evaluation underscores the link to planning as well as to the quality and efficiency questions just posed. Specifically, evaluators need to address systematically a variety of questions about the effects of changing practice and doing new things. These matters often call for longitudinal analyses. The importance of cross-sectional analyses should not be lost, however, insofar as regional or facility comparisons need to be made and differences understood; serial cross-sectional data can show patterns over time.

Research

Planning and (especially) evaluation clearly overlap with research, but important distinctions should be noted. Perhaps the most obvious is that research is often intended to answer relatively specific, detailed, or basic questions that are separate from day-to-day system operations of a program or service. EMS-C research questions cover a wide spectrum: for instance, elucidating biologic factors that contribute to the success or failure of basic or advanced life support (BLS, ALS) interventions in children, developing improved injury and illness acuity measures for children, investigating the etiology and epidemiology of childhood trauma or illnesses that account for the major part of EMS calls, predicting the emergency care needs of children with chronic or disabling illnesses, assessing outcomes of emergency care over time, or investigating factors that make public education campaigns about safety and healthy lifestyles successful. Thus, compared with planning and evaluation for EMS and EMS-C system operations, research asks new and different questions and requires rigorous and specialized study

design, data collection, and analysis. Costs must not be overlooked; conducting studies that are clinically and statistically meaningful can be expensive.

For purposes of this chapter, the common thread through these activities is data and information. EMS-C data are now available from an assortment of sources, but each source provides only a particular type of data; coordination among sources is usually minimal. There is also no consistency across EMS systems in whether data on similar activities will be collected. The next sections briefly review selected sources and limitations of data-related to EMS-C and present several committee recommendations concerning coding, data collection, and a national uniform data set. The chapter then considers a research agenda for EMS-C.

UNDERSTANDING CURRENT AND EMERGING SOURCES OF DATA AND DATA SYSTEMS

Strengths and Weaknesses

In principle, data on emergency medical care for children and the systems through which it is provided are available from an assortment of sources. Those different data systems have different advantages and disadvantages, and in no case can one source provide the full range of information needed for the planning, evaluation, and research activities discussed earlier.

Prehospital Services

Various approaches are used in collecting information on prehospital services. Dispatch centers, which are the first point of contact for most prehospital care, generally maintain information on the nature and timing of the calls they receive and on the response to those calls. The use of enhanced 9-1-1 and computer-assisted dispatch systems provides dispatch services with increased data capture capabilities.

EMS agencies often have extensive data collection systems that capture information about the vehicles and the personnel that respond, patients and their conditions, treatments used, time intervals in stages of prehospital care, and where patients are taken for further care. Where they are reported, these data are a resource for assessing patient care and system operations. More than 40 states have developed ambulance reporting forms (although the information on them is not always forwarded to central or state offices); 29 states have some form of statewide data gathering system (chiefly but not exclusively on ambulance runs); a few states more or less systematically acquire regional or county data, do periodic surveys, or have statewide data collection programs under development or revision (*Emergency*

Medical Services, 1992). Thus, a substantial number of states have essentially no reporting requirements at all. Local or regional data collection systems often exist, with or without statewide data collection. Because there is no widely accepted "standard" EMS data set, it is difficult to integrate data from separate systems. Cutting across all these points are the questions, often hard to answer, as to whether data are retrievable, reliable, and valid.

Hospitals

Emergency Departments EDs are an especially important source of information about emergency medical care for children. They have the potential to produce the broadest array of data on emergency care because many patients receive no prehospital or inpatient services. In addition, learning more about ED care provided to children who are not seriously ill or injured is important, in part to understand better the demands on the EMS system and in part to clarify the barriers to access to primary care that form a crucial part of the health care reform debate in this country.

National data on ED services will become available for the first time through the National Hospital Ambulatory Medical Care Survey (NHAMCS), a new annual survey being conducted by the National Center for Health Statistics (NCHS) of the Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services (DHHS). Results for 1992 should be available in late 1993 (although the sample size is too small to provide estimates for individual states or local areas). Currently, systems such as the National Electronic Injury Surveillance System (NEISS) and the Drug Abuse Warning Network collect data only on specific kinds of ED visits. Without more comprehensive ED reporting, it is difficult to track an individual, chief complaint, or type of call through the system; to assess EMS system performance; or to make comparisons among EDs. (Even if complete ED data were available, those emergency cases in which patients were admitted immediately on arrival at the hospital would not be identified.)

The usefulness of ED records depends not only on their accessibility but also on the adequacy of the clinical information they contain. Compared to prehospital data systems, the content and management of ED records are rarely addressed in the emergency medicine literature. An unpublished study conducted for the Wisconsin EMS-C demonstration project (one of those supported by the Health Resources and Services Administration [HRSA] in DHHS) found that some hospital information systems that recorded injury cause and ambulance information for ED registration did not include the information in the electronic medical record (Karlson and Eisenberg, 1990). The investigators also determined that hospital billing records for

ED patients may not include information routinely reported for inpatients (e.g., discharge status) because that information is not required by third-party payers. The patient's hospital record usually includes the missing information, but no systematic use is made of it. The investigators quote one hospital source to the effect that discharge status "would be 'easy to capture if there were some use for it'" (Karlson and Eisenberg, 1990, p. 10).

Inpatient Services Full inpatient records capture (in principle) more of the essential clinical information. The current state of paper-based medical records is quite lamentable, but greater use of computer-based record systems (IOM, 1991a) will make much of that information more accessible. Apart from information in the hospital records of individual patients, useful information may be retrieved through various databases created from sample surveys and discharge abstract reporting systems. The National Hospital Discharge Survey (NHDS) of the NCHS, for example, collects information from a sample of acute care hospitals across the country on patient characteristics, diagnosis, treatment, and disposition at discharge. As was noted regarding the NHAMCS, the NHDS is not designed to provide state or local estimates. Thirty states, however, maintain their own discharge data sets; billing data are the basis of discharge reporting for 23 of these 30 states (CDC, 1992a).

Discharge data are especially useful in studying injury because the diagnostic categories describing the nature of an injury (e.g., head injury, burn, fracture) are readily identifiable. Six states also require that discharge reports with injury diagnoses include separate external cause-of-injury codes (so-called E-codes from the ICD-9-CM [International Classification of Diseases, ninth revision, clinical modification]), such as for falls, motor vehicle crashes, and assaults (CDC, 1992a). Adding E-codes to discharge data enables researchers, policymakers, and others to use the data in planning and assessing injury prevention efforts. Provisions for reporting E-codes are also being made in the newly revised standard hospital billing form—the "UB-92," which should be available for use in 1993 (CDC, 1992a). Discharge data tend to be more useful in studies of injury than in studies of illness because reliable methods have not been developed to identify, through ICD-9-CM diagnostic codes or other means, children hospitalized for *emergency* treatment of illness.

For all patients, however, mortality reflected in discharge data is limited to deaths occurring in the hospital. Children who are declared dead outside the hospital and are not transported to the hospital will not be included in discharge statistics and analyses—a fact that could seriously distort conclusions and policy actions taken on the basis of such findings. One study, for instance, determined that 24 percent of pediatric injury deaths in an urban area were not seen in hospitals (Cooper et al., 1992). Such

deaths must be identified by other means if the aim is to estimate overall mortality from injury or illness severe enough to require emergency care. Analysts also must be cautious about using discharge data to estimate the incidence of injury or illness requiring hospitalization, lest children who are transferred after admission or who are readmitted for follow-up care be counted more than once.

Efforts by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) to incorporate ongoing monitoring of hospital performance into its approach to accreditation is likely to lead to new, targeted data collection in order to report specific performance indicators (JCAHO, 1987, 1988; Jurkiewicz, 1988; O'Leary, 1991). Trauma care is one of the areas for which indicators are now being tested. For example, an indicator of the appropriateness of airway management of comatose trauma patients is the proportion of such patients who are discharged from the ED before a mechanical airway is established (JCAHO, 1991). A set of data elements needed to determine performance on the indicators has been identified. How efficiently and effectively data amassed through this mechanism might be used in EMS and EMS-C planning, evaluation, or research on a broad scale remains to be seen.

Trauma Registries

Many hospitals maintain trauma registries that capture detailed information on the care and outcomes of patients admitted with traumatic injuries. Where trauma systems have been established, a registry may cover all the hospitals participating in the system. A few statewide registries also exist. Unlike many other emergency care data systems, trauma registries typically include data on prehospital *and* hospital care.

The CDC advises inclusion of core data elements in seven categories (Pollock and McClain, 1989): demographic and identifying data; incident description; prehospital care; ED care; surgical care; anatomic diagnosis; and outcome data. Software packages are now available that permit hospitals to manage their registries on personal computers.[4]

Two long-term efforts have been made to collect data on an even broader basis to help evaluate trauma care. The Major Trauma Outcome Study (MTOS) uses data from 139 hospitals to establish broad characteristics of trauma and to develop national norms for severity-adjusted survival (Champion et al., 1990b). By 1987, it had demographic, etiologic, severity, and outcome information on more than 80,000 patients of all ages; of these, just over 10 percent were pediatric patients. MTOS data have been used to calculate severity indexes and outcome norms (e.g., for probability of survival) for adults and for children and to analyze topics such as causes of injury, death rates, and lengths of hospital stays.

The National Pediatric Trauma Registry (NPTR) has focused specifically on the trauma experience of children (Tepas et al., 1989). A multi-institutional shared database designed to compile and evaluate information on all aspects of pediatric trauma care, it began in 1985. By mid-1992 it had collected information on more than 36,000 children from 61 participating centers. These data are available to any participating investigator (with certain provisos concerning publication). For example, studies on use of helicopter transport, incidence of discharge disabilities and impairments, and referral patterns for trauma centers have all been conducted using this database, and pediatric-specific trauma score norms have been generated.

As valuable as trauma registries are in studying the nature and quality of trauma care, they capture data on only a limited portion of the children who suffer serious injury. As with discharge data, information on children who die outside the hospital is not incorporated into these files. Those children with traumatic injuries who are cared for in hospitals that do not maintain a trauma registry or contribute to a trauma system registry are also missed as are children treated only in the ED. The absence of these cases from the data set makes comparing outcomes of care in a trauma system with outcomes in other hospitals impossible. Similarly, investigators cannot determine from the registry whether the children who were treated outside the trauma system were appropriately triaged.

Findings from work based on the data in the two trauma registries mentioned above have not resolved a key issue in this field—namely, whether pediatric-specific injury or severity scales are necessary or whether measures for adults (perhaps reweighted or recalibrated in certain ways) will suffice. The discussion in Appendix 7A also touches on this controversy, and the material below about data validity reflects a similar debate about severity-of-illness measures.

Generally, the committee believes that continued support for national or comprehensive regional databases of these sorts might facilitate progress in these areas, for instance by fostering the development and validation of objective outcome assessment measures (for death, disability, and quality-of-life domains) or the implementation of prospective clinical trials (e.g., on different methods for initial resuscitative care). Expansion and refinement of demographic and epidemiologic data sets also may help provide ongoing statistical support for development and evaluation of regionalized systems of pediatric trauma care. Ideally, given the comparative lack of information on childhood illness, such databases might even be expanded to include pediatric medical emergencies.

Health Insurance Claims and Administrative Data Sets

Claims data are increasingly used in research on variations in the use of

health care and on the effectiveness and outcomes of medical interventions (Lohr, 1990). Insurance claims data on children come from two main sources:[5] Medicaid and the private sector health insurance industry. In principle, insurance claims files constitute a large pool of data on inpatient and outpatient services and have several attractive features (e.g., the theoretical possibility of tracking the care for an individual "episode" through time and across settings). In practice, claims data are often difficult to obtain, lack complete or reliable information, or suffer from other drawbacks that make them a relatively poor source of anything but the most rudimentary information in the EMS context. Furthermore, Medicaid data may not be representative of the same populations from state to state, because of the variation in eligible and enrolled populations across states and over time. Finally, managed care plans are not likely to maintain insurance-claim-like records, so data on such patients would not be available through these types of data sets.

Nevertheless, as claims data become better and more complete (e.g., by virtue of linking payment to accurate coding of diagnoses and procedures) and as population-based files containing both inpatient and outpatient data are developed (e.g., as is being done for the Medicare program for the elderly), use of claims data becomes more appealing and feasible. In particular, the ability to track follow-up care after hospital treatment for an emergency would provide valuable insights into postdischarge mortality, residual morbidity, and similar outcomes of interest to researchers and policymakers.

Death Records

Although hospital records can be used to identify a large proportion of the deaths from serious illness or injury, they will not include deaths that occur before any emergency care can be initiated in a hospital setting. They are also poorly suited to large retrospective studies of national or statewide mortality. Hospital records also will not necessarily include the official cause of death for patients who died while still inpatients.

Other sources such as vital statistics systems or coroners' reports may be more useful for some purposes (e.g., simple epidemiologic studies, drawing samples for studies that will rely on other data sources). Mandatory E-coding in vital statistics records for injury-related deaths may make them a valuable resource for assessing the contribution of injury to mortality and for injury prevention studies (although it should be recognized that "traumatic injury" is no longer acceptable as a cause of death). Nevertheless, death certificates have considerable drawbacks—limited amount of data, inaccuracy and incompleteness of data that are supposed to be recorded, lack of standardization in assigning cause of death (the most critical data), and lack of information on EMS systems use. These limitations make them

a poor stand-alone source of data; vital statistics records must be regarded as only one component of a comprehensive data system.

Other Data Sets

More specialized data on pediatric emergencies, particularly injury, can also be found in various other data systems. A few of these are described here, although less is known about their strengths and weaknesses for EMS-C planning, evaluation, or research purposes than about the data sources discussed above. A more extensive list of national, state, and local data sources on injury has been assembled by the National Committee for Injury Prevention and Control (1989).

Poison Control Centers These centers (which are also discussed in Chapter 6) are a source of information on the nature, circumstances, and outcome of a large volume of cases of ingestion and other forms of exposure to potential toxins. The National Data Collection System of the American Association of Poison Control Centers is based on voluntary reporting by centers across the country (Litovitz et al., 1992). These data capture many cases of suspected and actual poisoning that can be successfully managed by the caller without other medical assistance; such cases would, of course, not appear in any prehospital or hospital data.

NEISS Operated by the Consumer Product Safety Commission of the U.S. Department of Commerce, NEISS collects data from a sample of EDs on injuries and deaths related to consumer products (CPSC, 1986). Estimates of injuries are produced for each calendar year on about 820 products, which cover an immense range of consumer goods (e.g., bicycles and other sports equipment or activity; beds, chairs, and other items of furniture; nails and screws; knives and other kitchen utensils; electronic appliances of all sorts; cleaners and caustics; prescription drugs; and fireworks). Automobiles and guns are not included, although gasoline and toy guns are. These data, which are reported for standard age groups (0-4, 5-14, 15-24, 25-64, and 65 and older), are especially valuable for identifying new injury risks (NRC/IOM, 1985).

Motor Vehicle Crashes The National Highway Traffic Safety Administration (NHTSA) of the U.S. Department of Transportation (DOT) maintains two data systems with reports on motor vehicle crashes. The Fatal Accident Reporting System assembles data from states on police reports of fatal motor vehicle crashes. The National Accident Sampling System, also based on police reports, captures information on nonfatal motor vehicle collisions, including those involving pedestrians and bicycles (National Committee for Injury Prevention and Control, 1989). The detail that these data systems

provide about the circumstances of crashes is useful in identifying injury risks such as those associated with driver or passenger behavior and vehicle or roadway condition or design. These data sets are good models of the kinds of information that might be obtained when such files are linked at the national level.

Uniform Crime Report The Federal Bureau of Investigation maintains information on violent crime, notably homicides, in its Uniform Crime Report (UCR); the data are collected from police reports nationwide. Reports on annual rates of crime and weapons involved are published through the UCR. These data are potentially useful in monitoring patterns of weapon availability and use and for helping to target prevention programs. Information on victims and violent crime are, obviously, more complete than data on perpetrators.

EMS-C Demonstration Projects Many of the EMS-C demonstration projects assembled databases for special studies on pediatric emergency care, and some have sought to establish ongoing data collection systems. The Arkansas project, for example, put in place at Arkansas Children's Hospital a program to collect data on admissions to pediatric intensive care units and critical care transports. A more extensive program was scaled back because of funding constraints. The New York program established an upstate regional registry for all seriously ill or injured children seen in the region's EDs. The project in Utah is working with nine other states in the intermountain region in an effort to establish a regional EMS-C database. Software has been developed to facilitate reporting by prehospital provider agencies and hospital EDs. The state of Maine has computerized its prehospital run sheets, and it has also established electronic linkages with computerized police accident report data and hospital discharge summaries, allowing officials to monitor data from the scene of injury through hospital discharge.

Special Concerns

Although the various data sources described above can provide information by which to study pediatric emergency care, they all have important shortcomings beyond the source-specific ones just noted. These problems tend to cut across information management goals; some critical areas identified by one EMS-C project, for instance, included the following: (1) defining clinical and epidemiologic data needed to identify problems to be addressed by EMS-C subsystems; (2) examining options for accurate information management methods; (3) determining who should collect data and the interface between the different entities that collect data; and (4) promoting use of data for evaluating and improving the effectiveness of EMS-C programs (California EMS Authority, 1992).

Issues of particular concern to this committee are introduced below; the literature on problems with health data sources generically is too vast to review here.[6] In the short-term, these constraints must be understood and, insofar as possible, accommodated, or they will seriously limit what can be learned. In the longer run, the committee believes that its proposals and recommendations in this and other chapters will help the EMS community to address and overcome some of these problems in a more permanent way.

Lack of Uniformity and Consensus About Data Elements

A fundamental difficulty with data on EMS and EMS-C today is lack of agreement about what data elements are important and about how (even agreed-upon) data elements ought to be defined. These conceptual problems also make it difficult to address technical issues, such as defining appropriate standards by which such information could be collected, stored, or transmitted electronically, that arise with the increasing use of computer-based information systems. Recognition of the need for standard data elements and definitions is not new, but only limited progress has been made in developing a common framework.

In the prehospital setting, for example, efforts to develop a nationally recognized prehospital data set date back to guidelines for a 20-item minimum data set published in 1974 by the Health Services Administration of the Department of Health, Education and Welfare (now DHHS) (Steele, 1974). More recent proposals have attempted to identify a core of widely used data elements (Joyce and Brown, 1991) or have focused on specific emergency conditions (e.g., cardiac arrest) (Eisenberg et al., 1990). Guidelines for a complete EMS management information system (MIS) are being formulated through the American Society for Testing and Materials (ASTM, especially Committee F-30) (Robinson, 1992; Ryan, 1992).

Planning is also under way by NHTSA for a national consensus development conference on EMS data elements (as part of an EMS-MIS), which is expected to be convened by fall 1993 (NHTSA, 1991a; Ryan, 1992). The ASTM guidelines may serve as a starting point for conference discussions. Organizations with a pediatric perspective are being included in these conference activities.

Other efforts to establish uniform definitions and data elements are also related to EMS-C data needs. In particular, a 1989 conference convened by the National Institute of Child Health and Human Development (NICHD, 1992) identified significant data elements in child injury research and formulated definitions. The conference report also addressed measurement and data collection procedures. Broad-based data collection programs such as the MTOS (Champion et al., 1990b) and the NPTR (Tepas et al., 1989) also encourage wider development of more uniform data.

The committee believes that efforts such as these are not adequate by themselves to ensure that critical conceptual and information needs in EMS-C will be met. Rather, a national uniform data set for EMS-C must be developed. The committee has taken preliminary steps to establish a data set by identifying some of the data elements that it sees as essential (see below and Appendix 7B). Certain of the elements proposed should help address some of the other significant limitations to existing data and data sources discussed below, especially linking and aggregating data over patients, settings, and time.

Linking and Aggregating Data

Linking Information on Individuals for Episodes of Care Being able to link information on patients, settings, and providers within and across systems is vital to a meaningful data collection and analysis effort, and hence to planning, evaluation, and research. An especially troubling problem for EMS is the difficulty of linking data collected by separate system components. Requirements on the part of JCAHO or others for hospitals to incorporate prehospital reports into patient records could facilitate links in one direction, especially if prehospital data can be incorporated into computerized record systems. (One effort along these lines is being mounted in Santa Cruz, California, where ED personnel will enter information into a computer-based clinical data system on patients who arrive via prehospital transport. This task, however, is not the same as linking existing data sets.)

Prehospital providers have an especially hard time gaining access to hospital data on patients whom they have treated (Joyce and Brown, 1991). Hospitals themselves may have no routine way to learn about subsequent care in outpatient settings or other facilities such as tertiary care hospitals or rehabilitation programs. Without information about the care that patients receive in other parts of the EMS system and the outcomes of that care, planners and evaluators will find it hard to determine what care is contributing to good or bad outcomes.

Various obstacles block the linking of system data. For example, major technical difficulties can arise in trying to match records across data systems. In some ways, linking insurance claims data may be the easiest task technically, because patient identifiers will, in theory, be available. Linking medical record information across prehospital, hospital, and ambulatory settings to span primary care, acute care, and rehabilitation is likely to prove much more difficult. Common patient identifiers beyond name may not exist, and available identifiers may be protected by privacy and confidentiality regulations. Linking information from, for example, police reports on motor vehicle crashes or autopsy reports is more problematic yet. The

cooperation of providers, facilities, and office-based physicians (among others) is critical.

The committee discussed the need for unique individual identifiers and strongly endorsed the concept that individuals should be assigned such an identifier at birth or as close after birth as possible. One prominent option is the social security number. It has been raised in proposals for revisions to the Uniform Hospital Discharge Data Set (UHDDS) (NCVHS, 1992b) and in recommendations of the Workgroup on Electronic Data Interchange established by the Secretary of DHHS (WEDI, 1992). Modifications necessary to establish truly universal and unique identifiers based on social security numbers appear more feasible than creation of any new system. Use of social security numbers remains a perennially knotty problem with many political, legislative, technical, and cost ramifications; psychological and attitudinal factors, such as people's views about privacy and confidentiality of sensitive medical, financial, and other data, also are considerations. The committee reached no conclusion on the specific merits of using social security numbers as the universal patient identifier, but it does believe that this is one logical option that should be explored and that, in any case, some identifier is essential.

Aggregating Data Across Systems Without a common framework for defining, collecting, or reporting EMS-C data, assembling data across different systems and comparing their experiences are very difficult tasks. Furthermore, the higher the level of aggregation (e.g., across counties, states, DHHS regions, or the nation), the worse the problem will be. As reiterated in Chapter 8, some attention to this issue should be high on the agendas of the proposed federal center and state EMS-C agencies. Moreover, the desirability of aggregating information across systems justifies, in part, the use of certain variables in the core data set proposed later in this chapter, and it also highlights the need for additional resources for this complex activity.

Diagnostic Coding for Mechanism of Injury

Information on the mechanism of injury is valuable in assessing probable type of injury. In fact, mechanism-of-injury criteria are often part of prehospital triage guidelines. Information on the factors that precipitate injuries is even more valuable in identifying specific risk factors, setting targets for injury prevention programs, monitoring the effectiveness of prevention efforts, and assessing the cost of care for specific kinds of injuries. The ICD-9-CM E-codes (external cause-of-injury codes, which are equivalent conceptually to mechanism of injury) are a convenient way of including mechanism of injury in reporting on diagnosis or cause of death—that is, in contrast to many of the problems identified in this section, this one

has a ready solution. For these reasons, **the committee recommends that states and other relevant bodies adopt requirements that ICD-9-CM E-codes be reported for all injury diagnoses for hospital and emergency department discharges.**

As noted earlier in this chapter, only six states currently require that hospital discharge data include E-codes for injury diagnoses (CDC, 1992a). A study using discharge data from Maryland found that without mandatory reporting the completeness of E-coding varied over time, by patient age, among hospitals, and by nature and severity of injury (Marganitt et al., 1990). Limited space on record abstracts or billing forms (e.g., the UB-82) for reporting diagnoses can leave no room to report an E-code. Even if space is available on the forms, providers have little incentive to report E-codes if they are not required, in part because the codes do not affect reimbursement (Sniezek et al., 1989). The federal government, through the Health Care Financing Administration, could, however, create a strong incentive by requiring E-codes for Medicare or Medicaid reimbursement for hospitalizations or ED visits.

Other factors that appear to deter E-code reporting are concerns over the cost of the additional coding responsibilities, inadequate guidelines for using E-codes, and insufficient information in the medical record to determine an appropriate code (Sniezek et al., 1989). Studies suggest, however, that costs are minimal. Coding of discharge data was estimated to impose an average of $600 in one-time implementation costs and $600 per year in operating costs (Rivara et al., 1990). One hospital ED is successfully using a checklist completed by the triage nurse to record E-code information in the patient's record (Ribbeck et al., 1992). The upcoming addition of an E-code field in the revised standard hospital billing form (the UB-92) and the recommendation that E-coding be included in the UHDDS (CDC, 1992a) should spur more extensive use of E-codes.

The committee's recommendation for use of E-codes in hospital discharge data joins that of other prominent groups such as the American Public Health Association (APHA, 1992), the CDC (1992b), the National Committee on Vital and Health Statistics (NCVHS, 1992a), and numerous state health departments, academic research centers, and nonprofit groups. In the committee's view, efforts to incorporate E-codes in patient records must extend to the hospital ED as well as to inpatient care.

Validity of Data and Performance Indicators

The problem of how valid information is for answering questions of access, costs, and quality is always paramount in health care assessment.[7] In the committee's view, special attention must be given to matters relating to diagnosis and patient acuity (e.g., severity of injury or illness). Patient

outcomes also must occupy a special place in planning and evaluation, as well as research.

Diagnosis Having reliable and comprehensive data readily available lies at the heart of validity of analyses. In the health arena, accurate and complete information on diagnosis and treatment is critical for assessment of mortality and morbidity. There are, however, continuing questions about those aspects of diagnosis and diagnostic coding. These problems are being addressed by many in the health sector who are engaged in survey work and research, and the EMS community will want to track developments accordingly.

A review by Iezzoni (1990) identifies several concerns about diagnosis that apply to all uses of data. At the heart of many difficulties is the inconsistent nature of the coding categories offered by the ICD-9-CM; they include clinical diagnoses, pathological processes, symptoms, physical findings, test findings, severity indicators, and potential quality indicators (Iezzoni, 1990). Because the specific clinical basis for determining the "correct" codes is not always clear, coding for similar conditions may vary among providers, institutions, or regions. This inconsistency undermines the face value of diagnostic data in comparative studies. Errors in coding or changes in coding practices (e.g., "unbundling" to maximize reimbursement) can further confound the meaning of diagnostic data and attenuate the reliability and validity of data collected.

Coding guidelines that, in the absence of a definitive diagnosis, call for using conditions identified as questionable (e.g., hospital admission to "rule out" a diagnosis) contribute another element of confusion. This may pose a special problem for EDs when physicians must make judgments quickly and on the basis of relatively little information. Clearer criteria for assignment of diagnoses and better training for physicians and coders might reduce some of the problems.

The availability of ICD-9-CM diagnosis codes for the nature of illness or injury (so-called N-codes) and the external cause of injury (E-codes) makes injury diagnoses a valuable tool for retrospectively identifying children who received emergency care and for identifying injury risks. (The value of E-codes for injury prevention was discussed above.) Retrospective identification of inpatients who received emergency care for illness-related conditions is much more problematic, and the obstacles to doing so deserve more attention than they have received to date. Evidence of admission through the ED might be helpful, but it is not always available in discharge data sets; moreover, not all patients requiring emergency care come to the hospital through the ED, so they might be missed altogether. In sum, this committee takes a strong position that better ways need to be developed to identify patients with serious illnesses who received emergency care.

Acuity Objective indicators of acuity of illness and injury are needed to guide clinical decisionmaking and to assess quality and effectiveness of care, but their successful development has proved to be difficult, especially for pediatric patients. Even when certain acuity or severity measures appear to be reliable and valid for use in adults, the question of scoring them for pediatric cases remains. Appendix 7A briefly explores issues relating to measures of acuity and severity of trauma and illness.

Several problems can be singled out. Observation at time of care is unreliable—for instance, it is inconsistent across bystanders, caregivers, or other involved parties—and this is especially true when the patient is a child. Appearance can be a poor indicator of the state of pathophysiologic derangement, and children's vital signs may be misleading. A mix of anatomic, physiologic, neurologic, and psychological factors may need to be assessed. The need to know about time since onset of the problem is often crucial, but it is easier to determine for trauma-related than for illness-related emergencies. Furthermore, the issue can be muddied when the "emergency" is actually the result of insidious deterioration of a chronic illness that suddenly reaches a crisis stage or when baseline status is not normal for age and sex.

In actual emergencies, acuity measures are especially important for decisionmaking about triage, transport, and transfer. Yet time may be of the essence, meaning that some physiologic measures may not be feasible to take and use on the spot. Thus, more research is needed on a reliable, valid, fast, and parsimonious set of measures that will accurately reflect severity of injury or illness as the emergency, and the EMS response to it, is actually unfolding. In broader planning and evaluation efforts, acuity measures are particularly important for comparative assessments of quality of care, because valid analyses require controlling for differences in the distribution of cases by severity. As reflected in the discussion in Appendix 7A, however, questions remain about how well existing measures perform in this capacity.

The difficulties in developing scoring systems for pediatric illness in particular have led to a suggestion to establish a medical registry, along the lines of the trauma registries discussed above, which would make it possible to accumulate the large volumes of data needed to support development of a broadly valid assessment measure (Buchert and Yeh, 1992). A different kind of response has emerged from observations of the inability of adult scoring systems to predict outcome accurately: Civetta (1991), citing seminal work by Feinstein (1967), argues that a better path may lie in closer observation of, and reflection on, the clinical characteristics of illness rather than in attempts to develop new, or yet more complex, scoring systems based on yet more sophisticated laboratory tests and physiologic parameters.

Patient Outcomes

Ultimately, the question of highest priority in planning and evaluation of EMS-C must center on patient outcomes. Asserting that, however, does not clarify several key points:

What Outcomes to Measure Outcomes of interest will differ markedly according to several factors, such as characteristics of patients and their emergencies, kinds of services rendered, and settings in which the interventions were provided. In some cases, alive or dead is the outcome of concern. Mortality is the most readily available and widely used outcome indicator in analyses of emergency care, but relatively few of the children needing or receiving emergency care die. (On frequency grounds, death is actually not an especially good indicator of outcome for many conditions or health care interventions across the entire age range.) Other kinds of outcome indicators are needed to assess residual morbidity from emergencies and the impact of differences in care.

That is, in most other cases, a wide range of health status outcomes is pertinent:[8] presence or absence of disease, of various types of impairments, of functional limitations, and of "disabilities" that interfere with age-appropriate activities (such as those for activities of daily living [ADLs] or, less likely for children, instrumental ADLs).[9] Of special interest may be the core domains of health status measurement—physical mobility and functioning, social and role functioning, and emotional and mental well-being—although measuring these reliably in children is an extremely difficult challenge.

EMS-C outcomes assessment can also be based on comparisons between "expected" and actual outcomes. Information on initial severity and acuity of patients' conditions can be used to estimate probabilities of particular outcomes. Death is frequently used as the outcome of interest, but other conditions such as permanent impairment or other forms of morbidity might also be used. Discrepancies between expected and actual outcomes may point to systems that are doing very well or very poorly.[10]

When to Measure Outcomes Leaving aside the complex challenge of obtaining a "baseline" measure of health status, analysts still face the difficult decision of when (and how many times) to assess outcomes. Is the appropriate time to evaluate outcomes of prehospital care upon arrival at the ED or at some later point? For children suffering significant trauma requiring intensive inpatient and outpatient care and rehabilitation, when in the sequence of events should outcomes be assessed? Studies of rehabilitation for traumatic brain injury, for example, have found improvements from treatment as long as three-years after the injury (Haffey and Lewis, 1989). Even the (comparatively easier) question of when to measure hospital deaths

(e.g., inpatient deaths only, inpatient deaths plus deaths occurring up to 30 days after discharge, or deaths occurring in or out of the hospital up to 30 days after admission) has been the subject of considerable debate (in this case for evaluations of hospitalization for Medicare patients, as discussed in, for example, Jencks et al., 1988; Kahn et al., 1988; Chassin et al., 1989; Ente and Lloyd, 1989). How much more complicated, then, is the task of deciding when and how often to assess the broad set of health status measures that arguably will tell much more about the end results of emergency care. The ideal would be to measure outcomes at various points in an episode of care in order to judge the variability in care provided, but the costs and practical considerations of taking that approach are extremely high and complex.

How to Measure Outcomes Two key issues relate to assessment techniques. One pertains to the assessor, that is, health care professional, parent, or child. Clearly, for infants and younger children as well as for profoundly impaired individuals, outcomes must be reported by adults. For most older children, adolescents, and teenagers, outcomes can be reported by the patients themselves, and in certain circumstances or for certain measures, this may be more desirable and more valid than relying solely on reports by either providers or parents. The other issue pertains to the measure and whether it and its scoring rules are appropriate for children (or for children of different age groups and developmental levels).

Privacy and Confidentiality

Equally complex and perhaps more contentious are issues of privacy and confidentiality and the related potential for legal liability or serious harm to individuals in the case of breaches of those legal or ethical rights. As noted in the discussion above on linking data, statutory or administrative constraints can restrict access to demographic and other identifiers needed to link data on individual patients, chiefly out of concern for privacy and confidentiality of sensitive medical information on specific, and potentially identifiable, patients and for the possible harm that might come from inadvertent disclosure of such information.[11] This committee encourages efforts to develop and implement data collection programs and policies that will protect patient privacy and confidentiality while making it possible to conduct needed studies for system evaluation.

In another vein, facilities and agencies collecting routine information may be reluctant to share data with institutional, physician, or other provider identifiers intact; they may fear potential malpractice liability or public disclosure of unflattering information about performance and patient outcomes. Here, too, an understanding of the need for evaluation and consumer

information must temper anxieties about release of valid and useful provider-specific information. Many states have legislation that protects the confidentiality of *quality assurance* information for at least some types of institutions and providers (particularly hospital medical staffs); California, for example, protects committees appointed by agencies of local governments to "monitor, evaluate and report on the necessity, quality and level of specialty health services, including, but not limited to, trauma care services" (State of California, Evidence Code, § 1157.7). Typically, however, no such protection is afforded to other entities such as fire departments or ambulance companies responsible for emergency care that engage in quality assurance activities on their own.

IMPROVING INFORMATION RESOURCES

The preceding discussion has shown that developing better and more extensive data collection and analysis programs must be a high priority for EMS-C systems across the country. If common elements can be established in the data of separate systems, then planners and evaluators can assess EMS-C needs not only from a local perspective but also at the national level. A common core of basic descriptive data needs to be adopted.

National Uniform Data Elements for EMS-C

Exactly what data need to be collected to develop a basic understanding of EMS-C systems? Although each individual system has unique characteristics, the committee concluded that a core of nationally accepted uniform data elements that encompass all phases of emergency care must be defined. The arguments are several: to see that essential EMS-C data are identified, to foster development of a body of nationally comparable data, to provide the EMS-C community with good data and analyses, and to convey to policymakers the national importance of EMS-C issues.

Thus, **the committee recommends that states implement a program to collect, analyze, and report data on emergency medical services; those data should include all the elements of a national uniform data set and describe the nature of emergency medical services provided to children. Further, the committee recommends that mechanisms be developed to link all data on a specific case, where those data are generated by separate parts of the emergency medical services system.**

The remainder of this section discusses key aspects of such a national uniform data set. For purposes of this report, "national" means that the core applies to data collected in both the public sector (by or for federal, state, or community governments) and the private sector (by or for all relevant providers in the EMS system). "Uniform" conveys the notion of commonly agreed-upon data elements and definitions for those elements. Ultimately,

that uniformity might also extend to standards for electronic acquisition, transmission, and storage of data. Moreover, a wide range of sources must be involved, extending beyond traditional EMS and health care providers even to first responders (such as police officers) and coroners or medical examiners.

The committee has started the process of defining a data set by proposing core data elements for prehospital and ED care. A comprehensive data set must go beyond this beginning to include data from the many other settings in which emergency-related services are provided. Even for prehospital and ED care, the proposed data elements constitute only a starting point, because neither the committee nor other experts can say with certainty what the utility of these data items may turn out to be in practice. Furthermore, a considerable amount of testing of inter-rater reliability and validity remains to be done. Nevertheless, the committee believed strongly that efforts must begin to define and develop such a core data set, if the field of EMS-C is to realize the advances envisioned for it throughout this report.

Criteria for Inclusion in a National Uniform Data Set

The committee identified seven criteria that should guide the selection of data elements for a national uniform data set for EMS. First, data elements should be included if and only if they serve a specific, identifiable purpose. Second, the data should be useful *and* used; a core data set must be relevant at all levels at which it is collected. Third, data should be obtained routinely from all providers and settings in an EMS system, where an EMS system is defined broadly to span prehospital, ED, inpatient, intensive care, and rehabilitation services. Fourth, the information should be sufficiently easy to collect that a high degree of reliability can be expected for data from different sources regardless of level of training. Fifth, the cost of data collection should not be excessive. Sixth, because of the importance of linkage, some way of tracking individuals through an entire episode of care must exist. Seventh, the data elements themselves should be "nonjudgmental"; using them in system evaluation is a separate step.

Priority Data Elements

Appendix 7B outlines the data elements on prehospital and ED care that this committee has determined should have highest priority for inclusion in a national uniform data set for EMS-C. The rationale for including each item is given. Appendix 7B also lists and comments on other data elements that the committee considered but chose not to include in its priority list. The committee classified some of these as desirable but not currently appropriate for inclusion owing to factors such as limited current use. Other

items were rejected because of difficulties in obtaining accurate information or in using them at the national level.

The committee's decision to focus its attention on specific data elements for prehospital and ED settings (see Table 7-1) should not be taken to mean that data are not needed from the many other components of emergency care systems (such as dispatch operations, critical care transport, pediatric intensive care, or rehabilitation). Rather, it reflects the committee's judgment that the prehospital and ED sectors, where the largest numbers of children receive emergency care, are the appropriate starting point for developing what should become a comprehensive EMS-C data set.[12] The committee lacked the time and the expertise to specify data elements for all of the other aspects of emergency care; that work must be part of subsequent efforts by the EMS-C community.

An Information Core, Not an Information Constraint

These proposed "core" data elements must be seen as only one facet of a much broader program of data collection for EMS-C across the country. The committee emphasizes that it is *not* proposing that EMS-C data collection efforts be limited to only those data elements especially valuable for national assessment. Interest at the national level in EMS-C data should spur states and localities and even individual health care providers to assess what data they need to support the planning, evaluation, research, or prevention activities that ought to be a part of their EMS-C programs. At these levels, in contrast with national-level analysis, it becomes possible to make meaningful use of a much broader range of data captured in greater detail to assess and guide improvements in local performance or to identify specific circumstances that may require special study. In short, the committee's proposed data elements should be thought of as a beginning and not an end—a core and not a constraint.

The committee focused most of its attention on the patient-based data generated by individual episodes of care. Those clinical data, along with other data on costs, are critical in answering a great many of the questions about the efficiency and effectiveness of emergency medical care for children. To answer other questions, however, additional "structural" data must be available: for example, on qualifications of individual providers, resources of specific hospitals, and numbers of ground or air ambulances available in a region. Data of these sorts can usually be maintained with only periodic (perhaps annual) surveys.

Further Work

The committee cannot emphasize enough how essential a strong data collection and analysis program is for understanding and improving EMS-C

TABLE 7-1 Priority Data Elements for a National Uniform Data Set for Emergency Medical Services for Children: Prehospital Services and Emergency Departments

Prehospital Services
Date of birth (or age)
Gender
Date and time of: call for assistance (or EMS dispatch), arrival on scene, departure from scene, and ED arrival
Prehospital assessment (nature of patient's condition)
Spontaneous breathing (Yes/No), on arrival at scene and at hospital
Spontaneous pulse (Yes/No), on arrival at scene and at hospital
Level of consciousness on arrival at scene (assessed as Alert, Response to Voice, Response to Pain, or Unresponsive)
Disposition: Left at scene or transported
Transported to: Hospital identification number, possibly hospital zip code
Zip code for site of EMS encounter
Prehospital provider identification number
Prehospital run report number
Type of responder (e.g., ALS, BLS)
Emergency Departments
Date of birth
Gender
Race/ethnicity
Mode of transport (e.g., self, EMS, interfacility, air, ground)
Date and time of arrival at ED
Date and time of discharge from ED
Disposition (e.g., dead on arrival, died in ED, discharged home, admitted, transferred)
Diagnostic codes (multiple ICD-9-CM N-codes)
Procedure codes (multiple CPT-4 codes)
External cause-of-injury codes (multiple ICD-9-CM E-codes, including site of injury)
Glasgow Coma Scale (separate scores on each component—eye opening, verbal response, and best motor response)
Vital signs (initial readings for pulse, respiratory rate, systolic blood pressure, and temperature)
Insurance/payer codes (e.g., self-pay, Medicaid, public assistance, CHAMPUS, private insurance)
Prehospital provider identification number
Prehospital run report number
Hospital identification number
Hospital zip code
Home zip code (or country if not a U.S. resident)

NOTE: ICD-9-CM, International Classification of Diseases, ninth edition, clinical modification includes the widely used N- (or nosology) codes and a separate, more specialized set of E- (or external cause-of-injury) codes; CPT-4, Current Procedural Terminology, fourth edition; CHAMPUS, Civilian Health and Medical Program of the Uniformed Services.

and seeing best how to integrate EMS-C into existing EMS programs. The proposed data elements reflect the judgment of the committee as to the kinds of data that are needed to develop a national view of the nature and operation of emergency medical services for children, but the committee also recognizes that they are just a first step. To make progress in this arena, the committee believes that federal action will be needed. To that end, therefore, **the committee recommends that the federal center responsible for emergency medical services for children (proposed in Chapter 8) develop guidelines for a national uniform data set on emergency medical services for children.**

Much additional work must be done on many fronts to achieve the committee's goal. For example, researchers, health care providers, and administrators must help develop the kinds of common definitions and reporting guidelines that are essential for aggregating data from separate sources and for making meaningful comparisons among separate systems. Efforts such as those described above on maintaining national trauma registries, generating standard variables and definitions for childhood injury research (NICHD, 1992), and developing consensus on EMS data elements (NHTSA, 1991a) need to be encouraged and coordinated to achieve as much consistency as possible.

Organizations responsible for collecting data must determine which technologies and methods are best suited to their needs and resources. Among the choices that can be considered are abstracting data from written records, completing machine-readable forms, or entering data directly into a computer-based data system. Centralized data processing (e.g., at the state level) may be appropriate for some systems, whereas others may prefer to delegate the task to local areas.

As discussed earlier in this chapter, linking data may require that separate data systems adopt common identifiers for patients or resolve technical questions about combining data created in differing formats. Administrative or statutory regulations that restrict access to personal records to preserve confidentiality may pose even more complicated problems.

Data collection must not be treated as an end in itself. Agencies, institutions, and systems must commit specific resources to analyzing and reporting data as well as collecting them. When their analytical capabilities are limited, they should seek technical assistance and additional training, perhaps through programs of the federal center and state agencies proposed in the next chapter. Furthermore, reporting plans must ensure that information flows back to those individuals and organizations whose activities are the source of the raw data. In addition to conveying useful information derived from those data, this feedback helps establish the value of specific data elements and promotes continuing interaction between those who generate the data and those who use them.

When data are available, using them for evaluation and quality assurance purposes requires defining the standards against which performance will be judged. Where quality assurance programs do not yet exist, for individual organizations or larger systems of emergency care, they should be established. Research also benefits from the availability of routinely reported data even though specialized data collection is often necessary as well. Standard data can sometimes yield valuable findings on their own, and they can often guide researchers to questions that require more detailed study.

Federal and State Guidance

Successfully establishing the state and national programs for data collection and analysis that the committee believes are needed will require the sustained cooperation and coordination of many parties. Few public or private groups, perhaps none, currently have the influence or the resources to serve as convener and moderator for the work that is needed. The committee is proposing, therefore, that a federal center and state agencies on EMS-C assume responsibility for determining how such activities should be organized and supported. The role that the committee envisions for these entities is discussed more extensively in Chapter 8.

Lessons and Remaining Challenges

Several lessons and ideas for the future emerge from the experiences to date in collecting and analyzing EMS data. One is the need for continuing attention to training personnel in data collection and analysis skills. Onetime training exercises or educational courses are not sufficient because of factors such as staff turnover, lack of understanding of the uses to which data will be put, changes in the system itself, or changes in requirements by external groups (e.g., regulatory agencies or professional accreditation bodies) that mandate new ways to record or report data. Furthermore, in all settings the direct impact of data collection efforts on care delivery and patient-provider interaction must be minimized, or all parties are likely to become frustrated or anxious (or both) about the health encounter itself.

Computerization raises a different set of challenges. Among the obstacles to greater use of computer-based data collection are general antipathy to direct data entry on the part of physicians and other health care professionals; the sheer enormity of the number of persons on whom data might be collected (especially for EDs that are very busy and handle a large number of true emergencies and for prehospital services in large metropolitan areas); the time needed to enter interpretation of events into computer language; the need for better software; and costs.[13]

For various reasons relating to costs, practicality, or community attitudes, EMS systems may remain reluctant to engage in broad data collection or analysis efforts. Costs, in particular, must be a concern in developing data sets and data collection programs. These efforts must be accepted as a high priority in EMS systems but will be difficult to sustain if their costs appear to compromise adequate funding for delivery of services. Incentives introduced at the national, state, or local level might help to overcome some of these obstacles.

The most obvious incentives are financial. They might take various forms: providing equipment and software, or training, free of charge; giving cash grants up front to acquire equipment and software, to underwrite the costs of training courses, or to pay outside contractors; and reimbursing for data collection and analysis activities (e.g., salary support for data collectors). Payer reimbursement practices also may play a role; better and more complete data may have sufficient utility to third-party payers that they would be willing to underwrite some of the costs of getting them. Less direct incentives might be found in contingencies for funding approvals that require EMS systems to maintain some minimum level of effort and to report data periodically to a central office.

Compliance with data collection requirements can also be established as a performance criterion for individual providers, facilities, or even EMS systems. Other incentives might relate to liability protections that sound documentation can provide. Finally, the satisfactions of participating in research projects may be an incentive for EMS personnel to increase their participation in data collection and analysis efforts.

IMPLEMENTING A RESEARCH AGENDA

Answering many of the questions posed at the outset of this chapter, as well as in earlier chapters, will require focused, well-conducted research programs. Although the data set described above might be used for research, that is not its primary application. Thus, all parties interested in advancing EMS-C will need to put forth a manageable research agenda, recognizing that it will entail, among other things, some investment in primary data collection beyond what has been proposed in this chapter.

Proposals for a "national institute of emergency medicine" (Mickel, 1990), which could support research related to EMS-C and EMS more generally, were not considered by the committee. Instead, the focus was on a proposed federal center for EMS-C (see Chapter 8) that would be charged with supporting an appropriate research agenda. Nevertheless, some of the subjects on which a national institute might conduct or support research are directly relevant to EMS-C. Cases in point (see Mickel, 1990) include basic research in physiologic dysfunction, physiologic reserves, and resuscitation;

toxicologic research, especially with respect to illicit drugs; medical, surgical, and psychological problems associated with disasters; improved triage criteria; effective management and coordination of EMS in urban and rural environments, with a view to understanding interrelationships across local, state, and national levels; and assessment of resources (personnel, equipment, and financing) needed to provide adequate emergency care in such settings.

MacKenzie (1991) has also offered a set of key topics for EMS-C research. Although oriented more toward trauma care, her questions are quite pertinent for EMS-C more generally: (1) Are the right patients getting to the right level of care—from time of initial injury or illness requiring emergency interventions through post-acute care services? (2) Are objective criteria available for classifying where patients should have been treated? (3) Can data across components of EMS systems (e.g., prehospital run reports, hospital discharge abstracts) be acquired through computerized methods, and can such data be linked? (4) Are ways available to set standards of performance for EMS-C systems and to change and improve performance according to those standards? (5) Do reliable and valid measures of outcomes—physical, mental, psychological, and functional—exist for children? (6) Do ways exist to take external factors, such as the physical, social, and economic environment, into account in assessing outcomes of care? (7) Can the costs and benefits of EMS-C be documented? She emphasizes three key elements needed to build a scientific base for EMS-C: population-based data, longitudinal research focused on outcomes other than survival, and well-designed projects to document "what works best and at what cost."

High-Priority Topics

Space does not permit a detailed presentation of a comprehensive research agenda in pediatric EMS (let alone EMS generally). Eight generic questions posed at the outset of this chapter identify issues of special concern: (1) What is the structure of the EMS-C system? (2) Who uses the system? (3) For what is the system used? (4) What services or procedures are provided to a patient? (5) When are services provided? (6) What are the outcomes of using the system? (7) What are the global costs of the system? (8) How well does the system perform? Because each of these topics could generate a long list of research projects, particularly important issues must be identified. Therefore, **the committee recommends that research in emergency medical services for children be expanded and that priority attention be given to seven areas: clinical aspects of emergencies and emergency care; indices of severity of injury and, especially, severity of illness; patient outcomes and outcome measures; costs;**

system organization, configuration, and operation; effective approaches to education and training, including retraining and skill retention; and prevention. These points are outlined below, together with some examples of specific studies and investigations that might usefully be carried out.

In the committee's view, support for EMS-C research should be available through a research grant program under the auspices of the proposed federal center for EMS-C. In the short run, the current EMS-C demonstration grant program might use its "targeted issues" grants to address some of these research topics. Furthermore, the committee believes that this research agenda is appropriate for consideration and attention by an appreciable number of other Public Health Service agencies (certainly some institutes of the National Institutes of Health, the Agency for Health Care Policy and Research, the Indian Health Service, and HRSA), other parts of DHHS (such as the Administration on Children and Families), and other executive-branch departments (particularly DOT). Moreover, many different private sector foundations with interests in children, emergency care, the organization, financing, and delivery of health care services, and the production of health care personnel might well see different parts of this research agenda as quite pertinent to their long-term research plans. Therefore, the topics proposed here are meant for a wide array of supporters of research and demonstrations, not just one (comparatively small) federal office.

It would be desirable if the data elements in the proposed core data set discussed above could be used in research efforts. The committee recognizes, however, that primary data collection will likely be needed to address many of the issues presented below and that broader secondary analyses of existing databases may prove helpful. The primary aims of the minimum national data set lie more in the areas of program planning and evaluation than in research, and the committee cautions against expanding or tailoring the proposed data set to meet more comprehensive research needs.

The seven areas briefly discussed below (and outlined in Table 7-2) are those the committee regarded as especially significant for early and rigorous attention, but *no* ranking among them is implied. (Similarly, no priorities are implied by the order in which particular topics are discussed within each of the seven sections.) Clinical issues are discussed first because, for many physicians, nurses, and EMS personnel, the challenges presented by the child in front of them will be those with the most immediacy. Research issues involving severity measures and risk adjusters, outcomes measures, and costs are, in some sense, all precursors to being able to mount comprehensive, credible investigations of system configuration and operation, so they are discussed in that order. Research into more effective approaches to education and training, and to prevention of illness and injury, will require long-term efforts and arguably will cut across many of the preceding issues, so they are addressed last in this section.

TABLE 7-2 Summary of High-Priority Topics for a Research Agenda in Emergency Medical Services for Children

Clinical Aspects of Emergencies and Emergency Care
Posttraumatic shock, septic shock, hemodynamic instability, and hypotension
Pediatric resuscitation
Appropriate uses of and techniques for intubation, bag-valve-mask ventilation, vascular access and intraosseous infusion, and pneumatic antishock garments in children
Physiologic responses of injured or sick children to certain interventions and when parents are present or absent
Operative versus nonoperative management of blunt hepatic, splenic, and pancreatic injuries
Management of injured children using blood products and synthetic blood products
Evaluation of minor head trauma including indications for CT scans, observation, and admission
Treatment of acute asthma attacks, including initial assessment and management and determining whether inpatient or outpatient follow-up care is needed
Psychosocial support for families of injured or sick children
Appropriate techniques for prehospital management of ill or injured children, including decisions about on-scene stabilization or immediate transport
Severity and Acuity Measures for Injury and Illness
Development and validation of injury and illness scoring scales for children, with special attention to applications in the field (for triage) and for research purposes
Ways of discriminating between life-threatening and non-life-threatening illness and injury
Survivability by level of severity of injury or illness
Scales for severity of abdominal and chest trauma injuries
Methodologies to triage patients more accurately in the field and in EDs, with particular attention to young children with possible serious illness
Patient Outcomes and Outcome Measures
Development and validation of practical functional and other outcome measures
Disability assessment and scoring systems for children
Innovative approaches to longitudinal follow-up
Costs
Determination of true direct and indirect costs associated with EMS-C for all major types and settings of emergency care
Assessment of the marginal (i.e., incremental) costs of improving EMS systems sufficiently to be able to handle the pediatric age group adequately
Economic consequences of pediatric trauma or severe illness to families and to taxpayers
Evaluation of the cost-effectiveness of different EMS-C program configurations, with particular attention to a broad set of program benefits (i.e., outcomes)
System Organization, Configuration, and Operation
Effective and practical ways to upgrade EMS system components
Effectiveness, efficiency, and other outcomes of various EMS/EMS-C arrangements for different populations and settings
Extent to which children who need emergency medical services receive them, with particular attention to care received (or not received) in hospital EDs

System Organization, Configuration, and Operation—continued
Population-based estimates of need for ED and PICU beds for assessment of emergency care resources appropriate for local and regional areas
Pediatric emergency care in special circumstances and locales
Effective ways to measure and improve the quality of EMS care, for different types of EMS providers, systems, and settings
Education and Training
Effective ways to provide professional education and training and retraining to maximize skill acquisition and retention and to improve practice patterns and patient outcomes
Public education in prevention, basic emergency care skills, use of the EMS system, and similar topics, with attention to level of resulting behavior change
Prevention
Effective strategies for injury prevention, including comparative effectiveness of laws, regulations, and educational programs
Outcomes, costs, and cost-effectiveness of prevention programs

NOTE: CT, computed tomography; ED, emergency department; EMS, emergency medical services; EMS-C, emergency medical services for children; PICU, pediatric intensive care unit.

Clinical Aspects of Emergencies and Emergency Care

Posttraumatic shock, septic shock, and hemodynamic instability, including the definition, identification, and treatment of pediatric hypotension, pose special problems for clinicians; even the adequacy of commonly used measures, such as capillary refill, blood pressure, and respiratory rate, is not well established. Pediatric resuscitation (e.g., adequate airway management, appropriate fluid volume, correct measures for monitoring central nervous system metabolic function, and stress response) also occupy a central place in management of severely injured or sick children. Appropriate uses of and techniques for intubation, bag-valve-mask ventilation, vascular access and intraosseous infusion, and pneumatic antishock garments in children must be established. Questions relating to the physiologic responses of injured or sick children often arise, including use of conscious sedation and traditional pain management and differences in responses when parents are present or not present for interventions.

For injured children, the merits of operative versus nonoperative management of blunt hepatic, splenic, and pancreatic injuries and use of blood products and synthetic blood products remain significant concerns. Critical elements for evaluating minor head trauma need to be established, including indications for CT (computed tomography) scans, observation, and admission. Several aspects of the treatment of acute asthma attacks require further investigation, including initial assessment and management, predictors

of successful outpatient treatment, the role of observation units, and optimal strategies for preventing repeat emergency visits. Psychosocial support for families of injured or sick children is a special, but not well understood, aspect of EMS-C. Finally, the appropriate field management of ill and injured children (i.e., by prehospital personnel) must be determined, especially establishing the biologic and physiologic aspects of on-scene stabilization versus immediate transport.

Severity and Acuity Measures for Injury and Illness

As highlighted in Appendix 7A, research to develop and validate injury and illness scoring scales for children, with special attention to applications in the field (for triage) and in research, is greatly needed. Among the topics deserving particular attention are ways of discriminating between life-threatening and non-life-threatening illness and injury, survivability by level of severity of injury or illness, and scales for severity of abdominal and chest injuries. In keeping with the clinical aspects of field management, methodologies to triage patients more accurately in the field and in EDs, with particular attention to young children with possible serious illness, will be especially important areas of investigation.

Patient Outcomes and Outcome Measures

In keeping with the comments about severity and acuity measures, development and validation of patient outcome measures is a critical need. Special attention must be given to functional outcomes and to practical measures that can be used for system evaluation and for later research (e.g., in the area of system organization and operation). Disability assessment and scoring systems for children should be given particular notice as well. Finally, better approaches to longitudinal follow-up need to be developed.

Costs

Throughout this chapter (and the report) concerns about costs and cost-effectiveness of EMS-C have been raised. These include, in particular, determination of the true direct and indirect costs associated with EMS-C for all major types and settings of emergency care; assessment of the marginal (i.e., incremental) costs of improving EMS systems sufficiently to be able to handle the pediatric age group adequately; investigation of the economic consequences of pediatric trauma or severe illness for families and for taxpayers; and, finally, evaluation of the cost-effectiveness of different EMS-C program configurations, with particular attention to a broad set of program benefits (i.e., patient *and* system outcomes).

System Organization, Configuration, and Operation

Assuming attention to researchable questions in the areas already noted, some research funding also should be directed to determining effective and practical ways to upgrade EMS system components, including data linkages and communication technologies. This would include investigations into the effectiveness, efficiency, and other outcomes of various EMS or EMS-C arrangements for different populations and settings (e.g., poor/nonpoor, minorities, those with chronic illness or disability, urban/suburban/rural geographic areas). Determining the extent to which children who need emergency care receive it, particularly in hospital EDs, will be critical. Related to this is developing population-based estimates of the need for ED and PICU beds that can be used to assess the emergency care resources appropriate for local and regional areas. Some efforts to study pediatric emergency care in special circumstances (e.g., on Indian reservations or U.S. military bases, or children in homeless families or those with fragmented support systems) are also warranted. Finally, effective ways to measure and improve the quality of EMS care available from different types of EMS providers, systems, and settings must be developed and tested.

Education and Training

In keeping with the distinctions raised in Chapter 4, the committee identified research needs relating to professional education and training as well as public education. As to the former, effective ways, in all settings and at all levels, to educate and train EMS professionals initially and throughout careers, were regarded as especially important. Particular attention to improved practice patterns, patient outcomes, and skill acquisition and retention is warranted. With regard to public education, the committee underscored the need for studies in effective ways to educate the public in prevention, basic emergency care skills, use of the EMS system, and similar topics, with attention to level of resulting behavioral change.

Prevention

In the eyes of many experts, sustained efforts at prevention have the potential to be the most effective EMS "intervention," but much research is still needed in this area. Effective strategies are needed for injury prevention (e.g., ways to promote use of bicycle helmets, car safety seats, or devices to prevent scalding; techniques to prevent drowning). The comparative effectiveness of laws, regulations, and educational programs in injury prevention should be assessed. Research on the outcomes, costs, and cost-effectiveness of prevention programs is also needed. Because children often can do little to control risks to which they are exposed, improving the

effectiveness of prevention will require a substantial focus on adults. The CDC's National Center for Injury Prevention and Control is an important resource in these efforts.

Other Areas for Research

Apart from the seven high-priority areas just discussed, committee members identified three other areas warranting targeted research efforts. Some of these pertain to epidemiology and biostatistics, and others to applied research in certain segments of the spectrum of care in EMS-C.

Epidemiology The epidemiology of emergency illness and injury should receive further attention, including the overlap of illness and injury. Specific concerns regarding illness include incidence and natural history of specific conditions. Research is also needed on use of services, particularly among chronically ill, immunosuppressed, and technology-dependent children. Concerns regarding injury include the risk of injury in general and by socioeconomic status. A more specific concern is patterns of musculoskeletal injury from motor vehicle crashes and the biomechanics of injury in restrained and unrestrained children. Attention also should be given to characteristics of firearm injuries. Finally, a better understanding of the epidemiology of transport is needed, including types of children transported according to sociodemographic characteristics, diagnoses, reasons for transport, and dispositions.

Prehospital Care Studies should be done to identify the types of skills and procedures most often needed in prehospital care. Whether care rendered by BLS and ALS responders leads to different outcomes should also be examined.

Rehabilitation EMS-C research on rehabilitation should determine the types of follow-up or rehabilitation services needed by children with significant complications or consequences of serious illness or injury that initially required emergency interventions. Also needed are studies to develop successful methods of returning severely ill or injured children to school. The research plan developed for the National Center for Medical Rehabilitation Research offers many useful examples in areas such as mobility; behavioral adaptation; whole-body system responses; assistive devices and technologies; approaches to measurement, assessment, and epidemiology; treatment effectiveness; and education and training (NCMRR, no date).

SUMMARY

Currently, inadequate EMS-C data and data systems make it difficult to conduct the planning, evaluation, and research that are needed to determine

whether children are getting the emergency care they need, when and where they need it. Most of this chapter addresses data collection issues concerning planning and evaluation at the institutional, system, local, state, and national levels. It also highlights special data needs for research and examines specific areas where research is needed.

All of these tasks require access to data, analytical resources to transform those data into meaningful information, and ways to use and disseminate the information to improve the care that children receive and to target prevention efforts. Four central points guided the committee's thinking about EMS-C data needs: (1) information is needed on structural aspects of care, processes of care, and outcomes of care; (2) individual components of an EMS system as well as the system as a whole must be examined; (3) EMS-C data are needed for analyses at the local, state, and national level; and (4) routine information gathering is needed for planning and evaluation purposes supplemented by additional primary, targeted data collection and analysis for research.

The committee addressed several concerns regarding data and data collection. Lack of uniformity and consensus about data elements must be overcome. The ability to link and aggregate data, in particular to link information from separate EMS-C system components on individual patients and to aggregate data across systems, is essential. Use of ICD-9-CM diagnostic codes identifying external causes of injury (E-codes) in ED and hospital discharge records must be expanded. Valid data and performance indicators, particularly for diagnosis and measures of acuity or severity of illness and injury, need to be developed. Information on patient outcomes is needed, but three technical matters must be addressed: what outcomes to measure, when to assess them, and how. The strength of the committee's positions on linking data and on use of E-codes is reflected in formal recommendations (see Box 7-1).

Developing better and more extensive data collection and analysis programs, with a common core of basic descriptive data, must be a high priority for EMS-C systems across the country. To promote progress in this area, the committee recommends that states implement a program to collect, analyze, and report EMS-C data that are consistent with a national EMS-C data set. It also recommends that the federal office assigned responsibility for EMS-C (discussed more fully in Chapter 8) develop guidelines for a national uniform data set. As a first step toward this data set, the committee proposes data elements for prehospital and ED care.

Research is needed to validate the clinical merit of emergency care procedures, to identify better kinds of care, to devise better ways to deliver that care, and to understand the costs and benefits of the EMS and EMS-C systems now in place and toward which the nation should move. The committee recommends that priority be given to seven areas—clinical aspects

of care; indices of severity of injury and of illness; patient outcomes and outcome measures; costs; system organization, configuration, and operation; education and training (including skill retention); and prevention. Other areas warranting targeted research efforts include the epidemiology of illness and injury, skills needed in prehospital care, and rehabilitation services. As with the earlier data-related recommendations, the committee believes that the proposed federal EMS-C center must take a strong leadership position in supporting a comprehensive research agenda for EMS-C.

BOX 7-1 RECOMMENDATIONS CONCERNING INFORMATION SYSTEMS FOR PLANNING AND EVALUATION AND CONCERNING AN EMS-C RESEARCH AGENDA

The committee recommends that:

- states and other relevant bodies adopt requirements that ICD-9-CM Ecodes be reported for all injury diagnoses for hospital and emergency department discharges.
- states implement a program to collect, analyze, and report data on emergency medical services; those data should include all the elements of the national uniform data set and describe the nature of emergency medical services provided to children.
- mechanisms be developed to link all data on a specific case, where those data are generated by separate parts of the emergency medical services system.
- the federal center responsible for emergency medical services for children (proposed in Chapter 8) develop guidelines for a national uniform data set on emergency medical services for children.
- research in emergency medical services for children be expanded and that priority attention be given to seven areas: clinical aspects of emergencies and emergency care; indices of severity of injury and, especially, severity of illness; patient outcomes and outcome measures; costs; system organization, configuration, and operation; effective approaches to education and training, including retraining and skill retention; and prevention.

NOTES

1. For a complete picture of EMS and EMS-C that would be helpful for planning and evaluation purposes, one would also want to know about who has not used the EMS system in circumstances that apparently would warrant such use. Learning about "nonevents" of this sort is more difficult than studying who has used a system. The committee advises that planners and researchers give thought to the survey or other techniques that might be implemented to obtain such information, as was attempted by the National Center for Health Statistics in the Child Health Supplement of the National Health Interview Survey in 1988.

2. The structure, process, and outcome framework for quality assurance in health care was first proposed by Avedis Donabedian (1966, 1980, 1982, 1985) in the context of assessing and ensuring the quality of medical care. *Structural measures* are the characteristics of the resources in the health care delivery system and serve essentially as indicators of the presumed capacity of the practitioner or facility to delivery quality health care. *Process of care* refers to what is done to and for the patient as he or she moves through a health care delivery system, and can encompass interventions ranging from primary and secondary prevention through diagnosis and definitive care through rehabilitation, palliation, and counseling. *Outcomes* are the end results of care—that is, the impact that the care process has had on the health and well-being of patients and populations. These concepts have a clear application to planning and evaluation of EMS-C programs.

3. This committee did not examine programs of quality assurance (QA) or quality improvement for specific facilities or providers, since its concern was more with systemwide questions. It notes, however, that some advice about assessing the quality of emergency medicine, at least in hospitals, is available. For example, the American College of Emergency Physicians has produced a manual that gives considerable detail on implementing an effective QA program in the hospital ED (ACEP, 1987b), and the California EMS Authority, through the Sierra-Sacramento Valley EMS Agency, has developed a detailed set of components and standards for a quality assurance program for a pediatric critical care system (Sierra-Sacramento Valley, 1992). An important portion of the literature on trauma also relates to program evaluation and related activities such as evaluating prehospital services and in-depth auditing of trauma deaths for quality control purposes (see, e.g., Sacco et al., 1988; Wesson et al., 1988; Nakayama et al., 1989; Pories et al., 1989; ACEP, forthcoming). Outcome-based, quantitative quality assurance and efficiency assessment, as it relates to pediatric ICU care has been recently reviewed (Pollack, 1993). McArdle and Cooper (1993) discuss aspects of system quality assessment, surveillance, and improvement (chiefly relating to pediatric trauma care). The Joint Commission for Accreditation of Healthcare Organizations has long-standing standards for emergency services; these involve a written plan, organization, direction, staffing, integration, training and education, policies and procedures, facility design and equipment, medical records, quality control mechanisms, and monitoring and evaluation (JCAHO, 1990). The National Highway Traffic Safety Administration's program for assessment of state EMS systems is discussed in Chapter 8.

4. A case in point concerns software for managing trauma registries: To assist in data collection for purposes of developing norms for measuring outcomes and assessing quality of care, one national group (the American College of Surgeons) has developed a software package to facilitate hospital-based collection and analysis of trauma registry data using personal computers (ACS, 1992). This multi-institutional network is intended to facilitate ongoing investigation of the efficacy of therapeutic interventions and to help define the socioeconomic effect of injury.

5. Insurance claims data on the elderly and certain other populations such as patients with end-stage renal disease are available through the Medicare program, and arguably the work being done to combine inpatient and outpatient data for the elderly promises to produce the best working files on health care utilization of any insured population.

6. The literature on limitations of various kinds of data sources amassed over the past two decades alone is quite large. The reliability of hospital discharge data, for example, was examined in the late 1970s by study committees of the Institute of Medicine (IOM, 1977, 1980b); the situation has improved some since the introduction of Medicare's Diagnosis-Related Groups Prospective Payment System for hospitals, but the problems are by no means solved. An authoritative review of proposed changes in major NCHS surveys (NRC/IOM, 1992b) documents many of the challenges that NCHS will need to address concerning these data collection efforts. With regard to so-called administrative databases, a 1990 conference

outlined many of the problems, but also the advantages, of these types of files (Hanft et al., 1990).

7. Discussions about data for planning, evaluation, and research are typically framed in terms of reliability and validity. Reliability is the extent to which data are accurate and reproducible. For instance, high reliability requires that the same data collected at two different times, by two different observers, or by two different measures be essentially the same; it also requires that the rate of missing (or deliberately false) data be low. Validity is the extent to which data actually measure what they purport to measure. For instance, a measure of physical mobility should not be confounded by elements of psychological well-being (or vice versa), and a measure of hospital charges may well not correctly indicate hospital costs. Technically, the level of reliability of a data collection instrument or method sets the level of achievable validity, and a measure can never be valid if it is not reliable.

Reliability and validity as defined here are critical, especially for data being gathered in many locations, by many types of providers, for several different uses. The concepts are particularly significant in evaluating outcomes; for example, death may be a reliable indicator of the outcome of care in that it is usually correctly recorded, but it may not be a particularly valid indicator of the quality of the care rendered.

8. The literature on functional outcomes, health status, and health-related quality of life is quite large—certainly too comprehensive to review here. For seminal articles and publications in this area over the past 30 years, the reader is referred to Katz et al. (1963); Patrick et al. (1973); Kaplan and Bush (1982); Wenger et al. (1984); Bergner (1985); Feinstein (1987); Katz (1987); Lohr and Ware (1987); McDowell and Newell (1987); Stein et al. (1987); Lohr (1989, 1992); Patrick and Bergner (1990); Spilker et al. (1990); Greenfield and Nelson (1992); and Stewart and Ware (1992). Of significance to EMS-C is the fact that the field of health status assessment for children is underdeveloped compared with the situation for adults.

9. One IOM report, *Disability in America*, makes a firm distinction between disability and impairments (even permanent ones) and functional limitations. Disability arises only when the demands of the environment exceed a person's capabilities to meet them or to maintain capacity for age-appropriate tasks (or activities of daily living) (IOM, 1991b). ADLs include tasks such as eating, dressing, and getting in and out of bed. IADLs (instrumental ADLs) include more complex activities such as shopping, use of transportation, and use of telephones. Applying these concepts, especially the latter, to children requires identifying the right age-specific activities.

10. This "expected versus observed" approach to assessing performance is essentially the tactic used by the Health Care Financing Administration in calculating and publishing hospital-specific mortality rates for the Medicare program. Attractive conceptually, the analyses are extremely hard to do because of the need to control or adjust for many case-mix (patient, diagnosis, and other) variables. Such an approach might be somewhat simpler when applied in the EMS context only, for instance in analyses of trauma deaths in a hospital setting using the so-called TRISS methodology (Champion et al., 1981; Boyd et al., 1987) (see Appendix 7A). However, the enduring controversies about acuity and severity adjustors, coupled with the range of settings in which emergency care can be rendered, makes any broad application of this approach debatable.

11. Privacy and confidentiality concerns have become increasingly visible in the past decade or so. Some issues are particularly significant in caring for children. Families may be anxious to restrict access to information about children's conditions such as HIV infection. Adolescents may wish to receive care without the knowledge of their families (e.g., for pregnancy or abortion). Cases of suspected child abuse involve not only the medical system but legal and social services as well.

A considerable literature exists about the extent to which sensitive, private information about individuals is (or is not) protected in this country. For seminal publications over the past

20 years, see generally Westin and Baker (1972); Privacy Protection Study Commission (1977); Rule et al. (1980); OTA (1986); Flaherty (1989); NRC (1991a); Powers (1991). The issues extend well beyond medical information to confidential financial and other personal data and to inadvertent as well as deliberate, and overt as well as covert, invasions of privacy (Rothfeder, 1992). With the advent of new abilities of scientists to map the human genome and increasing use of health-related information by employers and insurers, however, anxiety about misuse of such information has become more acute. The issue was recently examined by an IOM committee concerned with the computer-based patient record (IOM, 1991a) and by the DHHS Secretary's Workgroup on Electronic Data Interchange (WEDI, 1992). In 1992, privacy and confidentiality of personal health data was also to one degree or another the subject of debate by three IOM committees considering, respectively, employment-based health benefits (IOM, 1993c), the assessment of genetic risks (IOM, forthcoming), and questions of regional health databases (with a report due out in early 1994).

12. Concerning the significance of ED care in the hospital sector, Matson (1991) cites a prediction from the American Hospital Association that, by the mid-1990s, more than 50 percent of all hospital admissions will come through EDs; he notes that, today, perhaps as much as half of a hospital's total revenue stems from the ED and that within a few years the ED may emerge as the "single largest and most important department of many hospitals" (p. 18). This is already happening in many areas of the country.

13. For a thorough discussion of the difficulties, as well as the opportunities, presented by the computer-based patient record, see *The Computer-Based Patient Record: An Essential Technology for Health Care* (IOM, 1991a).

Appendix 7A

Methods for Scoring Acuity and Severity of Injury and Illness

A large array of measures has been developed over the past 20 years or so to enable clinicians, hospital staff, and prehospital personnel to judge how severely injured or ill an individual is. The main purposes of these measures are threefold: (1) to enable EMS personnel to triage patients appropriately; (2) to permit clinicians, researchers, and others to adjust for the severity or acuity of patients' problems or to predict outcome in carrying out various types of research projects of comparative analyses; and (3) to conduct evaluations of institutions and systems. The literature on these measures is quite large, in part because of controversies in three areas: the reliability and validity (or sensitivity and specificity) of the measures, their utility for pediatric (as contrasted with adult) patients, and their practicality and feasibility in institutional settings or in the field.

This appendix briefly introduces the main measures of injury and illness severity and the controversies about them, identifying the issues that led the committee to give such priority in its research agenda to this topic. The appendix is selective and illustrative, not exhaustive, in the measures discussed. It focuses more on the extensive work on trauma and injury measures than on the less well-developed illness instruments. It does not deal with the many generic or diagnosis-specific measures of health status or health-related quality of life that are used for health services, health policy, or biomedical research purposes. (Readers wishing to pursue these topics further are directed to the citations in Note 8 in the main text of this chapter.) Neither does it catalog the myriad of instruments available to track childhood physical and mental development, which typically could not be used as indicators of severity of illness or, especially, of injury.

TRAUMA AND INJURY MEASURES

Many measures and scoring systems have been developed for trauma and injury. Some are intended especially for field or later triage; this involves identifying injured patients who should be transported by, for instance, aeromedical services, transported directly to and treated in trauma centers, transported from one hospital to another that has more sophisticated facilities, or in other ways managed with services that imply considerable resource use because of increased medical need. Other measures are calculated only after complete diagnostic testing and evaluation; they are

intended more to predict mortality or for purposes related to quality assurance, planning, and evaluation.

Most of these measures, when validated at all, have been validated against death. Relying on death as an indication of validity is, however, regarded as an incomplete approach to psychometric evaluation. Some measures have been validated against various nonmortal outcomes or disability status, but generally, reliability and validity studies need to be conducted more frequently against benchmarks other than mortality.

Selected Measures

Among the better known measures focused on injury and trauma are (alphabetically) the following (with only key citations noted):

- the Abbreviated Injury Score (AIS) (Committee on Medical Aspects of Automotive Safety, 1971; AAAM, 1980; 1985; Sacco et al., 1993);
- CRAMS (the Circulation, Respirations, Abdomen, Motor, Speech scale) (Gormican, 1982; Clemmer et al., 1985);
- the Glasgow Coma Scale (GCS) (Teasdale and Jennett, 1974);
- the Injury Severity Score (ISS) (Baker et al., 1974; Baker and O'Neill, 1976; for a critique, see Copes et al., 1988), which is derived from the AIS;
- the Modified Injury Severity Score (MISS) (Mayer et al., 1980; Walker et al., 1984);
- the Trauma Score (TS) (Champion et al., 1981, 1983) and the Revised Trauma Score (RTS) (Boyd et al., 1987; Champion et al., 1989); and
- the Trauma Triage Rule (Baxt et al., 1990; Emerman et al., 1992).

Triss Analysis

The TRISS method of analysis (Champion et al., 1981, 1983; Boyd et al., 1987; Sacco et al., 1993) generates a probability of survival from a mathematical formula that combines a patient's Trauma Score (or Revised Trauma Score), Injury Severity Score, and age. Although TRISS is subject to certain methodologic problems of the original component measures (particularly the ISS) in underestimating survival probabilities for some types of patients, it has two major advantages. First, it links physiologic and anatomic information in a highly accurate and statistically powerful way. Second, it permits comparisons of survival outcomes to a national norm, thereby enabling hospitals and trauma centers to judge their outcomes against national data, adjusting for severity mix.

When Champion and colleagues (Champion et al., 1990a; Sacco et al., 1993) attempted in a methodology called ASCOT (A Severity Characterization of Trauma) to modify TRISS to address certain of its limitations, they

amassed information indicating that ASCOT was a significant improvement over TRISS (in a study involving nearly 80,000 patients). Markle and colleagues (1992), however, in a study involving about 3,000 patients, did not find that ASCOT produced quantitative gains sufficient to offset the greater complexity and need for computer processing. Thus, more research with different patient data sets will be needed before a definitive judgment about ASCOT can be made.

TRISS, like the other listed measures, was developed on and for adults, leaving (at least in some users' minds) a significant gap insofar as EMS-C is concerned. The reasons for expecting children to respond to injury differently than adults are summed up in the aphorism "children are not miniature adults." Anatomy (e.g., surface area, airway structure), physiology and physiologic reserve, ability to verbalize, and other factors are different for children than for adults. To the extent (which is great) that trauma scoring tools are based on those variables as calibrated for adults, they risk being inappropriate for children. That is, when used for triage (or severity or case-mix adjustments), they may not be very sensitive or specific for some or all of the pediatric age range (as discussed below).

Not all experts in this field agree with this assessment. They argue that the AIS, ISS, and TRISS have all been validated or at least used successfully in pediatric populations and studies and that the reliability of some adult-based measures is sufficiently high in pediatric populations to permit their use (Eichelberger et al., 1988a,b, 1989a,b, 1993; Nakayama et al., 1989; Kaufmann et al., 1990, 1991; Fortune et al., 1992; Reynolds, 1992). Furthermore, updates to the AIS in the early 1990s include definitions of injury that accommodate differences in severity assessment between adults and children; because this change will improve its potential for scoring pediatric injury, it will also improve the applicability of the ISS (and hence TRISS) for children.

Pediatric Trauma Score

To address the perceived void, however, Tepas and his colleagues (1987, 1988) developed the Pediatric Trauma Score (PTS) specifically for children. PTS uses scores on six parameters: size of patient, airway status and adequacy of breathing, blood pressure (as an indicator of perfusion status), central nervous system status (e.g., from awake to comatose), skeletal status (e.g., closed or open fractures), and cutaneous status (e.g., minor contusions and abrasions through penetrating injury and soft tissue loss). These components are intended "to quantify injury by the numeric gradation of anatomic, physiologic, or functional derangement" (Tepas, 1989, p. 65; Reynolds, 1992). These variables reflect what clinicians regard as the most predictive indicators of how severely injured a patient might be, based on initial presentation

or encounter, and they are specifically intended to reflect both physiologic derangement and anatomic dysfunction. Various other researchers have evaluated the PTS in both prehospital and hospital settings (Ford et al., 1988; Ramenofsky et al., 1988; Aprahamian et al., 1990).

The PTS is intended also to be a scoring protocol or short checklist that will assist in decisions regarding the potential use of considerable resources (e.g., when patients need to be transported from one hospital to another, higher-capability facility). Because its components are objective indicators of clinical status, without elements that might reflect socioeconomic or other considerations, its proponents argue that the PTS provides a useful mechanism for improving the operations of regionalized trauma systems and for tracking the appropriateness of transports and transfers (Tepas, 1992).

Other Pediatric-Specific Measures

Problems with applying the CRAMS score to children led one hospital to develop, as an alternative, a criteria-based Children's Trauma Tool (Kitchen and Haubner, 1989). The triage-revised TS (Eichelberger et al., 1989b) takes account of physiologically higher respiratory rates in children younger than 2 years but is otherwise equivalent to the RTS. Efforts also are being made to develop pediatric norms (based on children 14 and younger) that might replace adult norms in TRISS pediatric survival predictions.

Applications

Triage

The ISS is often regarded as a "gold standard" measure of severity of injury (mainly for adults but arguably for children as well), and it has been used to validate pediatric applications of such measures as the TS, RTS, and the PTS. The final ISS score cannot be calculated, however, until patients have been fully evaluated in a hospital setting; hence, it is not itself a triage tool. By contrast, the TS (or RTS) is intended to be (and is widely used as) a triage tool in the field, and some advocate that EMS systems routinely collect its component data elements (Morris et al., 1986). A related tool, the Triage Decision Scheme, is a flow-chart instrument designed to help emergency medical technicians (EMTs) make prehospital evaluations and decisions (chiefly as to whether to take the patient to a trauma center or evaluate and proceed under medical control) (NAEMT, 1990).

Many of the trauma measures, including the TS, have been criticized as being insufficiently sensitive or specific to be useful as prehospital trauma prediction rules. Using it only on an adult population, Morris and colleagues

(1986) showed, for instance, that the sensitivity and specificity of the TS (for correctly identifying patients needing or not needing to be transported to a trauma center) are highly influenced by the specific TS score selected to indicate "severe" injury. They present data to suggest that the TS may well identify patients likely to have severe injury, but it may also have some false-negatives and miss patients with major thoracic injury; in addition, problems of undertriage or overtriage may differ depending on whether the injury reflects penetrating or blunt trauma. Baxt et al. (1989) determined that the TS, RTS, CRAMS, and Prehospital Index (PHI) could accurately predict which trauma victims would die but that they could not accurately pinpoint which patients of those who initially appeared physiologically normal (in the prehospital setting) were in fact victims of major trauma (i.e., could not distinguish major from minor trauma injury). Kane et al. (1985) evaluated several existing measures (e.g., the TS) and some new instruments for triage and concluded that "the most striking finding … is the disappointing performance of *all* [emphasis in original] the triage techniques studied" (p. 488). They question whether methods based on rigidly defined variables can achieve high sensitivity, high specificity, and positive predictive validity, and they propose that the reliability of paramedic observation itself might deserve further exploration.

By contrast, Eichelberger and various colleagues (Eichelberger et al., 1989b) have developed evidence from a pediatric database (0 to 14 years) that the TS, PTS, and unweighted RTS have an acceptable sensitivity for triage decisions (e.g., whether to transport a child to a pediatric trauma center), although the last-named may have a less acceptable specificity. As noted above, the PTS has been shown to have good predictive validity when used for trauma triage in the field, and Tepas (1992) argues that a tool such as the PTS may have its "greatest applicability in … [improving] care for the rural population" (p. 176).

Not all experts in the field argue so strenuously for the use of formal trauma or triage tools. Emerman and colleagues (1991), for example, reported that, in one metropolitan area, EMTs' judgments about overall severity of trauma and predictions of mortality and need for immediate operative intervention were as accurate as scores from the triage-revised TS, the PHI, and CRAMS. (This point would seem to accord with the sentiments expressed by Kane et al., 1985.) With respect to triage-transport decisions, Orr and colleagues (1992) comment that the PTS (as well as the GCS and MISS) "may prove useful for certain categories of patients, such as those with multiple trauma or neurologic disease" (p. 1573). Overall, therefore, the evidence about the application of trauma severity measures in triage seems to be mixed; relatively poor performance in predicting major trauma for adults will likely be worse for pediatric patients.

Mortality Predictors

Some measures, such as the Pediatric Risk of Mortality (PRISM) score (Pollack et al., 1988b) and TRISS (Eichelberger et al., 1988b), can help identify unexpected (i.e., potentially preventable) deaths as well as unsurvivable injuries (i.e., expected deaths). At least one study, however, suggests that trauma scoring systems based on AIS and ISS, when used for pediatric patients, may overestimate the "non-salvageable" population in that age group, perhaps because of overemphasis on head injury or limitations of the original evaluation; some children so designated do survive, and at least some of those who do have a high probability of good long-term functional outcomes (Jaimovich et al., 1991). Generally, the state of the art of mortality prediction among injured children, which relates directly to ongoing debates about the adequacy of trauma scoring systems for pediatric patients, remains in flux.

Questions about mortality measures are pertinent to efforts to evaluate pediatric trauma programs. One issue centers on whether "preventable death rate" (PDR, the proportion of all deaths that could have been avoided had care been optimal) or "effectiveness" (E, the proportion of severely injured patients who were salvageable and survived, which excludes those who would be expected to die despite optimal treatment) is the better evaluative measure. Wesson and colleagues (1988), for instance, have argued that the PDR is sensitive to case mix—which in turn would be sensitive to the injury severity index used—and that E would be a superior way to assess how well a pediatric trauma program was functioning, but commentary on the work suggests that the issue is not resolved.

ILLNESS MEASURES

Scoring systems to assess the severity of pediatric illness, particularly in the prehospital setting for triage purposes, or to predict the outcome from illness, have proven even more difficult to develop than those available for trauma. Indeed, the committee recognizes that no reliable or valid illness severity scores exist that could be universally applicable for illness assessment of all pediatric patients. The following discussion provides a brief overview of some of the major illness measures presently available, but it is not all-inclusive. For example, disease-specific scores that are used in pediatric emergency care, such as for asthma, croup, or meningococcemia, are not discussed.

As with trauma and injury scores or other physiologic measures that, in theory at least, reflect illness acuity, most illness severity measures have been developed and used for adult patients in a general hospital population. They tend to be "global" measures (in much the same way that trauma or

injury can be considered a "global" or "generic" condition), rather than disease- or condition-specific. Not surprisingly, they may often not be appropriate for pediatric patients.

Selected Measures

General Illness-Related Measures

Iezzoni (1991) provides a definitive review of measures to standardize (i.e., adjust for) severity of illness, especially in their role in research, quality assessment, and health policy work. Among the better known severity-adjustment tools are the following:

- Acute Physiology and Chronic Health Evaluation (APACHE and APACHE II) (Knaus et al., 1981, 1985);
- the Computerized Severity Index (Horn and Horn, 1986; Averill et al., 1989);
- the disease staging methodology (Gonnella et al., 1976, 1984; SysteMetrics, 1988);
- MedisGroups (Brewster et al., 1985; Iezzoni and Moskowitz, 1988); and
- Patient Management Categories (Young et al., 1982; Young, 1984).

Measures that are well-known for or used for trauma and injury but are also regarded as applicable to illness include the PHI (Koehler et al., 1986), the Physiologic Stability Index (PSI) (Yeh et al., 1984), and the Therapeutic Intervention Scoring System (TISS) (Cullen et al., 1974; Yeh et al., 1982).

Pediatric Measures

Certain pediatric instruments can also reflect both illness and injury severity. For example, PRISM (Pollack et al., 1988b; Pollack, 1993) is a simplification of the PSI; one variant (Dynamic Objective Risk Assessment, or DORA) uses multiple PRISM scores to assess worsening or improving levels of severity of illness (Ruttimann et al., 1986; Ruttimann and Pollack, 1991). A pediatric version of the Glasgow Coma Scale has been proposed (Reilly et al., 1988).

The Maryland EMS-C Project (1992) developed a preliminary version of a Pediatric Severity Assessment Tool (PSAT) that is designed to be appropriate for prehospital providers as well as clinicians in community hospital EDs and physicians' offices. Its designers intend that it quickly identify patients who need various levels of emergency care without having to resort to much in the way of laboratory data (except perhaps for an electrocardiogram

or pulse oximetry reading). The PSAT is still undergoing field testing.

For children, the greatest success has occurred in formulating measures that assess mortality risk or the "intensity" of the care needed by the most critically ill (or injured) children; these include PRISM, PSI, and TISS. (Buchert and Yeh, 1992, review some of the prehospital illness scoring measures.) For severity of *illness* measures, a variety of physiologic and behavioral indicators—respiratory rate, fever, lethargy, irritability—contribute to assessments of severity of illness. Children, especially younger ones, may not manifest ordinarily well-known signs and symptoms of the illnesses they have, so a measure that would indicate which children require laboratory evaluation to rule out serious or life-threatening illnesses and which children have only minor ailments will be useful.

One such measure—what has come to be called the Yale Observation Score—was developed by McCarthy et al. (1982) in an attempt to identify items that could be used to help clinicians recognize, reliably, validly, and quickly, serious illnesses in children with fever. The model includes six observation items (quality of cry, reaction to parent stimulation, variation in awake-asleep status, color, hydration, and response to social overtures), each scored on an item-specific three-point scale (normal, moderate impairment, severe impairment). One test in the hospital ED setting raises questions, however, as to whether this scale, even in the hands of experienced physicians, will provide sufficient information to identify serious febrile illness in very young infants (Baker et al., 1990). The "SAVE A CHILD" triage approach, based on a simple mnemonic (skin, activity, ventilation, eye contact - abuse - cry, heat, immune system, level of consciousness, and dehydration) is another example of a protocol for EDs intended to provide markers of possibly serious illness (Wiebe and Rosen, 1991). The "SAVE" part of the triage guide involves simple observations, and the "A CHILD" portion involves observations and simple history questions; in total, it takes less than one minute to complete, and its developers thus claim that it would be particularly valuable for busy EDs.

Comment

Generally, it can be said that generic or global measures of acuity or severity of illness in children lag those for trauma and injury by a considerable degree. In view of the evidence presented in Chapter 2 about the extent to which illness is the reason that children (especially younger children) require emergency care, this is a major gap in the tools available to EMS-C personnel, researchers, and evaluators. In addition, measures otherwise considered reasonably applicable to the pediatric age group tend to be unreliable in infants under 2 months.

Typically, instruments are developed first for research purposes (which call for retrospective scoring of the severity of illness), and they may be quite sophisticated. Those intended for prospective clinical use come later and may not, at the outset, be as complex, reliable, or valid. Few if any global illness assessment scores can be used to predict outcomes reliably across the entire pediatric age span; even among the disease-specific measures, predictability may not be high.

Far less has been done to try to apply existing measures in any program evaluation or quality assurance effort. Thus, an appreciable amount of investigation and validation lies ahead to provide the EMS-C field with reliable and valid instruments related to illnesses across the pediatric age range that can be employed in research and evaluation activities. As with the trauma and injury measures, then, the committee concluded that this was an area warranting high priority in the research agenda proposed in the main part of this chapter.

Appendix 7B

Emergency Medical Services for Children Proposed National Uniform Data Elements

As is clear in the main text of Chapter 7, the Institute of Medicine study committee firmly believes that high priority must be given to collection and analysis of nationally comparable data at local, state, and national levels on emergency medical services for children (EMS-C). Data must be obtained from all phases of care for emergency conditions, including prehospital, emergency department (ED), intensive care and other inpatient services, and rehabilitation. The committee recognizes that, for data collection and analysis to succeed, a wide range of interested parties (e.g., health care providers, public agencies, hospitals, researchers, and administrators) will need to reach consensus regarding definitions and formats for specific data to be collected. Substantial work also remains to resolve many administrative and technical issues, such as determining which federal and state agencies will have responsibility for assembling and analyzing data or what electronic format will be used to store the data.

The committee agreed that it was not the appropriate body to resolve these various issues. Instead, the committee sees its role as having three parts: to make clear the importance of data collection and analysis in the further development of EMS-C, to emphasize the need to establish an essential core of data to support important analyses, and to encourage individuals and institutions to take action. The committee felt very strongly that *getting started* on defining a core data set and collecting data was critical. To that end, it has proposed an initial set of data elements for EMS-C, which is described in detail in this appendix. These data elements must be seen as a starting point for a more comprehensive data resource.

In its discussions of these issues, the committee focused particularly on prehospital and ED care, believing that systematic collection of nationally comparable EMS-C data should begin with those settings. It then identified data elements that it believes ought to be part of a national data set. Several criteria guided the selection of specific elements, including utility of a data element for national and local analyses, adaptability to changing information requirements, ability and willingness of providers to capture accurate data, and availability of reliable and valid measures. The committee also considered whether evidence was available that data can be collected and used successfully without undue cost. Finally, it focused on the utility of this core data set for planning and evaluation purposes, rather than for research.

The "priority" or "core" data elements are listed below along with comments reflecting the committee's reasons for selecting them or other observations about the data element. In the case of E-codes, the formal recommendation made in the full report is noted. Also listed are two other categories of data elements—"desirable" and "rejected"—that the committee discussed but chose not to select, and annotations concerning the basis for consideration or rejection (respectively) are also given. General statements agreed to by the committee regarding the collection of these data are presented just below.

SPECIAL CONSIDERATIONS

Prehospital and Transport Services

The committee advanced three broad principles to guide collection of these data in the prehospital setting. First, data should be collected on every call to which a prehospital provider responds, even if no patient is transported. Second, data should be collected from each ambulance (or other EMS unit) that responds to a request for assistance; coding schemes should be developed to make it possible to link separate reports on the same event. Third, data should be collected on interfacility transport provided by ambulance units; data on these transports should be distinguishable from prehospital transports. (The data elements relevant for interfacility transports may differ from those presented below for prehospital reporting; the committee did not attempt to develop a list of data elements specifically for interfacility transports.)

Emergency Departments

The committee noted that several parameters that are markers for the physiologic status of the child should be collected routinely in EDs (even if they are not now so collected); they may then be helpful in comparing institutions, systems, regions, and states. These measures include the elements of the Glasgow Coma Scale (GCS) and vital signs. The committee recognizes that problems exist at present in collecting these data reliably; for example, clerical personnel who routinely abstract data may not be familiar with the particular elements (especially of the GCS). A somewhat similar case is made for collecting certain kinds of zip code information as part of the prehospital data set. That is, even though such information is not now routinely collected by EMS agencies, it will be valuable for system evaluation, planning, and descriptive work, and the committee therefore advises that these data elements be included in routine data collection.

TABLE 7B-1 Data Elements Considered for a National Uniform Data Set for Emergency Medical Services for Children: Prehospital Services and Emergency Departments

Prehospital Data Elements	
Data Element	Basis for Selection, Consideration, or Rejection
Priority Data Elements	
Date of Birth/Age	Relationship of age to number and nature of emergency events and to outcomes; facilitate linkage between ED and EMS records; may not be routine part of current prehospital data collection; the committee encourages use of date of birth, which is a better tool for record matching.
Gender (M/F)	Distinguish differences in types of emergencies (and therefore service needs), especially among adolescents.
Date and Time: • Call for assistance (or EMS dispatch) • Arrival on scene • Departure from scene • ED arrival	Calculate elapsed time in stages of prehospital care; travel time can be an indicator of distances; ED arrival time can facilitate linkage between EMS and ED records. Time reporting is often retrospective; need to be aware of limits on accuracy.
Prehospital Assessment	Nature of patient's condition (e.g., injury, illness, uncertain).
Spontaneous Breathing (Y/N): • On arrival at scene • On arrival at hospital Spontaneous Pulse (Y/N): • On arrival at scene • On arrival at hospital	State of breathing and pulse give an indication of acuity; deterioration or improvement on arrival at hospital.
Level of Consciousness on Arrival at Scene (A/V/P/U) Alert Response to Voice Response to Pain Unresponsive	Indication of acuity, salvageability; use to assess destination choices and triage practices.
Disposition: Left at scene Transported	Distribution of cases by action taken; assess relationship of acuity to disposition.
Transported to: Hospital identification number (Hospital zip code)	Nature of destination ED (community hospital versus referral center); possible development of denominator data; facilitate linkage between EMS and ED records.
Zip Code for Site of EMS Encounter	A consistent national system; location of emergency relative to location of initial hospital care; analysis of transport and triage practices; location of events for prevention analysis; possible development of denominator data; can aid in matching EMS and ED records when location zip code is also home zip code.

Prehospital Data Elements—*continued*

Data Element	Basis for Selection, Consideration, or Rejection
Prehospital Services: • Provider identification number; • Prehospital run report number	Facilitate linkage between ED and EMS records.
Type of Responder (e.g., ALS, BLS)	Qualifications of responders.
Desirable Data Elements	
Mechanism of Injury	Good correlation with outcome; already part of trauma system and much EMS reporting; valuable for analysis of determinants of injury; appropriate response categories need to be defined before inclusion in a national data set.
EMS Interventions Used	Appropriate response categories need to be defined before inclusion in a national data set; may not be possible to determine appropriateness of intervention use or nonuse; very important for local quality assurance/ quality improvement activities.
Rejected Data Elements	
Vital Signs	Not useful for aggregated analysis; may not be reliably collected in the field.
Loss of Consciousness or Conscious (Y/ N/Uncertain)	Replaced as acuity indicator by level of consciousness on arrival at scene; potential for uncertainty in determination; requires careful specification of time of assessment.
Dead on Scene/ Alive on Arrival at ED	Acuity indicator; complications in determination of death (e.g., state before and after resuscitation); restrictions on EMT authority to declare death; significant regional differences in practices regarding declaration of death.
Resuscitation Needed	Acuity indicator; based on judgment rather than objectively observable or measurable state.
Medical/Surgical/Other	Nature of case; replaced by condition categories more appropriate for determination by EMS personnel.

Hospital Emergency Department Data Elements	
Data Element	Basis for Selection, Consideration, or Rejection
Priority Data Elements	
Date of Birth	Relationship of age to number and nature of emergency events and to outcomes; facilitate linkage between ED and EMS records.
Gender (M/F)	Distinguish differences in types of emergencies (and therefore service needs), especially among adolescents.
Race/Ethnicity	Assess relationship to incidence and acuity (implications for access to other care).
Mode of Transport (e.g., self, EMS, interfacility, air, ground)	Distribution of cases by transport; relationship between transport and acuity; relationship between transport and outcome; appropriate response categories and criteria need to be established.
Date and Time of ED Arrival	Calculate length of time to discharge; facilitate linkage between ED and EMS records.
Date and Time of Discharge	Calculate length of time from arrival to discharge; relationship between time, acuity, and nature of disposition.
Disposition (e.g., dead on arrival; died in ED; discharged home; admitted; transferred)	Distribution of cases by disposition; assess referral patterns; indication of acuity; identify cases to track for need/use of further services.
Diagnostic Codes (allow for reporting multiple ICD-9-CM nosology [or N] codes for each patient)	Distribution of conditions presenting to the ED; indication of acuity. Hospitals may not currently be coding diagnoses and procedures if they do not bill for ED services; ICD-9-CM coding is often time consuming and imprecise; alternatives should be explored.
Procedure Codes (allow for reporting multiple CPT-4 codes for each patient)	Indication of acuity; appropriateness of care; resources and training used; accuracy of coding may be poor.
External-Cause-of-Injury (E) Codes (allow for reporting multiple ICD-9-CM including site of injury)	Correlation with outcomes; assessing prevention needs and impact of prevention programs; committee strongly recommends universal adoption of E-codes.
Glasgow Coma Scale (GCS) Components Verbal response Eye opening Best motor response	Acuity indicator; valuable research tool; application to children may need further refinement.
Vital Signs (initial readings) Pulse Respiratory rate Systolic blood pressure Temperature	Necessary element for TRISS analysis, so required for aggregated comparative analyses when adjustments for differences in patient injury severity are desirable; also useful for adjustments for illness severity (TRISS analysis is based on Revised Trauma Score and Injury Severity Score).

Hospital Emergency Department Data Elements—*continued*

Data Element	Basis for Selection, Consideration, or Rejection
Insurance/Payer Codes (e.g., self-pay, Medicaid, public assistance, CHAMPUS, private insurance)	Clarify impact of insurance status on ED and EMS use (actual and perceived costs; relationship to acuity, diagnosis, transfer, access to other care).
Prehospital services: • Provider identification number • Run report number	Facilitate linkage between ED and EMS records.
Hospital Identification Number	Characterize level of care available from ED (community hospital versus referral center); facilitate linkage between ED and EMS records.
Hospital Zip Code	Assess area resources through other sources of data; possible development of denominator data.
Home Zip Code/Country	Facilitate other analyses: correlate area resources for family of patient; describe population characteristics of area; possible development of denominator data; relation of residence to location of initial emergency care; referral patterns; regional concerns regarding use of services by residents of other areas (counties, states, countries).
Desirable Data Elements	
Date and Time of Physician Encounter	Assess timeliness of care or transfer to more appropriate level of care in relation to acuity.
Date and Time of Disposition	Identify procedural delays between ED assessment or treatment and discharge or transfer to most appropriate care.
Usual Source of Care (e.g., yes, no, not known)	Indicate access to routine care (i.e., a medical home); timing and acuity of visits when source of routine care is available; needs further study before being added to the recommended data elements.
Communication Barriers Between Provider and Patient (or Family)	Clarify relationship with acuity, outcome; appropriate indicators need to be determined.
Prior Health Status	Identify children with chronic illness or other special health care needs; appropriate indicators need to be determined.
Rejected Data Elements	
Loss of Consciousness (history at time of arrival)	Acuity indicator; replaced by diagnostic and procedure codes.

8

Leadership for Developing Emergency Medical Services For Children

The committee has, by now, clearly set forth its support for two goals: ensuring the development of high quality emergency medical services for children (EMS-C) as integral components of existing emergency medical services (EMS) systems and ensuring strong links to the broader realm of child health care. Although the committee's charge refers only to emergency medical care, its positions rest on the belief that society has a special obligation to attend to the health care needs of children. They depend on others for their care and have no independent political voice through which they can make their needs known.

At present, EMS-C has significant shortcomings. Many can be attributed to insufficient integration of EMS-C with other areas of health care. In particular, we note inadequate attention to the needs of children on the part of an emergency care system developed to meet the needs of adults—from emergency dispatch centers to emergency transport systems, emergency departments (EDs) and intensive care, and rehabilitation and support services in the community. We record also inadequate attention to children's emergency care needs on the part of the pediatric community, which has traditionally focused heavily on primary care. Overcoming these problems will require efforts on many fronts and by many people. Currently, however, EMS-C has neither a readily identifiable source of authoritative and visible leadership nor any forum for cooperative efforts that can coordinate the activities that the committee proposes.

The committee is heartened to see that clear weaknesses in EMS-C have begun to receive much needed attention. It concludes, however, that

further work is required in several areas to bring both the quantity and the quality of EMS-C to appropriate levels across the country. As presented in preceding chapters, these areas include:

- education and training for the public, for health professionals generally, and for emergency care providers specifically;
- organization and delivery of care, especially regarding equipment, protocols and guidelines, medical control, categorization of facilities, and regionalization of care;
- communication, including universal adoption of 9-1-1 for telephone access to the emergency system and movement toward enhanced 9-1-1; and
- planning and evaluation, including efforts to institutionalize a national uniform data set appropriate for EMS-C and to require reporting of ICD-9-CM E-codes[1] for injury diagnoses, and augmented research activities.

As a way to focus attention and resources on efforts to improve EMS-C, the committee sets forth in this chapter recommendations for establishing EMS-C agencies at the federal and state levels and discusses the rationale for its position. It reviews the broad range of parties whose representation is essential, chiefly through national or state advisory councils to these agencies; it also discusses the issues that should be high on the agenda of such bodies. Finally, the committee considers the value of such an approach for accommodating the very diverse needs, resources, and organizational characteristics that individual states and localities bring to efforts to improve emergency medical care for children.

THE DISJOINTED "SYSTEM" OF TODAY

Response to the committee's diverse concerns regarding EMS-C calls for leadership in many circles because of the complicated nature of the "system" in which EMS-C operates. Changes in training programs for physicians, for instance, need to be implemented by bodies very different from those that ensure that ambulances carry appropriate equipment or those that institute 9-1-1 telephone systems. Interested parties include various agencies in the federal government, elements of state and local governments, hospitals and their component departments, EMS agencies, individual health care and emergency services providers, professional organizations, community groups, and the public. Each group has its particular priorities and opportunities for action, but there are common concerns that each of those groups should know about and take into account within their separate spheres.

Across the country, communities have developed EMS systems that reflect local conditions and expectations. Ideally, these systems coordinate

the activities of the separate pieces, helping them work together in a smooth, consistent, and effective fashion. The pieces remain, nevertheless, under the jurisdiction of largely independent entities, whose priorities and concerns may not always be consistent with those of the system or its other component parts. This fragmentation of responsibility and authority for emergency care services can hinder optimal day-to-day operations and make long-term system planning difficult. It also creates many independent channels through which changes such as those sought by the committee must be pursued.

Many states and localities attempt to overcome some of this fragmentation through EMS advisory councils, which can bring together representatives from many areas of interest and expertise. These standing bodies, often legislatively mandated at the state level, have varying responsibilities, authority, and structure. They represent an existing mechanism through which some EMS-C issues might be addressed, but their scope is at once too broad and too narrow to be able to address the full range of EMS-C concerns raised by the committee. For instance, these advisory bodies must concern themselves with services to patients of all ages, but generally only for prehospital care. Part of the vision advanced in this report is that EMS-C must concern itself with a broader range of services running from prevention through primary care, inpatient care, and rehabilitation in addition to the traditional prehospital and ED concerns.

Federal efforts have played an important part over the past 25 years in promoting the development of EMS systems across the country. The limited federal role in the delivery of emergency medical care has rested largely with the health care systems of the Indian Health Service in the Department of Health and Human Services (DHHS) and the Department of Defense (DOD).[2] Much more important have been program guidance and funding from DHHS and the Department of Transportation (DOT), but DHHS contributions to EMS were significantly curtailed in the early 1980s, when dedicated funding was abandoned in favor of block grants. DOT's National Highway Traffic Safety Administration (NHTSA) has been the one federal office with a continuing program in EMS since the late 1960s.

Since 1984, the federally funded EMS-C demonstration grant program, administered by the Maternal and Child Health Bureau (MCHB) of the Health Resources and Services Administration (HRSA) in DHHS, has given valuable assistance to states and localities to begin to address EMS-C, but it does not provide for ongoing activities at the federal or the state level. Further, it has not served (nor was it designed) to establish and maintain links among the many federal activities related either to emergency care or to child health (although it has promoted informal networking among *state* EMS-C programs). Neither was creation of an EMS-C advisory body with a role for experts and interested parties outside the federal government

within its mandate. With the adoption of the Trauma Care Systems Planning and Development Act of 1990 (Public Law [P.L.] 101-590), HRSA's role in EMS-related activities has expanded; an advisory council, grant awards, and other program activities will be directed toward assisting states to improve their trauma systems.

Professional organizations, such as the American Academy of Pediatrics (AAP), the Ambulatory Pediatric Association, the American College of Emergency Physicians, the American College of Surgeons, and the Emergency Nurses Association, have served as focal points for bringing attention to EMS-C concerns. Given their national memberships, such organizations can help spread interest in EMS-C across the country. For example, the AAP reaches a broad spectrum of pediatric primary care and hospital-based practitioners. At the same time, it does not encompass in its membership other providers, such as nurses and emergency medical technicians (EMTs), who are important participants in emergency care services, and it also has no formal link with the public agencies that are responsible for many aspects of EMS. Thus, the responsibility for promoting more cohesive and comprehensive EMS-C efforts cannot rest entirely on the shoulders of professional groups.

A FOCUS FOR EMERGENCY MEDICAL SERVICES FOR CHILDREN

In sum, progress in improving the quality of emergency care given to children and the readiness of EMS systems to provide that care depends on ensuring that essential EMS-C components become an integral part of both EMS in general and the broader realm of child health care. To promote that integration, EMS-C needs to be given recognition and priority in both areas. As a means of bringing this level of attention to EMS-C issues, **the committee recommends that Congress direct the Secretary of the Department of Health and Human Services to establish a federal center or office to conduct, oversee, and coordinate activities related to planning and evaluation, research, and technical assistance in emergency medical services for children. The committee also recommends that Congress direct the Secretary to establish a national advisory council for this center; members should include representatives of relevant federal agencies, representatives of state and local governments, the health care community, and the public at large.**

Although some might argue that establishing a formal EMS-C center or office is not necessary, the committee concluded, after considering alternatives, that lesser steps would not be adequate.[3] The Secretary could assign this EMS-C responsibility to an existing agency or give it to a newly created entity. Either way, the committee emphasizes two concerns. First,

EMS and EMS-C are important matters of *Health* and *health care* in which DHHS must assume a leading role. Second, past experience suggests that children's needs will not be adequately represented without an identifiable institutional voice.

Furthermore, the proposed federal center can provide a national framework within which to encourage the continued efforts of the many individuals and organizations across the country that have been responsible over the past decade for bringing EMS-C issues to the attention of health care providers and EMS systems. The EMS-C center will be in a position to contribute to the long-term success of efforts to formulate widely recognized and consistent goals for EMS-C.

Because the organization and delivery of emergency care services rest not with the federal government but with state and local governments and health care providers in the private sector, action at the federal level alone is not sufficient. Therefore, **the committee further recommends that states establish a lead agency to identify specific needs in emergency medical services for children and to address the mechanisms appropriate to meeting those needs. The committee also recommends that state advisory councils be established for these agencies; members should include representatives of relevant state and local agencies, the health care community, and the public at large.** In making this recommendation, the committee emphasizes that its call for an EMS-C agency is not intended to isolate EMS-C from other EMS activities or to promote development of separate EMS-C systems; rather it is intended to ensure that EMS-C issues are visible and have adequate representation.

These two pairs of major recommendations for agencies at both the federal and state levels take as their starting point the myriad issues confronting EMS-C that were detailed in earlier chapters. The next section of this chapter explains the functions of the proposed federal center more fully, and the subsequent section addresses functions of the proposed state agencies.[4] The final sections address questions of funding and examine further some of the obstacles to successful implementation of entities of this sort and how those challenges might be met.

A FEDERAL CENTER FOR EMERGENCY MEDICAL SERVICES FOR CHILDREN

Charge and Agenda

National leadership is essential to improving the quality of EMS-C across the country. In the committee's judgment, a federal EMS-C center or office can be a significant vehicle for exercising that leadership, demonstrating through its activities a commitment to EMS-C at the highest levels

of government. This center should be charged and authorized to propose federal policies and carry out programs in two main areas.

The first part of the charge to a federal EMS-C center presupposes a national perspective and targets the following eight areas:[5]

1. developing a national strategy;
2. coordinating efforts throughout the federal government;
3. disseminating information and providing for a clearinghouse function;
4. improving access to care;
5. underscoring medical illness as a special concern in EMS-C;
6. assisting education and training efforts;
7. collecting and analyzing data; and
8. supporting enhanced research efforts.

The second part of the charge to a federal EMS-C center aims to foster state and local efforts, with three main thrusts:

1. creating incentives for state action;
2. providing technical assistance; and
3. encouraging regional coordination.

Developing a National Strategy

Perhaps the highest priority for the federal EMS-C center is to develop a clear national strategy for ensuring that the emergency care needs of children are met. As a nationally recognized entity that can represent or respond to many interests, the EMS-C center together with its national advisory council would be able to speak to such a broad need in an authoritative voice not always available to other groups. It should lay out a strategy that is in keeping with the health promotion and disease prevention objectives of *Healthy People 2000* (DHHS, 1991). An evaluation of the effectiveness of projects supported under the demonstration grant program could provide valuable guidance as a strategy evolves.

Secondarily, the EMS-C center needs to consider various practical, political, and logistics issues that emerge directly from that strategy. Opportunities must exist for review and revision, with the implicit expectation of public accountability. Annual reports—for example, to the Secretary of DHHS, to Congress, or to "the public"—can help the center meet that responsibility. Such yearly (or otherwise regular and periodic) reports, from either the center or its national advisory council, might analyze the results of EMS-C efforts across the nation—for instance, in data collection and analysis and progress on a uniform EMS data set. Such reports might examine where revised policies and procedures are needed and develop specific research questions and hypotheses warranting future investigation.

Coordinating Federal Efforts

As noted in earlier chapters, a variety of ongoing activities in federal agencies relate to EMS-C issues. In the past, no mechanism has existed for identifying or coordinating those activities. The EMS-C center should carry out that function. Given the aim of ensuring that EMS-C is integrated into broader emergency and child health care, the EMS-C center should be charged with increasing the awareness among such agencies of the place of children's emergency medical care needs in their programs. The center also might undertake a review of the statutory charges to these agencies in areas related to EMS-C to identify existing opportunities for action. Of particular importance is work on EMS systems, trauma and trauma systems, injury prevention, rehabilitation, and pediatric critical care.

Prominent work in these areas includes the activities in HRSA of the MCHB and the Trauma and Emergency Medical Systems Division. Major programs at NHTSA in DOT include curriculum development for training prehospital personnel, technical assistance in assessment of state EMS systems and development of trauma systems, highway safety, and public education.

Numerous agencies in DHHS have programs in relevant areas. At the Centers for Disease Control and Prevention (CDC), the newly created National Center for Injury Prevention and Control is intended to provide leadership in a broad national program related to nonoccupational injury prevention and control, with the aim of preventing premature death and disability from intentional injuries resulting from violent and abusive behavior and from unintentional injuries. Activities at the National Institutes of Health include research and education programs in asthma and emergency cardiac care at the National Heart, Lung, and Blood Institute; work on injury and injury surveillance at the National Institute of Arthritis and Musculoskeletal and Skin Diseases; work on child health, injuries, and medical rehabilitation at the National Institute of Child Health and Human Development; and shock and trauma research at the National Institute for Neurological Disorders and Stroke. Also in DHHS is the Indian Health Service (IHS), which delivers health care services to American Indian and Native Alaskan communities.

The EMS-C center should also help bring to the attention of the EMS-C community those programs with less obvious but still relevant connections. A case in point is the set of programs in outcomes and effectiveness research, clinical practice guidelines, database development, and cost, quality, and access administered by the Agency for Health Care Policy and Research (AHCPR) in DHHS. Other relevant activities in DHHS include those of the National Center on Child Abuse and Neglect (NCCAN) and the Office of Disease Prevention and Health Promotion (ODPHP), which are discussed below as possible models for the proposed EMS-C agency.

The activities of the Health Care Financing Administration (HCFA) concerned with both Medicaid and Medicare should also be of interest. Medicaid relates directly to the health care coverage of children in low-income families. Medicare regulations, which apply principally to elderly patients,[6] can also be important because they exert such a strong influence on hospital operations, physician reimbursement, and the health care delivery system generally.

Among the other federal agencies with activities of interest for EMS-C include the DOD, farm safety activities of the Department of Agriculture, the Consumer Product Safety Commission of the Department of Commerce, the National Institute on Disability and Rehabilitation Research of the Department of Education, the Federal Communications Commission, and the Federal Emergency Management Agency.

Disseminating Information

One part of this broad scope to coordination is information dissemination and exchange. To that end, the federal EMS-C center should provide for a clearinghouse for the products of various EMS-C grants and contracts that it awards over the years. These may well relate to education and training programs, planning and evaluation tools, results of data collection and analysis, communication techniques, and many other subjects identified in Chapters 4 through 7 of this report. The committee takes no stance on whether the clearinghouse function ought to be based "in-house" or be contracted to an outside group. It does argue, however, that the materials and documents catalogued, disseminated, and exchanged should have a direct bearing on the national strategy that the center formulates.

Improving Access to Care

Numerous factors can limit the availability of appropriate emergency medical care for children and can otherwise distort patterns of seeking and receiving nonemergency care, which in turn impinges on the EMS system. The EMS-C center should identify ways in which actions at the federal level can overcome some of those limitations or help states and municipalities to do so. One step is to consider what the appropriate federal role is in ensuring adequate staffing in hospitals and EMS agencies, particularly because shortages are encountered in both urban and rural areas. It might, for example, review the issue of staffing "standards," as has been called for in other areas such as nursing homes.

Consideration of staffing issues will also require that the EMS-C center take broader questions of availability of facilities (or units within facilities) into account. The continuing closures of rural hospitals can leave communities

dependent on facilities in distant towns and affect the availability of prehospital emergency services as well. In suburban and urban areas, some hospitals are closing their EDs, thus reducing the availability of services and increasing the burden on remaining facilities. Access to emergency services may also be affected by policies of health maintenance organizations.

Lack of health insurance and low provider reimbursement rates in the Medicaid program constrain access to primary care, which increases the demand for ED services in two somewhat conflicting ways. First, children are often sicker when they finally seek care, and second, they are often brought to EDs for routine care. The latter problem may actually be the more difficult to solve (and questions about the troubling prospects for EDs of the future are revisited in Chapter 9). The EMS-C center, in concert with other appropriate federal agencies, should consider whether federal actions through Medicaid, MCH block grants, or other programs can help lower barriers to primary care and thus reduce the inappropriate use of EMS (particularly ED) services for nonurgent problems. These issues must be a serious concern because, as hospitals face increasing burdens from under-and uncompensated care, access to emergency care is threatened as well.

Drawing Attention to Illness-Related Emergencies

Emergencies from serious illness have, overall, received less attention than injury, yet illness is a major reason for young children, especially the very young, to require emergency care and hospitalization. As discussed in Chapter 7, for example, much less progress has been made for illness than injury in developing measures of severity. The EMS-C center should ensure that illness-related emergencies are not overlooked in the system development and research priorities of either federal programs or the provider community. One step might be to ensure that groups engaged in trauma and trauma system research (from funders to researchers) are better connected to groups concerned with those illnesses likely to create emergencies in children (e.g., asthma, seizures, or certain infections). Finally, the EMS-C center should also work to guarantee that due attention is paid to outcomes of care, broadly defined to include functional, emotional, and other outcomes that matter to patients and their families.

Enhancing Education and Training

The value and effectiveness of the current potpourri of education and training programs and curricula in EMS and EMS-C remain in question. This committee has emphasized the role of the states in educational matters, but in its judgment the federal government has a role to play as well. In

particular, federal leadership could be pivotal in promoting appropriate content of curricula, with an emphasis on components crucial to training in pediatric emergency care (such as assessment, cardiopulmonary and newborn resuscitation, trauma care, and management of severe illness). It should also ensure integration of EMS-C content into EMS educational programs. Finally, the federal center could also develop ways to act as or support a clearinghouse through which proven, or innovative, curricular programs and other teaching materials might be shared.

Collecting and Analyzing Data

The committee believes that assembling a core of nationally comparable data on pediatric emergency care is essential. The current scarcity of data and the lack of comparability in the data that are available pose serious impediments to assessment of emergency care needs, efforts to prevent injury and illness, evaluation of the care that is given, research on the clinical effectiveness of care, and research on the effective organization and delivery of care.

Therefore, the federal EMS-C center should provide a locus for stable funding for the development of a national uniform core EMS data set to be used in nationwide surveillance of EMS-C systems and functions. This work should give particular attention to coding schemes that will categorize patients by disease process, acuity, and interventions and that will support periodic analyses and comparisons of local, state, and regional information. (The committee's preliminary proposal for some of the elements of such a data set appears in Chapter 7.) Consistent with promoting the adoption of a uniform data set, the committee believes that the EMS-C center should assume responsibility for developing a national EMS-C database and providing, at a minimum, annual descriptive reports based on those data.

In this work the center should consult with the National Center for Health Statistics in CDC to ensure that effective use is made of existing data and that new data sets are, to the extent possible, consistent with other relevant data programs. In short, a significant part of the work of the EMS-C center will be to define the federal role in EMS-C data collection and analysis.

Similarly, the center should devise ways to support continued progress in methods to collect data reliably and in (near) real time. Advances in computer-based patient records, patient questionnaires, and trauma registry information systems illustrate the kinds of technologies and methods the center might investigate. It also should promote sharing of technologies and instruments for data collection that may be developed or adopted in various places around the country. In addition, the center should investigate the advantages and disadvantages of central registries of patients served by EMS systems that might enhance longitudinal surveillance. Controlling the costs of data collection must be a concern as well.

Finally, the federal agency assigned responsibility for EMS-C data should promote the use of those data for planning and evaluation at the national, state, and local levels. Thus, the EMS-C center must also work to make clear to funders and administrators the need for adequate resources (in the form of funding, personnel, and equipment) to support data collection activities, and it should promote reasoned allocation of those resources at the federal, state, and local levels.

A special word is needed about measuring funding for and costs of EMS-C and EMS systems. As noted in several places throughout this report, assembling complete, reliable, and valid dollar figures on the costs, or benefits, of EMS systems (let alone EMS-C programs and services) is extremely difficult. For example, programs appear in different parts of state, county, or city budgets (depending on where programmatic authority and responsibility lie); they are funded in different ways; and accounting systems differ across states and municipalities. Costs borne by hospitals and other providers for uncompensated care can be hard to estimate as is the value of services provided by volunteers.

Putting a dollar value on benefits is quite difficult, for a considerable number of methodologic reasons. Even more problematic are the difficulties, in ethical terms, of placing "value" on human life in general (and for the pediatric age range in particular) and on life-years saved, especially taking the quality of the lives saved into account. In fact, trying to move toward cost-benefit calculations may prove sufficiently demanding that policymakers and researchers may choose to focus on cost-effectiveness, where the equations would balance costs of services against effectiveness and outcomes not measured in dollar terms.

Notwithstanding these challenges, credible numbers for the costs of EMS-C must be found, if the programs are to be held accountable, evaluated, and justified to an increasingly beleaguered public. For this reason, the committee advises that the federal center give early and strong priority to developing methods for generating good cost and cost-effectiveness data and to making the case to the states that they, in turn, will need to find ways to obtain these data. Both the federal and state advisory councils can be used to carry this message to the broad set of interested parties in both the public and private sectors. All such groups must come to understand (1) that progress will be impeded to the extent that believable cost and financing numbers cannot be generated and (2) that all have a role in generating the relevant information.

Supporting Research

Finally, the committee sees the federal EMS-C center as one that can provide contract and grant support for targeted and investigator-initiated

research in the area of EMS and EMS-C. The center should consider both short- and long-term concerns, and it should aim to improve the knowledge base regarding the effectiveness of EMS-C programs. Because costs and financing rank among the very troublesome questions for EMS and EMS-C, the center should devote considerable research resources to refining methods for estimating benefits and effectiveness and to documenting costs, so that the cost-effectiveness of EMS-C can be better understood. Other topics (such as the need for better severity-of-illness and -injury indices, and others discussed in Chapter 7) should also be targeted for early investigation. The center should be charged, however, to coordinate its research program with related efforts in other federal agencies, particularly those in DHHS and NHTSA, to reduce the risk of duplication of effort and to enhance the opportunities for leveraging scarce resource dollars across agencies and projects. The earlier research program in trauma and emergency cardiac care for adults administered by the National Center for Health Services Research (the predecessor to AHCPR) may offer some useful direction for EMS-C research.

Creating Incentives for State Action

Because the federal government has only limited responsibilities for the direct operation of EMS systems, its efforts to improve their services must operate through states and localities and the various health care providers who do deliver those services. States are an especially important target because of their frequent role as funders of EMS and as regulators through standards for provider training and practice, facilities, and equipment. The federal EMS-C center should, therefore, assess mechanisms that could be used to encourage state action on EMS-C.

Funding programs (such as block or formula grants) are frequently used to promote specific goals. They can achieve their desired effect by providing additional resources and by prompting states to take actions required to qualify for funding. If the legislation called for in this chapter—to establish the center and to appropriate funds—does not specify criteria for state block or formula grants, then the center would need to develop criteria by which states would be eligible for grant or other support, and it would need to issue some form of guidance to the states.[7]

Those criteria would certainly need to be clear about the kinds of activities—training, supporting additional staff, purchasing new equipment, for example—that would be supported. The center might want to require the states to develop a formal plan for addressing EMS-C needs before federal funds are released, and it might also require them to submit an annual report indicating how those funds have been spent and how well the goals of the state plan have been met. Making some funding available on

the basis of a "formula" (size and other demographic characteristics of a population, for example) may be appropriate to help ensure that all states are eligible for at least some support.

Serious consideration should be given to the impact of funding mechanisms. Matching-fund programs, for example, may discourage participation by states with severe shortages of state funds; maintenance of "level of effort" (e.g., that a certain level of state expenditure in one-year becomes the base for ensuing years) also may be a significant barrier for states in serious fiscal disarray. Nevertheless, even with these disadvantages matching-fund programs can be extremely important politically and can contribute significantly to the perception, and the reality, of continuity of effort. Thus, a significant issue for the federal center (and its advisory council) will lie in devising funding strategies that will be attractive to states and feasible for them to manage.[8]

Apart from direct "grants," the EMS-C center should also seek to identify other mechanisms that could create incentives for states to give attention to EMS-C needs. These might involve different kinds of financial incentives (for research, training, highway funds, or the like), user liaison and outreach programs, and information exchange. For example, the center might undertake to increase access to training or to help finance purchases of additional equipment.

Providing Technical Assistance

States and localities may not have available the kinds of expertise they need either to assess shortcomings in their ability to provide emergency care for children or to develop the new programs that would improve their capabilities. A technical assistance program at the federal level could help make the necessary expertise available. That assistance might take various forms, including model legislation, periodic workshops conducted at the local level, or special expert panels assembled to give advice on especially difficult problems. Other areas include specific pediatric training and strategies for retraining, pediatric hospital classification and destination guidelines, pediatric triage protocols, and pediatric quality assurance criteria.

Early in its existence, the federal EMS-C center should identify high priority areas, such as data collection and analysis, where technical assistance would be especially valuable. Federal employees, outside experts acting as consultants to the center, and subcontractors might all be used in this technical assistance role.

NHTSA's program for state EMS assessments illustrates the kind of services that can be provided (NHTSA, 1991b). When a state requests an assessment, NHTSA assembles a team of experts and serves as a facilitator for the review. The members of the team are picked to ensure standing and

proficiency in areas of specific concern to the state (e.g., rural EMS systems, legislative proposals, or data systems). Assessments are made in 10 areas on the basis of standards developed by NHTSA: regulation and policy, resource management, human resources and training, transportation, communications, facilities, public information and education, medical direction, trauma systems, and evaluation. The judgments and recommendations of the assessment teams also take into account the unique features of a state.

Promoting Interstate Coordination

Because population and health care resources are not distributed evenly across the country, some states (or parts of states) must rely on the emergency care resources of neighboring states, particularly specialized pediatric referral centers, to provide the care that their populations need. States also may have common regional concerns but lack the resources or the motivation to develop cooperative responses.

The EMS-C center should develop ways in which federal activities can promote interstate coordination, which may well include addressing problems of both sparsely populated rural areas and urban metropolises. In so doing, it should determine whether federal regulations or program requirements create impediments to regional coordination and how those impediments can be reduced. Finally, it might investigate whether future federal efforts could facilitate interstate reimbursements under Medicaid or other programs, particularly in the context of state agency efforts to develop written transfer agreements and other interstate cooperative initiatives.

A special form of coordination to which the federal center ought to direct some attention is international, especially relationships between states of the United States and neighboring countries. Sixteen states share borders with Canada or Mexico; Alaska also has as a neighbor the former Soviet Union. In particular, cooperation and collaboration for states bordering on Canada and Mexico will be especially important in addressing the full range of issues and services embodied in this committee's view of EMS-C. The expected implementation of the North American Free Trade Agreement for Canada, Mexico, and the United States, which may attract new industries and new populations to the border regions, will add a challenge to the efforts of the border states to expand their EMS-C programs.

Models for a Federal EMS-C Center

Described below are several models that Congress and the Secretary of DHHS could consider in drawing up plans for a federal EMS-C center. This committee has recommended a fairly traditional federal agency arrangement, coupled with a national advisory council, but it notes that a hybrid

approach to organizational structure and governance might be considered. For example, the federal center would carry out tasks appropriate to national policy and serve as the publicly accountable agent for federal monies to pass to states, localities, and the private sector; one or more "national centers" or "technical" or "resource" centers might be established outside government to discharge specific responsibilities such as technical assistance and information clearinghouse functions.[9] In selecting these models, the committee has focused on the structure and activities of each, not any specific placement within the parent agency.

Existing DHHS Offices

At least two units located in the Office of the Assistant Secretary for Health, DHHS, might be regarded as prototypes for the type of agency contemplated by this committee, because they carry out the kinds of activities envisioned for the federal EMS-C center. One is the Office of Disease Prevention and Health Promotion (ODPHP); the other is the Office of Minority Health (OMH).

ODPHP was established in 1976 to coordinate DHHS policies and programs in the health promotion arena, and it has considerable responsibility within the PHS to implement various health promotion and disease prevention strategies (such as those advanced in *Healthy People 2000* [DHHS, 1991]). ODPHP is charged to foster the development and adoption of prevention efforts among many groups outside the federal government—both in state and local governments as well as many different organizations in the private sector. It supports staff involvement in a wide array of issues relating to prevention and conducts a number of cross-cutting programs (e.g., development of clinical practice guidelines in the prevention area; operation of a national health information center) on a budget that in FY 1988 was just over $4.4 million (DHHS, 1990).

OMH is a newer agency (created in 1985) to oversee implementation of the recommendations of a secretarial task force on black and minority health (DHHS, 1990; IHPP, 1990). Activities targeted on prevention (budgeted in FY 1988 at just under $8 million) include operation of a resource center for information on minority health issues—infant mortality; cancer; heart disease and stroke; cirrhosis caused by alcohol dependency; diabetes; homicide, suicide, and accidental injuries; and acquired immune deficiency syndrome. OMH has created a computerized database of materials, organizations, and programs pertinent to these issues. In addition, OMH administers a grants program to support community coalitions that will plan and implement innovative local efforts to reduce risk factors for disease among blacks, Hispanics/Latinos, Asians, Pacific Islanders, and Native Americans. It also underwrites the efforts of community-based and national minority organizations

to provide education and information concerning prevention of the transmission of the human immunodeficiency virus. As of late 1990, several states had followed the federal lead and established offices or similar bodies to address minority health problems (IHPP, 1990).

Centers on Pediatric Emergency Care

Some elements of other programs more directly associated with EMS-C might also serve as models for a national center. The two examples noted here are part of the EMS-C Resource Network; although based in the private sector, both are funded by MCHB in HRSA.

The EMS-C National Resource Center (NRC) at Children's National Medical Center in Washington, D.C., provides extensive consultation and technical assistance to state EMS-C projects or coalitions in a variety of areas: building successful coalitions, tracking legislation and forming public policy, and identifying long-term funding sources. Newly funded projects are assisted in initiating start-up activities, improving communication skills, and developing action plans. The EMS-C NRC provides guidelines for networking with community voluntary organizations that have a child advocacy focus, and it disseminates information about foundation, corporate, and federal funding sources. It also tracks and analyzes state and federal legislation and policy issues with a pediatric or an EMS focus, and it disseminates guidelines for educating the public about those policy issues.

The National EMS-C Resource Alliance (NERA), located at Harbor-UCLA Medical Center in Torrance, California, aims to improve EMS-C capabilities in existing EMS systems with the assistance of a network of experts who can serve as consultants on a variety of EMS-C matters. Its services include on-site and telephone consultation about child advocacy, minority issues, access for children with special needs, pediatric trauma, injury prevention, and other EMS-C topics; advice on data collection (including a uniform national EMS-C data base) and access, at low cost, to certain types of computer software programs developed by EMS-C projects; information about educational curricula, videotapes, quick reference drug and equipment charts, and equipment guidelines; and regional conference and workshops aimed at integrating primary care pediatricians, family physicians, and other providers into EMS activities. In addition, NERA publishes a quarterly newsletter (*EMSC News*).

Centers on Child Abuse and Neglect

One prototype for a national center might be the C. Henry Kempe National Center for the Prevention and Treatment of Child Abuse and Neglect, which is based at the University of Colorado Health Sciences Center

in Denver. An outgrowth of the Child Protection Team at the Health Sciences Center and in formal operation since 1972, the Kempe Center provides a wide array of education and training courses and materials, renders clinical services for individuals and families, and conducts research in the areas of child abuse and neglect, protective services, preventive interventions, and related policy concerns. Although its clinical services are concentrated in the Denver area, the Kempe Center serves as a national resource on clinical issues "by providing training and consultation on a fee-for-service basis and through networking and streamlining resources and referrals" (Krugman, no date, p. 4). Its activities include operating a clinically-oriented resource library.

NCCAN is an example of a national center within an existing federal agency (namely, the Administration on Children, Youth, and Families in DHHS). NCCAN, which has been in operation for nearly 20 years, conducts a variety of legislatively mandated and discretionary activities that are much like those that the committee believes are needed in EMS-C (U.S. Advisory Board, 1991): coordinating federal programs through an interagency task force; conducting research (including data collection and analysis) and making research grants; awarding grants to states and localities to develop or enhance services; providing technical assistance; and supporting the operation of an information clearinghouse (at the Kempe Center, noted above [Clearinghouse, 1992]). Recently, NCCAN has been criticized for relative lack of impact and deficiencies in its research and demonstration efforts, which the evaluators attributed in part to unrealistic expectations on the part of Congress and inadequate budget and staff (U.S. Advisory Board, 1991).

Other Executive Branch Models

The Office of Juvenile Justice and Delinquency Prevention in the Office of Justice Programs of the Department of Justice might be yet another model (U.S. House of Representatives, 1990; OJJDP, no date). It comprises divisions targeted on (1) research and development; (2) training and technical assistance to federal, state, and local governments, private agencies, and professionals in the juvenile justice system; (3) programs of special emphasis (e.g., reducing illegal drug use by high-risk youth); (4) state relations and assistance, which provides formula grant funds and technical assistance to states in areas such as separation of juveniles and adults in jails and implementation of comprehensive state plans; (5) information dissemination and other clearinghouse activities; (6) missing children; and (7) concentration of federal efforts. For FY 1993, appropriations for these various efforts totaled about $73.5 million, of which two-thirds constituted formula grants to the states.[10] The Coordinating Council on Juvenile Justice and Delinquency Prevention, an independent organization in the executive branch,

plays a key role. Operating under a mandate from Congress, this council comprises (among others) the secretaries of several cabinet-level departments, directors of several other independent agencies, and nine public members expert in the field of juvenile justice. It meets quarterly and makes recommendations annually to the President and Congress concerning coordination of policies and programs in this area and success in meeting program objectives and priorities. Although clearly the interests and purview of OJJDP and the Coordinating Council are much different from those envisioned for the federal EMS-C center and its advisory council (discussed below), their operational structures and organizational influence may bear important lessons for the program this committee is advocating.

A National Advisory Council

As proposed by the committee, the Secretary of DHHS should appoint a national advisory council for the federal EMS-C center.[11] This action serves two purposes. First, as has been noted, it adds to the visibility and credibility of the federal effort. Second, it helps ensure broad communication and interaction among all parties with an interest in EMS-C, EMS, and child health.

Structure and Membership

Although DHHS should determine the membership of the national advisory council (unless legislation has specified the expertise and constituencies to be represented), the committee advises that it reflect a wide set of interests and areas of expertise. These experts should be able to address operational and clinical concerns for illness and injury, but the general point is that the council must have broader EMS and child health perspectives in order to further the aim of integrating EMS-C better into these two fields.

Private Sector Membership Voting members should include representatives across a broad spectrum of health care providers. Among these at a minimum should be providers of prehospital care; pediatricians and other primary care providers for children; physicians in specialties such as emergency medicine and other fields appropriate to a full range of services from prevention and primary care, through definitive treatment of serious illness and injury, to rehabilitation; and nurses, including emergency and critical care nurses.

The hospital and insurance communities should be represented as well. Similarly, voting members should include representatives of the public, particularly consumer and child advocacy groups, and perhaps from the business community. Finally, membership should involve experts in health policy issues, such as those versed in health economics, health services research, health law, and related disciplines.

Public Sector Representation Representatives of state and local government (both executive and legislative branches) should be included as voting members. Nonvoting members should include representatives of federal agencies with major responsibilities in emergency medical care and child health and possibly other federal agencies with significant but less direct interests in these issues. Many of those agencies discussed above in connection with coordination of federal efforts would be represented. Altogether, the number of federal agencies with a potential interest in the activities of this proposed EMS-C agency is large.

In addition to representatives of government agencies, activists should not lose sight of the value of organizations that may bridge a gap between federal and state interests or across state lines. Groups that might sensibly be involved from the outset include the National League of Cities, the U.S. Conference of Mayors, the National Association of Counties, the Council of State Governments, the National Conference of State Legislatures, the National Governors' Association, the U.S. Conference of Local Health Officers, the National Association of County Health Officers, the Association of State and Territorial Health Officers, as well as the U.S. Advisory Commission on Intergovernmental Relations.

Length of Service The committee advises that members of the advisory council for the EMS-C center serve for a fixed period, such as two or three-years. The committee also advises that terms be set in a staggered fashion, so that no more than one-third to one-half of the advisory council is "new" in any one period.

Staffing and Reporting Given its charge, a national advisory council for the EMS-C center should require only minimal administrative support from DHHS; it is assumed that this support will come from the center itself. The committee also believes that the advisory council should be charged with issuing periodic reports to the Secretary, preferably annually. Those reports should be widely disseminated to, among others, Congress, involved executive branch agencies, the states and their EMS-C advisory councils, and other interested parties. They should present recommendations of the advisory council concerning the main goals of the EMS-C center as well as any advice it has concerning programs or activities to be initiated, carried on, expanded, modified, or ended.

STATE AGENCIES AND ADVISORY COUNCILS ON EMERGENCY MEDICAL SERVICES FOR CHILDREN

The committee's second major pair of recommendations in this chapter is that each state establish a lead agency for EMS-C and a corresponding advisory council. The committee takes no position on whether these should

be created by the governors or by state legislatures and assemblies, recognizing that the states differ widely in their constitutional and political structures (Rosenthal, 1990). For simplicity, the discussion is mainly in terms of gubernatorial action, because at some point the agency (and its council) will need to be supported as an executive branch entity.[12] The mission is to build an effort that can creatively pursue two major goals: to bring EMS-C issues to the attention of a broad audience in state, county, and local governments and in the health care community, and to have children's emergency health care needs incorporated into standards setting, system planning, and program operation.

State Agency Structure

These lead EMS-C agencies in the states are, in the committee's view, likely to have a much more direct impact on the organization and delivery of services to patients within each state's borders than the federal EMS-C agency can hope to have. Each state will have a unique mix of opportunities and constraints—based on factors such as population, geography, culture, political system, economics, and health care policies and resources—and each state agency must formulate programs suited to its specific circumstances. Thus, although the committee believes that lead agencies for the states are key to integrating EMS-C into EMS and in improving the outcomes of EMS-C, it does not present a single model for them.

Each state will need to determine, based on its specific organizational patterns and requirements, an EMS-C agency's appropriate administrative base. The critical requirements are that the lead agency clearly have the principal authority for EMS-C matters and that it operate at a high enough level to ensure that it can be effective with all the groups it needs to reach.

Several models for development and integration of EMS-C activities within state programs presently exist. New Jersey, through legislation, has established a program for EMS-C within the EMS agency. Other states (e.g., California, Idaho, and Maryland) have used the state EMS agency as the lead agency for EMS-C. These states have integrated ongoing EMS-C activities into the respective agencies and have specific advisory boards or committees for those agencies. In states with programs such as these, responsible officials may want to apply the IOM recommendations simply to ensure that the agency is appropriately placed and able to discharge its obligations effectively. In states where this is not the case, the governor should make such designation of a lead agency a matter of high priority. When an implicit designation of responsibility exists, the governor should make the agency and other interested parties fully aware of that assignment and make the designation explicit and public.

In some states where no obvious locus of responsibility for EMS-C can be found, the problem may be that departments disagree on where EMS-C responsibilities should lie—with an EMS bureau or an MCH office, for example—or that responsibilities are fragmented (inadvertently or otherwise) across units of the state government. In some states, the real heart of EMS may lie in regional, county, or local programs. In situations of this sort, the governor may find it convenient to appoint an advisory council first and seek its advice as to where best to locate an EMS-C lead agency, and perhaps even obtain its help in "negotiating" with the contending agencies to reach an agreement.

State Agency Charge and Agenda

The committee sees at least eight areas on which a state EMS-C agency ought to place high priority:

1. planning state programs;
2. enhancing education and training;
3. strengthening structural elements of the EMS-C system;
4. collecting and analyzing data;
5. improving access to care;
6. broadening interstate cooperation;
7. ensuring public accountability; and,
8. in terms of implementation broadly conceived, taking political considerations and fiscal constraints into account.

Planning State Programs

The committee believes that initial high priority should be given to the development of a comprehensive state plan for advancing EMS-C programs and integrating them within the existing EMS system(s) of the state. This will be crucial for the state to be able to compete successfully for federal funds or to use productively the formula or block grant monies to which it may be entitled.

In producing this plan, the agency must actively communicate with all sister units in the state government—those involved in EMS, in health care generally and child health in particular, in traffic safety, in law enforcement, and so forth. It must also reach out to government departments at the county and municipal levels. Finally, it must look beyond the public sector to those parties in the nonprofit and private sectors—the health care professions, child and public advocacy groups, and the like—whose cooperation and support will be necessary to effective implementation of the state plan. In this regard, active participation of the advisory council will be vital.

Enhancing Education and Training

Education in this nation is traditionally a state and local responsibility rather than a federal one. For the subject of this report, this remains a bedrock assumption. The states will and should have major obligations and duties in both public and professional education. The suggestions below, by no means exhaustive, are intended to illustrate the set of actions that a state EMS-C agency might take in the education arena, following the recommendations and discussion in Chapter 4.

Public Education This committee has formally recommended that states and localities develop more extensive public education programs in prevention, first aid, cardiopulmonary resuscitation, and how and when to use the EMS systems. These programs need to be developed for a variety of groups: parents, teachers, day-care providers, coaches, recreation personnel, others with responsibility for children's activities, and children themselves. The state agency should address where responsibility should lie for developing those programs and for actually bringing them to the target audiences. Where appropriate, it should establish criteria for the curriculum of such programs, provide financial support, underwrite teacher training, and in various additional ways take active steps to reach the relevant audiences and populations. It may be a special duty of the state agency to address particular concerns of minority or otherwise hard-to-reach groups, such as those in remote rural areas.

Professional Education This committee has also made a number of suggestions, and five formal recommendations, in Chapter 4 concerning professional education—new or augmented curricula in resuscitation skills in the early years of training, for example, and involvement of accreditation organizations in changing residency programs and establishing requirements for more advanced EMS curricula for certain health care professional groups. Although these recommendations are aimed chiefly at the professions, states may be able to help in several ways. For example, the lead EMS-C agencies can work with counterpart units in state departments of education to foster curriculum and other changes in publicly supported schools and universities. They can also review relevant licensing, certification, and accreditation requirements in the state (which may involve elements of other state departments as well), and promote continuing education efforts for practitioners licensed or certified by the state. Finally, these EMS-C agencies might support high-technology communications programs that would permit volunteer EMS personnel or those in remote areas to participate in educational activities without disruption of local emergency care services or personal lives.

Strengthening Structural Elements of the EMS-C System

Medical Control Originally focused on physician oversight of prehospital advanced life support procedures, support exists for extending medical control to all aspects of prehospital care (see Chapter 5). In its "off-line" form, it is particularly vital in system planning, establishing training requirements, developing triage and treatment protocols, and evaluating quality of care. Real-time (or "on-line") guidance is also valuable, but it remains costly to provide and beyond the means of many EMS systems.

State agencies should assess the adequacy of medical control for EMS operations in general and for EMS-C in particular. They should determine whether attention to the needs of pediatric patients in the existing medical control activities is sufficient and identify ways to improve the pediatric component where necessary. They should study both broad state level practices and medical control applied in local areas. For example, some communities may not have physicians with appropriate pediatric expertise who can provide the kind of oversight needed. The state agency should explore ways that the state itself, or the state's health care community, might provide access to such services for both off-line and on-line guidance in such locales.

Guidelines for EMS-C EMS-C requirements need to be addressed in all parts of a state's EMS systems, including training, equipment, system access (9-1-1 and enhanced 9-1-1 systems), dispatch protocols, triage and treatment protocols, transport procedures, and so on. The agencies should actively promote the development of appropriate EMS-C guidelines in all of these areas. The process should include determining the content of the guidelines and the providers to whom they will apply (e.g., whether first responders will have pediatric equipment requirements). Although the focus may initially be on statewide guidelines, state agencies also should give attention to how those guidelines will be implemented at the local level and ways that the process can be enhanced.

Collecting and Analyzing Data

As discussed at length in Chapter 7, the committee believes that data collection and analysis programs are a vital component of the comprehensive development of EMS-C capabilities. Without adequate data, it is difficult to know the true scale and nature of the demand for EMS-C services, how well those services are being provided, and whether better patient outcomes are being obtained. In the committee's view the state agencies should treat data collection and analysis capabilities as early and major priorities, much as it has advised that the federal center do.

States and localities need to be encouraged to develop systems for obtaining data on EMS-C patients; on prehospital, ED, and inpatient services; and on the characteristics of providers delivering those services. Lead agencies should emphasize the need for adequate and continuing funding to maintain data collection and analysis and the benefit to be gained in the improved ability to plan services and allocate resources efficiently. They should establish the principle (if not the absolute requirement) that data ought to be consistent across a state (and, ideally, across the country) and support adoption of a national uniform EMS-C data set proposed in Chapter 7. They also should advocate prompt movement toward computerized data collection efforts, including computer-based patient records, to take advantage of the considerable efficiencies available through computer-based systems.[13] Moreover, the state EMS-C agencies should ensure that plans are made for *use* of the data that are collected for research and analysis at the national, state, and local levels, because effective use will to a large degree determine the quality (reliability, validity, and completeness) of the data over time.

Improving Access to Care

Many structural and financial factors affect access to medical care. Children who are uninsured or whose care is provided through the Medicaid program face problems in obtaining care, and the physicians, clinics, and hospitals that do provide their care face financial burdens from insufficient reimbursement levels. The agencies should help identify barriers to care created by Medicaid and other payment schemes and explore opportunities that might exist for reducing those barriers. In this effort, the array of access indicators developed by the Institute of Medicine (IOM, 1993a), which will be adapted by the Robert Wood Johnson Foundation for its own projects, may be especially helpful.

Broadening Interstate Cooperation

Because of the particular distributions of population and medical facilities, in many places in the country patients who need specialized care must turn to hospitals in another state. In some areas, patients may even use hospitals in other states for more routine care. EMS agencies may also become involved in interstate operations. Where local facilities are lacking, they may need to arrange transport for patients to facilities in other states; alternatively, the emergency care providers may come from another state to provide services that are not available locally. Metropolitan areas spanning more than one state are yet another complex situation requiring consideration and cooperation; examples include Kansas City (Kansas and Missouri),

Memphis (Tennessee, Arkansas, and Mississippi), the District of Columbia (itself, Maryland, and Virginia), and Philadelphia (Pennsylvania, Delaware, and perhaps New Jersey). The Utah EMS-C project took on a similar challenge in fostering the development of a broad regional effort to develop uniform protocols and educational programs among the intermountain states of Utah, Wyoming, Montana, and Nevada. Idaho, Oregon, Washington, and Colorado are also participating in at least some of the regional activities.

Some states have been able to reach agreement on common standards for provider certification and authorized practices, but agreement on other issues such as Medicaid reimbursements or liability guidelines can often be more problematic. State agencies should try to determine the extent to which patients flow across their borders, either into or out of the state. Where movements of patients are substantial, they should try to identify the factors that underlie those movements and the problems that hinder interstate cooperation.

Clearly, individual state agencies will not be in a position to resolve all difficulties, but they should initiate a process aimed at resolving them. For example, state EMS-C agencies working collaboratively might be able to foster transfer agreements among facilities across state lines and, as a part of that effort, make progress on uniform facility categorization with respect to tertiary pediatric care. They might also undertake development of regional communication systems and protocols for prehospital care and medical control.

The agencies and their respective advisory councils should seek out any and all positive factors that can motivate states to seek greater interstate cooperation. Common regional interests and circumstances may make it useful for states to work together to develop programs, to share resources, and to learn from each other's past experiences, especially to the extent that federal mandates to states create fiscal or other problems that perhaps can best be addressed with some collective state action. Nevertheless, without institutional frameworks, sustaining or even initiating cooperative arrangements can be difficult, so representatives of the state agencies or their advisory councils must look diligently for opportunities for such cooperation and for mechanisms to sustain it. Working through national organizations concerned with state, county, and city matters, such as those noted earlier in this chapter, may be one effective tactic.

Ensuring Public Accountability

State agencies, or their advisory councils, must take visible responsibility for their actions; they must be, and be seen to be, publicly accountable for the performance of the EMS system. The public should have a way to ensure that their investment in EMS-C is beneficial and used in an appropriate

manner. Although the public might exercise that right more through an advisory council than directly with a state agency, the point is made here because the *ultimate* obligations for accountability rest with the public sector agency.

Apart from fiscal auditing procedures, a state agency might discharge its public accountability duties in several ways. Among the tasks that might be pursued are formal quality assurance for providers, rigorous program evaluation, citizen review panels for complaints, and review of training and continuing education materials and programs.

Taking Political Considerations and Fiscal Constraints into Account

Steps at the State Level Various approaches may be needed to bring about the kinds of changes required to provide adequate levels of care for seriously ill or injured children. State agencies should identify mechanisms most appropriate for their circumstances, depending on such factors as the political and economic climate, the flexibility and effectiveness of existing organizational arrangements, and the specific problems that demand the greatest attention. They can then formulate specific proposals with many environmental factors already taken into consideration.

In some cases, legislative action may be appropriate to establish an official EMS-C component in the state's EMS program. New Jersey, in fact, passed such legislation in September 1992 (New Jersey P.L. 1992, c.96). It establishes an EMS-C program in the state EMS office and creates an EMS-C advisory council; it also calls for the program to develop education and training for EMS personnel, an interhospital transfer system, pediatric rehabilitation units, and guidelines for triage, prehospital equipment, ED capabilities, pediatric intensive care units (PICUs), and pediatric trauma centers. The AAP (1992e, Appendix Q) has published the text of this legislation as a model that other states might follow. Legislation can also be targeted to specific problems, such as requiring use of bicycle helmets, motorcycle helmets, safety seats in automobiles, and protective gear for sports. Broader legislation involving consumer safety programs might call attention to issues concerning baby cribs, children's toys, medicines, cleaning supplies, plumbing codes for water temperature regulation, and smoke detectors.

Funding policies provide another tool that can be used to encourage adoption of desired practices. Medicaid reimbursement criteria could be revised to promote certain practices—for example, to encourage use of office-based physicians for routine pediatric care, to promote better prenatal care, or to coordinate care for children with chronic illness; they also could be modified to permit exceptions to certain reimbursement limitations (e.g.,

those on hospital length of stay) in special circumstances. Similarly, such regulations might be used to discourage other practices—for instance, to deny reimbursement for specific procedures performed at hospitals not meeting specific EMS-C qualifications. As a case in point, the Medical (California Medicaid) program will not pay for pediatric critical care services in hospitals that do not have a PICU, and neonatal intensive care will not be reimbursed unless rendered in an appropriate facility.

Relationships with "Local" Public Sector Entities Clearly, a concern of any state agency is how its work relates (or should relate) to activities at the county, district, and local levels. The particular distributions of statutory and regulatory authority, as well as historical (and unwritten) patterns, govern these relationships. One task before the lead agency will be to make creative and constructive use of those formal and informal controls to ensure that EMS agencies, other public programs (such as law enforcement or traffic safety), and institutional and clinical health care providers find the motivation and mount the resources to develop better EMS-C capabilities. For example, in some states, programs that specifically finance additional training in EMS-C or equipment purchases may be required to enable smaller communities to make the needed changes. The committee's point is that reaching its ambitious goals for EMS-C at the state and local level may call for uncommon sensitivity, as well as bureaucratic agility, on the part of the lead agency vis-à-vis its public sector counterparts at the substate level.

Relations with Nongovernmental Parties Actions by the state agency necessarily will involve special interests and groups "outside government." Here, too, the committee believes that perceptive attention to the needs, capabilities, and priorities of these parties will be critical. More than with the public sector groups mentioned just above, active involvement of the advisory council may be helpful. Creative thinking about incentives directed at professional groups (such as emergency nurses) and provider associations (such as the state hospital association)—for example, on matters relating to licensure, certification, accreditation, or even financing of postgraduate or continuing education—will be indispensable.

State Advisory Councils

Structure, Membership, and Other Factors

As at the federal level, state advisory councils should bring together representatives of key groups in local government and in the private sector as well as those in various state departments and offices that have an interest in or an impact on the delivery of emergency medical care to children. With respect to the private sector, EMS agencies and rescue squads, hospital

management, provider groups (including primary care physicians, emergency and critical care physicians, nurses, EMTs, paramedics, and rehabilitation and prevention professionals), and the public are all key players. A critical step is to bring into the group a broader array of participants than those who usually address EMS and EMS-C issues or, for that matter, children's health issues. Some creativity should be used in involving public groups, and approaches to entities such as the American Red Cross, Boy Scouts and Girl Scouts, Parent-Teacher Associations, and a wide array of other voluntary associations (e.g., the March of Dimes) should be considered.

One factor that has hindered recognition of pediatric emergency care needs has been a lack of input from pediatricians and others with pediatric expertise in EMS planning and advisory groups. In many cases, neither side has appreciated that a patient population with distinct emergency care needs was being overlooked. The need for specialized care for pediatric emergencies must be made clear among groups that have not yet recognized it, and the EMS-C community has to be able to work with groups with overlapping concerns.

Therefore, the state EMS-C lead agencies and their advisory councils should identify ways to include appropriate pediatric expertise. Permanent pediatric representation is preferable, but having a broad enough set of members from this area may risk making the formal advisory council too large and unwieldy. In such situations, a pediatric subcommittee might be created to advise the main group. Another tactic may be for the advisory councils to have all subcommittees, task forces, or work groups chaired or co-chaired by a pediatric representative.

The specific health offices involved will depend on the state; the areas of responsibility represented should include public sector EMS systems (e.g., those administered through city fire departments), child health and welfare, hospital planning and regulation, health care provider licensing and certification, and insurance programs and policies (including Medicaid). Offices with responsibilities for the chronically ill or disabled and for any special population groups (e.g., Native Americans, non-English-speaking communities) should be represented as well. In states with a large agricultural sector, a unit such as the Farm Bureau may be a valuable participant. Consideration also should be given to including state departments concerned with education. Finally, representatives of counties, metropolitan areas, and other forms of local government should have a place at the advisory table. In some states, substantial authority, experience, and influence in EMS lie with these local governments.

The actual structures of state advisory councils will vary by state. Some states may adapt the federal model with an advisory council that is appointed by the governor and includes voting members from the private sector and nonvoting public members. Others may look to different models

such as that offered by the appointment of a state board of health by professional associations or by a state health agency rather than the governor (IOM, 1988).

As with the federal advisory council, the committee advises that the term of the state councils be set for some minimum period (say, two or three-years) and be staggered. Periodic reports to the governor or the state legislature, or both, at least some of which are to be made public, should also be required.

One Model

An illustration of how advisory councils can be helpful is given by Washington State's recent experience in developing its trauma system (Esposito et al., 1992). The governor appointed an advisory committee to study the state's trauma problem and to develop a plan for a state trauma system. Within two-years, legislation was passed authorizing implementation of the trauma system. To gain a clear understanding of the patterns of trauma and trauma care in the state, the advisory committee relied heavily on obtaining and analyzing data. This information proved valuable in establishing budget priorities (training for rural providers was given a high priority) and in formulating system standards so as to encourage small, rural facilities to maintain or upgrade their capabilities. The value of obtaining data to make a thorough needs assessment may be an especially important message for states that have, as yet, done little to address issues of emergency medical care for children.

Potential Limitations to "New" Agencies and Councils

In proposing these new agencies and advisory groups, the committee recognizes that simply "establishing entities" is only part of the response that is needed to develop the emergency care capabilities to which children across the country should have access. Such organizations must be given the authority to establish regulations and implement new programs, but they also must bring some powers of persuasion into play given the political and fiscal constraints that have already been noted in the discussion of an agenda for state agencies. Thus, the credibility and enthusiasm of the members and the range of interest groups that they represent play an important part in determining the success of such organizations.

Although these considerations also apply at the federal level, the committee sees the responsibility for organizing and managing EMS-C services and integrating them better into both primary pediatric care and broader EMS programs as vested more in the states than in the federal government. Thus, the following discussion focuses primarily on state issues.

Political Considerations

Some states may be reluctant to establish an EMS-C agency or advisory council because of competition for attention to many matters within the state. If many advisory bodies already exist, little energy or patience may be left for yet another group. This may be especially true if the new group is likely to present recommendations for new, perhaps unfamiliar, tasks for state and local agencies that are already struggling to meet their current obligations.

There is also some risk that a proposal for entities targeted on EMS-C will lead to a large number of similar requests from other groups that see their issues as equally compelling. Determining which, if any, of those requests to accept may be so costly in political capital that the EMS-C position will be much weaker than it might otherwise have been.

Related to these points is a considerable political science literature that explores differences in state political culture and general receptivity to (and capacity for) policy innovation (Walker, 1969; Gray, 1973; Rose, 1973; Menzel and Feller, 1977; Foster, 1978; Light, 1978; Savage, 1978; Berry and Berry, 1990). An historical lack of interest or responsiveness in such areas (e.g., health) could prove to be a problem, especially if it exists in states that have, to date, made little progress in EMS or EMS-C programs. That is, states with the biggest need to move ahead forcefully could conceivably be those most likely to drag their policymaking feet.

Active competition among departments or among important groups in the provider community can make it difficult to form an agency—or advisory group—that can work together or that will be recognized by all sides as authoritative. Such competition may be about jurisdiction for specific programs, or it might be tied to the funding implications of recommendations that the state bureaucracy might decide or the advisory council might suggest. Indeed, such fragmentation is common in many spheres of public health policy and can prove extremely difficult to overcome (see, e.g., Rabe, 1986). Furthermore, various groups and influential individuals may not be persuaded that these special mechanisms are needed to ensure adequate attention to EMS-C concerns. Reasons for such hostility may reflect a general resistance to regulation or the view that enough opportunities exist within routine procedures to make any changes that are needed.

Fiscal Constraints

Another source of likely resistance stems, of course, from fiscal considerations. At latest count, some 35 states are in fiscal distress (Ehrenhalt, 1992; Gold, 1992; National Association of Budget Officers, 1992). This follows an explosion of state spending during the 1980s especially in the

areas of health care, environmental protection, criminal justice, and economic development. These constraints, coupled with considerable uncertainty about economic prospects and concerns about continued federal mandates in programs such as Medicaid (Weissert, 1992), make states notably less likely than before to be amenable to assuming *any* new funding responsibilities, no matter how worthy. This may be an especially significant barrier in states requiring balanced budgets, such as California and Michigan, where statutes would not permit them to finance EMS-C efforts without "paying" for them directly.

The present lack of credible data on the costs and benefits of EMS-C, or on the marginal costs and benefits if such programs were expanded, makes arguing for such efforts more complicated. In the short run, proponents must to some extent fall back on clinical, ethical, and political reasoning; but in the longer run, should the committee recommendations be forcefully acted upon, better cost, outcome, and effectiveness data should be available, ameliorating this problem to some extent.

THE CASE FOR NEW ENTITIES TO ADDRESS EMERGENCY MEDICAL SERVICES FOR CHILDREN

While fully aware that its recommendations for new federal and state entities may face some obstacles, the committee nonetheless firmly believes that ensuring adequate emergency medical care for children is of such significance that those obstacles must be understood, met, and overcome. In seeking to bring major attention to children's needs, the committee is not proposing to establish a new entitlement for children's medical care. Instead, it is trying to ensure that children are not *deprived* of the level of care that is the expected norm for adult patients. EMS systems and EDs are widely assumed to be equally capable of caring for children and adults. In fact, this is not true. Children's needs have been (and continue to be) overlooked in emergency medical care, and the committee wants to see that oversight corrected.[14]

In recommending the formation of federal and state centers and advisory councils for EMS-C, the committee believes that they can and will have the following special merits:

- *Advancing an ethical imperative*. One might first consider the ethical argument: Surely no compelling rationale exists for ignoring or downplaying the needs of children vis-à-vis those of nonelderly adults or the elderly.[15] Both the national and the state agencies and councils can make this point directly and forcefully to many different audiences.
- *Counterbalancing the weakness of children as a political force*. Because children must depend on others for their care, the committee believes

that society has a special responsibility to ensure that they receive appropriate care. Unlike adults, children have no political voice to raise on their own behalf in pursuing such care. Therefore, a voice must be raised for them. This committee's report is one such voice, but to sustain it, especially at the state and local level, the committee believes that entities such as those described above will be necessary.

- Furthermore, advisory councils, in particular, are well suited to bringing to the table groups in the private sector that may, for whatever reasons, rarely if ever engage in productive discussions or negotiations about EMS or EMS-C. That is, councils can be, in effect, a neutral arena in which the various parts of the professional and health care delivery communities, the business sector, labor, the voluntary associations, and others can usefully exchange views and work toward mutually beneficial programs and services. Solid achievements along the lines of the recommendations in this report might have beneficial spillover effects for other knotty health policy issues in those states and localities.
- *Providing visibility for an important health need*. The committee is seeking to establish highly visible and prestigious focal points for addressing EMS-C issues quickly and aggressively. It believes that the entities recommended in this chapter should be appointed by the Secretary of DHHS and the state governors in order to invest them with sufficient stature and influence to be able to bring to EMS-C issues the level of attention that they require. In the majority of states, a gubernatorial body has ample precedent to be a vehicle for serious policy deliberation and innovation; the same is true of secretarial-level groups. They ought to be able, therefore, to bring together the diverse groups that have important roles to play in EMS-C but which would otherwise lack an established means of working together. They would provide a channel for information and ideas to flow among a broad range of groups.
- *Strengthening partnerships across federal, state, and local levels of government*. These proposals at both the federal and state levels reflect the committee's position that neither level alone can adequately address the full range of issues that must receive attention. Some matters, such as developing nationally comparable data or broad guidelines for education and training, will benefit from the national perspective. Other matters, such as provider certification requirements or medical control procedures, which relate more directly to the delivery of care, are appropriately addressed at the state (or perhaps local) level. Substantial areas of overlap exist between national and state concerns—for example, using federal funding to create incentives for state action, collecting and analyzing data, or disseminating the results of research—and this factor should lead to coordination of efforts between federal and state agencies or advisory councils or both.

The proposed structures might in many respects be a model for the sort

of federal-state partnership that may prove increasingly desirable in health policy in the future. Given the serious fiscal constraints of the federal government and a majority of the states, future intergovernmental initiatives in health policy are unlikely to be successful if they require substantial amounts of new funding. Various recent federal mandates, including many in health care and public health regulation, have generated requirements for additional state spending with little or no federal funding support, leaving states increasingly cynical toward new initiatives from Washington (Conlan, 1991; Zimmerman, 1991). As a result, any EMS-C policy strategies that call for major new state expenditures or impose significant new federal oversight are virtually certain to meet state—and local—government resistance and face considerable implementation problems.

By contrast, the proposed federal center, plus state lead agencies, are intended to stimulate rather than impose requirements for state actions. This approach recognizes the extraordinary diversity in state capacity to fund effective EMS-C programs as well as the tremendous interstate variation in the challenges that EMS-C providers face. Rather than attempt to compress these different states and situations into a uniform national model for EMS-C, the idea is to give new prominence and visibility to the issue at both the national and state levels while permitting each state to explore its own unique circumstances and opportunities for improvement.

In fact, a growing body of literature on intergovernmental relations emphasizes the limitations of federal policy interventions that involve rigorous federal "command and control" over state actions (Conlan, 1988; Anton, 1989). More coercive interventions may be warranted in those situations where a need for a uniform federal standard exists and its implementation is feasible. Construction of interstate highways is a case in point, as are eligibility standards for Social Security and Supplemental Security Income, Medicare reimbursement practices, and standards for federal MCH block grants. All of these programs, however, run a risk of fostering intergovernmental conflict and developing a preoccupation with procedural compliance rather than creative problem-solving; more innovative partnerships may be more desirable and more effective (Wilson, 1989; Osborne and Gaebler, 1992).[16]

In some ways, the committee proposals may be in the tradition of past federal health policy efforts under the Hospital Survey and Construction Act of 1946 (the Hill-Burton Act), which is seen as a unique model of intergovernmental problem-solving and relative ease of implementation (Peterson et al., 1986). The primary purpose of the Hill-Burton Act was to fund hospital construction and expansion, but it also provided each state with a small amount of funding to develop planning groups that could examine state hospital needs and develop statewide priorities for allocating subsequent Hill-Burton dollars. This approach recognized the enormous interstate variation

in hospital capacity and need, and it enabled each state to tailor plans with minimal federal direction.

- *Improving organizational efficiency*. Yet another political argument is one of efficiency in government. All states, whether in fiscal turmoil or not, can benefit from streamlined, nonduplicative bureaucracies and agencies, less interagency conflict over turf, clearer policy directives and authority, and better communication with and accountability to the public. The committee's view is that appropriately constituted and supported agencies, especially at the state level, can address jurisdictional problems and foster more efficient planning, oversight, and operations of EMS and EMS-C programs, at least those parts of such programs that relate to the public sector or are affected by governmental policies and funds.
- *Improving economic efficiency and countering economic losses*. An economic argument can be made to the effect that promoting the delivery of high quality emergency care to children can reduce both the direct and the indirect costs associated with adverse outcomes from inadequate care. For example, if an injured child receives no care or inadequate care, the years of life and labor lost are much greater than what would be calculated for an adult. Arguably, the psychic costs for the child and his or her family are greater as well. Furthermore, additional direct economic costs may be incurred in rectifying the problems that timely and appropriate care could have forestalled. Thus, these agencies and advisory councils can help ensure that services relating to prevention of injury and illness, disability prevention, and rehabilitation for children are included in the state EMS plan and are linked to more general planning for child health needs. More broadly, they can work to guarantee that these and related emergency services are universally available to all children residing in the state.

FINANCING CENTERS, AGENCIES, AND RELATED ACTIVITIES

Proposing new programs and new organizational entities, no matter how worthy, is irresponsible if not accompanied by some examination of the cost implications. This is especially true when the programs and agencies are in the public sector and when fiscal constraints on the public treasury are as severe as they are in this nation today. It is even more critical when the mandates come from the federal level and the funding must be found at the state, county, or municipal level.

This committee did not attempt to develop a thorough cost-benefit or cost-effectiveness analysis of its recommendations—doing so would have been beyond its charge and, as discussed above, would not have been as full as possible owing to the significant lack of appropriate, reliable, valid, or generalizable cost data. The committee did, however, develop some rough

estimates of levels of *federal* expenditures that would be needed to start and sustain these efforts in the short run. It offers one specific funding recommendation in this chapter, and returns to costs and benefits issues in the final chapter.

The committee advocates congressional appropriations of new federal monies for each of the ensuing five-years for federal and federally supported activities related to emergency care for children. Part of this funding would directly support federal center efforts; most of the funds would be made available to support state agency programs (and perhaps, through the states, some local activities).

Specifically, **the committee recommends that Congress appropriate $30 million each year for five-years—a total of $150 million over the period—to support activities of the federal center and the state agencies related to emergency medical services for children**. The five-year time frame is essentially arbitrary, and the committee has not made allowances for inflation.

The total of $30 million per year might be allocated as follows, although these figures are purely illustrative:[17] $1.5 million for direct operation of the federal center in DHHS (including staff costs, travel for advisory council members and staff, and similar expenditures); $1 million for data collection, analysis, and minimum data set activities; and $1.5 million for technical assistance and clearinghouse tasks. An additional $2.5 million might be allocated for research, which the committee explicitly assumes will be awarded for extramural research; the committee takes no stance, however, on whether the national advisory council should have review and approval authority over such contracts or grants.

The remaining $23.5 million (that is, about three-quarters of the total annual appropriation) might be allocated to the 54 "states" on the basis of a two-part formula—one part representing fixed costs and the other representing variable amounts based on population. The latter, for instance, might be a function of the absolute number of children in the state (e.g., persons age 0 to 17 years) or a function of children as a proportion of the entire state population. Thus, for each entity, an annual grant of $250,000 for fixed operational costs might be supplemented with population-based grants from $50,000 to $500,000 per year. States and localities (e.g., counties, metropolitan areas), as well as organizations in the private sector, would be eligible to apply for federal funds for research, technical assistance, clearinghouse activities, and similar functions financed directly through the national center. State agencies could establish policies for making some portion of their own federal dollars available to local communities or in state private sector entities (in addition to whatever state funds such agencies might have at their command for these purposes).

This committee cautions that the recommended level of support is the

absolute minimum for development of an effective program. A token, underfunded EMS-C program cannot discharge its responsibilities satisfactorily. Such an effort may thus waste the resources that are provided, lead to a false sense of security about the state of EMS for children today and tomorrow, and be unable to demonstrate any meaningful effect on the planning and delivery of emergency care for children.

Alternatives to this two-part, five-year strategy might be considered. For example, the EMS-C demonstration program in HRSA might be expanded. The committee welcomes the FY 1993-97 reauthorization as an interim, maintenance-of-effort step, but the panel also regards it, for long-term progress, as too awkward and indirect an approach. First, a federal grant program cannot easily accomplish many of the goals the committee wishes to see accomplished now at the federal government level. Second, *continued* reliance on simply a demonstration program (and one that is sparsely funded at that) risks undercutting the visibility the committee wishes to bring to the need to improve EMS-C throughout this country and delaying needed progress at all governmental levels.

This committee clearly envisions a major expansion of EMS-C activities in both the private and public sectors as a consequence of its full set of recommendations for education, communication, data, research, and the like. A significant number of such programs would involve start-up efforts, and many of these will be in states and locales facing drastic budget problems of their own. The committee does not view a sixfold increase in existing funding, under these circumstances, as inappropriate for giving the entire program the visibility and influence it needs from the outset.

In its financing recommendations, the committee has specified a target amount for the sake of concreteness and face validity. It recognizes, however, that detailed point estimates can be convenient targets for critics and budget-cutters. Moreover, implementation can be a rocky road, and some details and desirable (or not so desirable) aspects of this effort will emerge only as the program progresses. Thus, it concedes that the recommended dollar figures above might well be revised, either upward or downward, over the proposed five-year funding period. Part of the reason for advising that the federal center develop annual, public reports is to enforce accountability for monies expended, to provide ammunition to counter critics, and to make the case, where it can be made, for increased levels of funding in the future.

The committee also acknowledges that its recommendations may seem costly in the face of stringent budget constraints at the federal and state levels and the need for "pay-as-you-go" legislation at the federal level (pursuant to the Deficit Reduction Act of 1990 [Omnibus Budget Reconciliation Act of 1990, P.L. 101-508]). It rejects, however, the notion that in *absolute* terms this level of spending is excessive to address the myriad needs of a

broad-based program to expand and integrate EMS-C into a more comprehensive EMS program for the country and to promote stronger links with broader child health concerns.

SUMMARY

To focus attention on efforts to improve EMS-C, the committee set forth in this chapter two pairs of recommendations regarding the establishment of EMS-C entities at the federal and state levels (see Box 8-1). Specifically, the committee recommends: (1) that the U.S. Congress direct the Secretary of DHHS establish a federal center or office, together with a national advisory council, to identify national concerns in EMS-C and to coordinate federal efforts in this area, and (2) that the states establish lead agencies, as well as related advisory councils, to identify specific EMS-C needs in their states and communities and to address the mechanisms appropriate to meeting those needs. The committee advocates secretarial and gubernatorial action to ensure that EMS-C issues receive adequate attention. To underwrite these efforts initially, the committee further recommends that Congress appropriate a total of $30 million each year for five-years (for a total of $150 million over the period).

In these efforts a broad range of parties must be represented at all levels. State bodies should accommodate the very diverse needs, resources, and organizational characteristics of individual states (rather than attempt to reflect a preconceived single model).

Significant issues at the national level include: developing a national strategy for EMS-C, coordinating efforts throughout the federal government, disseminating information and serving a clearinghouse function, improving access to care, underscoring medical illness as a special concern in EMS-C, assisting education and training efforts, collecting and analyzing data, supporting enhanced research efforts, creating incentives for state action, providing technical assistance, and encouraging regional coordination. At the state level, the following matters are paramount: planning state programs, enhancing education and training, strengthening structural elements of the EMS-C system, collecting and analyzing data, improving access to care, broadening interstate cooperation, ensuring public accountability, and taking political considerations and fiscal constraints explicitly into account.

The committee strongly supports its recommendations for federal and state action on EMS-C. It recognizes limitations and possible resistance, but it concludes that the counterarguments and strengths of these types of entities outweigh the drawbacks—both in general and for EMS-C in particular. The committee is confident that, by starting at the highest levels with a public-private approach (as is inherent in its proposal for advisory

councils), efforts to ensure that children's emergency care needs are met will, at last, receive adequate attention.

BOX 8-1 RECOMMENDATIONS CONCERNING FEDERAL AND STATE AGENCIES AND FUNDING FOR EMS-C

The committee recommends that:

- Congress direct the Secretary of the Department of Health and Human Services to establish a federal center or office to conduct, oversee, and coordinate activities related to planning and evaluation, research, and technical assistance in emergency medical services for children.
- Congress direct the Secretary to establish a national advisory council for this center; members should include representatives of relevant federal agencies, representatives of state and local governments, the health care community, and the public at large.
- states establish a lead agency to identify specific needs in emergency medical services for children and to address the mechanisms appropriate to meeting those needs.
- state advisory councils be established for these agencies; members should include representatives of relevant state and local agencies, the health care community, and the public at large.
- Congress appropriate $30 million each year for five-years—a total of $150 million over the period—to support activities of the federal center and the state agencies related to emergency medical services for children.

NOTES

1. As discussed in Chapter 7, ICD-9-CM E-codes refer to the set of "external cause-of-injury" codes that supplements the standard diagnostic codes of the International Classification of Diseases, ninth edition, clinical modification.

2. The Department of Defense (DOD) has been responsible for much research into acute emergency care and historically has trained many medics, corpsmen, and similar personnel. This training is not identical to civilian EMS training, but it may well meet paramedic certification and licensing requirements in various states. Although DOD provides medical care, including emergency care, to children of service personnel, its principal focus in research and training is on care of active-duty personnel, particularly for combat casualties. The health care system of the Department of Veterans Affairs also delivers some EMS care but obviously does little if anything in the pediatric EMS arena.

3. The committee considered at appreciable length various alternatives to the creation of a federal center or office for EMS-C. These included continuation of the demonstration grant program—essentially a status quo stance not favored by the committee or likely to be an acceptable option to key interested parties, such as those in Congress. Also debated at great length was creation of a federal or secretarial "Task Force," which would fall quite short of a new center or office. This was rejected as insufficient to the tasks and responsibilities outlined

in this chapter for the proposed center, as likely to have many administrative and political drawbacks, and as likely to delay more effective federal action.

4. For purposes of the discussion about a federal center and state agencies, the committee assumes a total of 54 "state" entities—namely, the 50 existing states, the District of Columbia, Puerto Rico, the Virgin Islands, and a combined area of American Samoa, Guam, and the Commonwealth of the Marianas. It uses the term "state" for simplicity of presentation.

5. A report by the congressional Office of Technology Assessment (OTA, 1989) on needs in rural EMS identified five areas where federal leadership was needed: promoting training of providers; facilitating the development of national guidelines; providing technical assistance to states; supporting research; and providing incentives for state planning. The committee regards these areas as equally appropriate for EMS-C; many relate directly to the policy and program needs examined in Chapters 4 through 7. The committee's proposals also address other concerns: supporting national data collection and analysis, with attention to a uniform data set, conducting research, and disseminating research findings are cases in point.

6. In addition to elderly adults, Medicare regulations apply to children with end-stage renal disease (IOM, 1991c).

7. With respect to funding EMS-C efforts, the committee takes no stance concerning formal block or formula grant specifications enacted into law. It notes several problems with that approach, however. First, if the legislation is not crystal clear, the process of developing implementing regulations (which would require approval by the Office of Management and Budget) or even formal guidance could be difficult and drawn out. Second, it is not a given that such statutory language, regulations, or guidance could be made sufficiently flexible that the EMS-C office could respond adequately to the quite varied circumstances of pediatric emergency care across the states. That factor could thus inhibit the agency's ability to foster the variety of different programs and activities that might be desirable in these locales.

8. Weissert (1992) examines the potential (and now real) effects of federal (chiefly congressional) mandates to states in the absence of federal resources adequate to meet those mandates. This committee is sensitive to the fiscal problems now facing many states, particularly those in financial distress and those needing to upgrade their Medicaid programs substantially. It therefore calls for federally mandated requirements on the states in the area of EMS and EMS-C to be issued only when they can be accompanied by appropriate levels of federal support.

9. Various models of a federal EMS-C center could be considered. The most direct is one that operates as a government agency and is located, bureaucratically, within an existing agency; the committee recommends this option, chiefly for its appeal in coordinating disparate federal efforts and the clear accountability that can be maintained for the disbursement and use of federal monies. A variant is to site the agency somewhere outside the government itself, as in a university setting. Another option might parallel the "national laboratory" model, where the government establishes and owns the facilities but contracts with an entity in the private sector to run it; in this instance, the government can exercise a fair amount of control depending upon how stringently the contracts are written and enforced. A third possibility is the grant model, in which an existing agency might simply award a long-term grant to a private sector group such as a university; here the authority of the government to direct activities will be weaker than through a contract mechanism.

10. The authority for making grants and contracts to the states (for "development of more effective education, training, research, prevention, diversion, treatment, and rehabilitation programs in the area of juvenile delinquency and programs to improve the juvenile justice system") is spelled out in considerable detail in amendments to the original legislation for the OJJDP (U.S. House of Representatives, 1990, p. 10). Of interest, for example, is that funds are allocated annually among states on the basis of population under 18 years of age, minimum amounts for every state, and requirements for three-year state plans and annual performance reports.

11. The committee is cognizant of the fact that federal advisory groups might be constructed under several different rubrics and in several different ways. For instance, it might be called a task force, a secretarial work group, a federal coordinating committee, or a national advisory council (as this committee has done), or any number of other designations. In federal administrative terms, these have different connotations and, in theory at least, different memberships and levels of authority. Some may have private sector voting members and federal government nonvoting members, again as this committee has proposed. Others may be only interagency task forces with advisors and consultants from the private sector; yet others may be constructed so as to involve both the public and private sectors in equivalently responsible roles. Furthermore, some arrangements may be only advisory, with no implementation authority or public accountability; others may have more far-reaching powers, such as the responsibility to approve research grants above a certain dollar level.

12. For the discussion of lead EMS-C agencies at the state level, "state agency" refers specifically to the recommended "lead agency" in each state's executive branch; to avoid confusion, other elements of state government are designated as departments, offices, units, or by some other rubric.

13. Significant impediments to progress toward computer-based patient records are often encountered at the state level, through archaic requirements for maintaining paper records, having physician signatures in ink, and similar conditions (IOM, 1991a). Obviously, expecting a state EMS-C agency to take the lead in overcoming such obstacles is not realistic, but such an agency can support appropriate change in state statutes and regulations that would permit inpatient and outpatient settings and offices to move more expeditiously toward computerized systems. It might be able to take an even more daring position concerning computer-based record keeping for prehospital providers. Assistance might be available from the Computer-based Patient Record Institute, established at the recommendation of an IOM committee (IOM, 1991a), which as of 1993 was temporarily house in the Chicago offices of the American Health Information Management Association.

14. Although attention to children has increased in some communities, EMS systems, and training programs, pediatric concerns remain a low priority for others. East Tennessee Children's Hospital, for example, resorted to suing the state of Tennessee to get children included in the state trauma plan. More recently, early drafts of the National Trauma Plan mandated by the Trauma Care Systems Planning and Development Act of 1990 (P.L. 101-590) omitted reference to existing pediatric standards and the specific needs of children despite explicit legislative language requiring their consideration; following public and professional review and comment, later drafts corrected the oversight.

15. In other health policy spheres, the argument that the pendulum must swing back toward children is already having some impact. Recently, general expansion of Medicaid programs through the Omnibus Budget Reconciliation Acts of 1989 and 1990 (P.L. 101-239 and P.L. 101-508, respectively) has been targeted at women and children. For example, these statutes have mandated complete state coverage of pregnant women and children up to 6 years of age who are in families with incomes below 133 percent of the federal poverty level, with subsequent coverage phased in, one-year at a time, for all children through 18 years of age with family incomes less than 100 percent of poverty (Lee, 1992; Weissert, 1992). Some health care reform proposals appear to be predicated on the need to address access problems that affect disadvantaged populations, which clearly include intolerably high numbers of children (NRC/IOM, 1992a).

16. Several IOM reports touch on these questions of federal-state-local relationships. The landmark report, *The Future of Public Health* (IOM, 1988), delineated coordinated levels of responsibility for public health activities at the federal, state, and local levels—namely, "assessment, policy development, and assurance" (pp. 7-8); it went on to specify functions and responsibilities unique to communities, states, and the federal government in some detail. The mission of public health introduced in that report—"fulfilling society's interest in assuring

conditions in which people can be healthy" (p. 7)—is one with which the present committee's focus on EMS-C is quite congruent. This consistency with the earlier, broader report lends additional credibility to the committee's recommendations that there be leadership from the federal government but considerable operational action by states and localities.

A more recent monograph on prevention of disability (IOM, 1991b) makes the point that meeting the challenges of disability and prevention calls for federal, state, and local responsibility: "Government involvement at all three levels is a necessary condition for progress" (p. 261). It calls on the federal level "to provide leadership, financial support and technical resources to states and localities" (p. 262) and for states and communities to act "on their own" as well. This report goes on to argue that "input and contributions from the private sector" (p. 263), such as businesses and other private organizations and associations, also will be necessary, further underscoring the need for effective links to be forged between the public and private sectors in addition to those developed across all levels of government.

Even a program such as Medicare can gain from approaches that extend beyond simple federal administration. In a detailed examination of approaches for ensuring the quality of health care delivered to the elderly (IOM, 1990b), yet another IOM committee laid out a strategy that involved considerable collaboration between a federal agency (HCFA), state-based (but private) Peer Review Organizations, and local provider organizations (hospitals, physician offices, health maintenance organizations, and the like).

17. For comparison purposes, the following figures for the main (non-Medicaid) federal program for children might be considered. For the MCH block grant program to the states, which is administered by MCHB/HRSA, approximately $547 million was available in FY 1992 for direct block grants, approximately $96 million for SPRANS grants (Special Projects of Regional and National Significance), and about $11 million for program operations at the federal and regional office level, for a total of about $654 million. Operations thus constitute about 1.7 percent of the total. The proposed level of funding for EMS-C (i.e., $30 million annually), much of which would be a pass-through to states or would support special projects and activities, represents the equivalent of about 4.6 percent of the MCH block grant effort.

Figures from the HRSA EMS-C demonstration grant program also provide a useful context. For example, start-up funds for the initial four projects were approximately $500,000 each ($2 million annually in the early years of the program); more recently, annual allocations for two resource centers totaled approximately $650,000. Appropriations in FY 1991 were $5 million for about 22 different projects. In October 1992, the EMS-C program was reauthorized until 1997 (P.L. 102-410) "for such sums as may be necessary for each of the fiscal years 1993 through 1997"; funding had been $5 million for each of FY 1991 and 1992. This bridging authorization is basically a means of ensuring some continuity in the EMS-C effort until action can be taken on the IOM committee's recommendations.

9

Improving Emergency Medical Services for Children: Looking to the Future

Comprehensive care for illness and injury in children includes organized and coordinated systems of emergency medical services (EMS) that can provide timely access to appropriate forms of care. As this report shows, however, throughout most of the country the ability to provide that care to children is limited by lack of attention to children's unique needs in emergency care. The report has addressed in detail certain areas where significant steps must be taken to ensure that children's emergency care needs can be met.

The committee is concerned that other important issues affecting emergency medical services for children (EMS-C) have not been addressed. A systematic assessment of benefits and costs of EMS-C is needed, but serious conceptual and practical questions remain unanswered. Matters of health care reform, access to primary care, and pressures on emergency care facilities and providers are of considerable significance for EMS-C but lie beyond the scope of this committee's charge. Nevertheless, they should not be overlooked. This chapter briefly examines certain major issues that form the backdrop against which the committee's recommendations will have to be played out.

BENEFITS AND COSTS

In an era of severe budget constraints at the national, state, county, and municipality levels, the difficulties of paying for programs such as EMS and EMS-C loom large. To persuade officials to find the necessary funds,

some estimates of the costs of the programs—and the benefits expected from them—ought to be generated. Ideally, both costs and benefits would be precise and methodologically defensible, would cover many different types of costs and benefits, and would be denominated in dollars. Practically, costs (and expenditures) can be difficult to calculate, particularly across the many different activities, settings, and types of personnel encountered in EMS and EMS-C; furthermore, separating out *EMS-C* costs from those for EMS poses an especially great challenge. Benefits are even more difficult to define and measure; in addition, they can almost never be couched in dollar terms. Instead, they have to be stated in terms of measures of effectiveness and outcomes, such as lives saved, debilitating impairments averted, illnesses and injuries prevented, or time to complete recovery reduced.

In principle, then, this committee would have liked to develop estimates for costs and benefits of EMS-C; in practice, it determined that at this stage, doing so was fraught with too many drawbacks and limitations in the knowledge base. Work is needed to resolve these problems. Offered here is a discussion of some key issues in addressing benefits and costs.

Benefits

Most of what has been documented about the benefits of emergency care for children concerns reduced morbidity and mortality from injury (see Chapter 2). Some measures are applicable to adults and children. Assessments of preventable deaths are often used to evaluate the effectiveness of trauma centers (as remarked in Chapter 7). Other, indirect measures include less delay in reaching definitive care and reductions in suboptimal care, from which inferences are made about long-run benefits to health and well-being.

Other outcome measures commonly used for adults include return to productive activities (chiefly work, especially the *same* work as held before a severe injury or illness) and extent of recovery of physical and cognitive functioning. Depending on the age of the pediatric patient, these types of measures may be fairly appropriate (return to regular, full-time schooling, for instance, as a substitute for work-related activities) or fairly implausible (cognitive functioning in an infant). As in many other areas of health services and health policy research, however, the appropriate measures of benefit for children—in health-status and quality-of-life terms—are not well developed.

Benefits also may be estimated in terms of costs of health care that might not be incurred (by virtue of preventing or reducing the morbidity that results from trauma or illness) and in terms of incomes earned over a productive lifetime that might otherwise not be earned. These costs can be

more difficult to conceptualize and certainly more difficult to measure for children than for adults. Making lifetime estimates of such variables requires major assumptions about length of life, other health events that may occur during that lifetime, earnings, and rates of discounting future dollars (or indeed any benefits) to the present (which is, in effect, when the EMS funds will be spent); all such assumptions are likely to be more heroic in studying children than in studying adults.

These points are essentially technical, methodologic issues—ones that make benefits difficult to estimate accurately. There is no question, however, that benefits of EMS systems can be demonstrated, at least for adults suffering major trauma. For example, Shackford and colleagues (1986) compared the frequency of suboptimal care and preventable deaths of major trauma victims before and after the establishment of a regionalized trauma system. Suboptimal care occurred in 32 percent of the cases before the system was instituted and in only 4 percent of cases afterward; of deaths, the proportion judged preventable dropped from 14 percent to 3 percent. Champion et al. (1992) reported that the presence of a trauma center resulted in 13 more survivors per 100 patients treated per year among those patients with high injury severity scores. On the basis of those findings the authors estimated that 6,900 lives could be saved annually by having trauma centers nationally.

Translating these figures into concrete estimates for children is not straightforward. What can be said, however, is that deaths among children account for the loss of many more years of healthy life or quality-adjusted life years than do deaths among adults. Thus, good EMS and EMS-C programs can be expected to have very great impact for children, in terms of productive lives saved, disability and impairment forestalled, and other problems averted.

Benefits of injury prevention programs have been documented as well. For example, through an energetic and effective nationwide injury prevention effort, Sweden reduced the rate of fatal injuries in 1-to 4-year-olds from 55 per 100,000 population (in 1957-59) to 7 (in 1986) (Bergman and Rivara, 1991). As noted in Chapter 6, the "Children Can't Fly" initiative in New York City, through several different tactics (installing window guards in houses, enacting legislation requiring such guards, and conducting various educational and outreach efforts), reduced falls from windows by 50 percent (Speigel and Lindaman, 1977; National Committee for Injury Prevention and Control, 1989). A study in Ontario, Canada, documented a high incidence of unsurvivable injury (owing to the severity of the initial injury) and concluded that over the long run, "promotion of injury prevention programs will likely prove more cost-effective in reducing injury morbidity and mortality than any changes in trauma care systems" (Dykes et al., 1989, p. 729).

Despite these encouraging facts as well as the many advances in EMS-C documented in this report, the dearth of information about the benefits, in terms of health outcomes, of EMS-C programs *per se* is clearly a hindrance to developing quantitative estimates of cost-benefit or cost-effectiveness ratios. This is one reason that so much emphasis was put on patient outcomes (and costs) in developing the research agenda for EMS-C. What clinical expertise, personal observation and experience, and common sense tell us now about the value of EMS-C can then be rendered in monetary terms better suited for making programmatic and funding decisions.

Costs and Financing

Costs and financing issues rank in significance with patient outcomes and benefits. The committee has argued for a concerted initiative in the public and private sectors at the national, state, and local levels to expand EMS-C programs across the country. In the committee's view, this must happen by ensuring that EMS-C resources and planning become integral elements of the broader EMS scene; further, EMS-C must be solidly linked to broader child health concerns. However, in a period of growing anxiety about costs of care and rising inability of the nation to believe it can pay for the health care system it has now and wants to maintain, such calls for expansion of one portion of that system must acknowledge that funding such efforts will require difficult trade-offs between many worthy programs.

The public sector is severely affected by fiscal constraints. The private sector is also affected, and this includes health care organizations, facilities, and individuals (i.e., the providers of emergency care services and the consumers of those services). Hospitals, particularly trauma centers, face serious reimbursement problems. For example, reimbursements based on diagnosis-related groups tend to underestimate the level of care required for victims of major trauma; the numbers of uninsured patients are not decreasing and may indeed be increasing; and trauma center costs cannot be covered, with cross-subsidies less available and infusions of state funds less likely. Reimbursements for primary care are also problematic, and to the extent that they are very low in the Medicaid program, they are a disincentive for office-based physicians to accept Medicaid patients and an incentive for such patients to continue to rely on hospital emergency departments (EDs).

One conclusion to be drawn from all these factors is that a partnership between the public and private sectors will be required—neither can handle the costs alone. It is partly for this reason that the committee has advocated an agency-plus-advisory-council structure that deliberately involves the private sector.

The committee's desire to see EMS-C incorporated into the larger EMS system means that EMS-C funding mechanisms must largely reflect existing arrangements. The merits of those funding mechanisms and any alternatives—which include public funds drawn from general revenues and special fees, fee-for-service charges (which may or may not be covered by insurance), excise taxes or fees for 9-1-1 telephone service, subscription drives for private services, as well as reliance on volunteers as providers of prehospital services and medical control—should be assessed.

Beyond simply financing EMS and EMS-C programs lie additional costs for training and for equipment and supplies; these are a particular concern when EMS systems are trying to expand in ways that will provide high quality EMS for *children*. Moreover, other activities advocated by this committee related to planning, evaluation, quality assurance and improvement, and research (data collection and analysis, in particular) are all significant programmatic efforts that can consume equally significant amounts of money. They are, however, essential for ensuring that EMS systems provide clinically sound care in an efficient and cost-effective manner. In short, meeting all these monetary needs will be a major challenge—one that the committee believes the national and state advisory councils should consider placing high on their respective agendas. They will need to do so in full recognition that aggregate outlays for health care are high and growing more rapidly than the economy as a whole and that reallocations of health-sector dollars among competing needs may be the likely near-term solution.

A CHANGING HEALTH CARE ENVIRONMENT

The health care system within which EMS-C exists faces significant questions regarding its shape and structure in the future. Although EMS-C concerns are not likely to determine the answers to these questions, EMS-C will certainly be affected in important ways by the decisions that are made. Health care reform promises to have the most far-reaching effects, but increasing pressures on hospital EDs are a more immediate concern. The committee found it neither feasible nor appropriate to address these larger issues in detail, but it was unwilling to ignore them and their possible implications for EMS-C. They are briefly explored below.

Health Care Reform

No one confronting health care policy and delivery issues today can fail to notice the intense debate about health care reform now occurring in this nation. Whatever directions reform takes, it can be expected to have an impact on EMS-C, and most experts argue for special attention to the health needs of children in whatever reforms are made. Those calls tend to focus

on primary care, however, and some on the committee thus were concerned that EMS-C might not command the attention it deserves.

Arguably the most pressing issue confronting the health care system today is the continued upward escalation in health care expenditures and costs of care (or, more precisely, the continued growth in the *rate* at which expenditures increase). Spending levels in this country are expected to be more than $903 billion in 1993 (14.4 percent of the nation's gross domestic product [GDP]) and nearly $1,740 billion (18.1 percent of GDP) in 2000 (Burner et al., 1992). These figures well outstrip health care expenditures of other industrialized countries. The disparities in spending have not, however, translated into better (or sometimes even equivalent) coverage of the population, nor have they given us better health outcomes as reflected in standard population indices such as the infant mortality rate. Furthermore, virtually every part of the health care sector has experienced increases in expenditures—both the private and public sectors, both fee-for-service and prepaid capitated systems, and both inpatient and outpatient care. Increases in employers' group health insurance premiums have been very steep in recent years, although the upsurge may have been dampened by other changes in the health insurance picture; these include more utilization management, more health maintenance organizations (HMOs), preferred provider organizations, and point-of-service plans, and greater cost-sharing by employees.

The other leading concern is access to care—that is, the ability of individuals needing health services to recognize that need and to seek and obtain appropriate care in a timely way. These elements are hallmarks of emergency care. Appropriate care might be thought of as necessary and effective care that can maintain or improve the health status and quality of life of individuals and populations. Some of the barriers to that care lie in residence, language, cultural values and expectations, and the presence of impairments or stigmatizing diseases.

More fundamental concerns for access, however, are problems that have been clear for some time: something approaching 35 million, perhaps even 40 million, people in this country have no or at best sporadic health insurance coverage and concomitant poor access to care; the bulk of those individuals (although clearly not all) are from poor families; and this lack of access affects children hardest. These are not new problems—what *is* new is the erosion in health insurance benefits that the middle-class once took for granted and the apprehension that health care may not be available, or at least affordable, should it be needed.

Demographic and socioeconomic factors contribute to the challenges facing our health care system. The "graying of America" reflects the fact that an increasing proportion of the population is over the age of 65; it raises concerns about the large number of the elderly who live alone, the

aging of this population itself, and the remaining high levels of poverty among the elderly. Some suggest that emergency care for the elderly deserves attention much like that being recommended by the committee for EMS-C (Sanders, 1992). Moreover, the proportion of the total population accounted for by immigrants and nonimmigrant minorities is growing, and differences in socioeconomic and health factors between blacks and Hispanic groups, on the one hand, and the white population, on the other, are dramatic. Families themselves are changing; single-parent households, nontraditional households of various sorts, and homelessness are all on the rise.

Patterns of illness are changing. The control of many infectious diseases and the emergence of chronic illness has shifted most deaths to later ages. Some implications seem clear: death is a less relevant endpoint to measure; health-related quality of life is a more salient one. The same can be said for the emergence of impairments and disabilities—we save more people from genetic illness and life- or limb-threatening injuries, for example, leaving them to live longer lives but often of poorer quality. Superimposed on this picture is a complex set of sociomedical problems—acquired immune deficiency syndrome (AIDS), use and abuse of illegal drugs, alcohol, and tobacco, and both interpersonal and intrapersonal abuse and violence. Some of these (especially the last) have immense ramifications for EMS in general and EMS-C in particular.

Something else is changing: people's attitudes toward health and health care services. People expect to be able to exercise some autonomy and to express their preferences about how they will be cared for. This means they expect to be informed about all reasonable options open to them and what the benefits and risks of those options are. Although patients with life-threatening emergencies typically are not physically capable of entering into decisionmaking or expressing preferences, other patients requiring emergency care, the families of patients, and perhaps especially the parents of acutely ill or injured children may well have concerns in this regard. EMS and EMS-C systems around the country must, therefore, consider these points.

The number of health care reform proposals circulating in Washington by year-end 1992 was large and growing (AMA, 1991; Blendon et al., 1992), with most observers expecting a landmark reform proposal to be introduced by the incoming Clinton Administration by spring 1993.[1] Furthermore, action on the state level is accelerating (Blue Cross of California, 1992; IHPP, 1992; Iowa Leadership Consortium, 1992).[2] Some plans are quite comprehensive, others narrowly focused, and some are quite well thought out and others less so, but all appear to take a long-term view of improvement of the health care system.

Significant reform will require painful choices for many parties and trade-offs among several desirable objectives. It will also demand that a considerable array of difficult topics be competently addressed: who pays;

what are the covered benefits; who makes the rules; how universal is coverage and access; how best should we reach special populations in need; how will we contain costs; how can we maintain and enhance the infrastructure for health care (e.g., the information and knowledge base; health personnel and facilities); how central do we want characteristically American preferences for diversity and choice to be; and how can we maintain, if not improve, the quality of health care and the value received for our health care dollar.

Answering these questions will have immense ramifications for EMS and EMS-C. This committee takes the position that those responsible for the future of EMS and EMS-C must become knowledgeable in the technical aspects of health care reform proposals.[3] The proposed national advisory council (and state councils in those states where significant reform changes are under way) could easily be expected to track these issues carefully to ensure that the interests of EMS-C and EMS more generally are reflected in national or state reform bills. Because, in the committee's view, EMS-C should also operate against the broader background of children's health care, how (and how well) proposals for restructuring the health care system attend to particular needs of children will be especially important (NRC/IOM, 1992a).

Special Challenges for EMS Systems

Regardless of the outcome of the health care reform process, EMS-C must contend with more immediate challenges that arise out of problems facing EMS and the larger health care community.

The Demand for Emergency Services

EMS systems, particularly in major urban areas, face increasing demand for their services, often in circumstances in which emergency care resources are scarce or overburdened. In some areas of the country, the call for ED and inpatient care exceeds the capacity of the hospitals in question, making it difficult for them to provide optimal care.[4] In rural areas, prehospital EMS providers may need to serve large regions with limited staff and equipment. Moreover, lack of 24-hour physician coverage in EDs and loss of ED services secondary to the closure of small rural hospitals (200 between 1980 and 1988 alone) place increasing demands on the remaining prehospital providers (OTA, 1989; GAO, 1991a). In urban areas, hospitals and EDs are closing as well, often because of, or to avoid, the financial burden of uncompensated care, particularly for trauma patients (GAO, 1991b). To the extent that Medicaid eligibility is broader for children than for adults, the financial risk from potentially uncompensated emergency care of children

may be somewhat less than for similar care of adults (Mitchell and Remmel, 1992); in practical terms, however, this may turn on whether persons eligible for Medicaid (or parents for their children) have actually enrolled in the program.

Overcrowding in remaining EDs and in hospitals results in long waits for care and even long delays in providing beds to patients requiring inpatient care (Andrulis et al., 1991; Baker et al., 1991; Bindman et al., 1991; GAO, 1993). Such delays may be attributable in part to increased visits for violent acts, illegal drugs, alcohol use, and AIDS-related illnesses as well as to hospital occupancy rates above 60 percent (GAO, 1993). Some EDs in seven major cities report responses to overcrowding such as refusing to accept transfer patients and even refusing to receive any ambulance patients; for patients seen in some of these EDs, waiting time for beds was more than a day (sometimes several days) (Andrulis et al., 1991).

Emergency Care Personnel

Emergency care providers themselves are among the scarce resources in EMS. The loss of volunteer emergency medical technicians (EMTs) and paramedics, who are the only providers of prehospital care in some localities, is a special concern for some EMS systems (OTA, 1989; McHenry, 1991). The GAO (1993) reported that nursing shortages in the ED were significant factors in delays for physician examination and for transferring admitted patients to inpatient beds. Stresses associated with the demands of emergency care are contributing to loss of providers and difficulties in replacing them. Work stress has been documented among all levels of providers—EMTs and paramedics, nurses, and physicians (McHenry, 1991; Neale, 1991; Back, 1992; Gallery et al., 1992). Providers are increasingly concerned about violence in the community and even in the ED (Keep et al., 1992), as well as about the risk of infection from treating patients carrying dangerous diseases.

Caring for children is often reported to be extremely stressful, a situation of particular concern for EMS-C. In fact, the critical-incident stress debriefing program in Virginia's EMS system has found that 40 percent of its debriefings are related to the death of a child or adolescent, and only 26 percent to adult deaths (McHenry, 1991). As the roles of EMS and EMS-C evolve, these work force issues must receive serious attention.

The Impact of "Anti-Dumping" Regulations

Hospitals, EDs, and EMS systems are facing concerns over the impact of requirements for minimum levels of care and appropriateness of transfers of patients between facilities. Since August 1986, federal legislation (the

Consolidated Omnibus Budget Reconciliation Act of 1985 [COBRA] and the Omnibus Budget Reconciliation Act of 1989 [OBRA]) has required that hospitals that meet Medicare "conditions of participation" must evaluate any unstable patient or woman in labor (regardless of insurance or payment status) who arrives at the hospital's ED. A hospital must (within its staffing and equipment capabilities) do what is necessary to stabilize the patient before transferring that patient to a different facility, a mandate set in place to counter inappropriate transfers for economic reasons (a practice widely characterized as patient "dumping").

The legislation poses several complexities for individual hospitals and for an integrated EMS system, in which transfers can play a considerable role. First, the level of service required before a patient can be discharged or transferred may not be clear; for hospitals with comparatively minimal EDs or with extremely overcrowded EDs, pressures for staffing and equipment (and consequent costs) may be intense. Second, acceptable grounds for transfer or refusal of further care need to be defined clearly. Cases in which the primary reason for the transfer is explicitly identified by the sending facility or physician as "indigent" or in which no specific reason is given are certainly suspect, but many other cases may be less conclusive.

Third, who makes the assessment to determine that a patient is stable (and able to be transferred) or unstable (and thus eligible for care in the original facility) may be a critical factor. Decisions may differ depending on whether the assessment is made by a physician or a nurse, or whether the clinician making the assessment has special training in emergency medicine. Fourth, dumping can be a particular problem for pediatric tertiary centers. In particular, referring hospitals can claim that they are transferring patients to a higher level of care (i.e., a solely pediatric institution) when the reasons may be more economic than medical. Fifth, COBRA and OBRA can complicate efforts to make appropriate referrals to primary care providers, if ED obligations to patients without a need for emergency care are not clear.

The demands created by these requirements along with the financial burden of inadequately reimbursed care are leading some hospitals to limit or eliminate the emergency services they provide. Thus, the net effect may prove to be a reduction in the health care resources available to the very patients whom the legislation was intended to help. Again, the committee did not explicitly take up the topic of evaluating the impact of COBRA and OBRA on EMS and EMS-C—in part because their overall impact is still not well documented or understood and in part because doing so would have exceeded its charge. As with other matters raised here, the committee suggests that the proposed national advisory council might be well advised to consider this issue.

The Role of Primary Care

Although some (possibly most) of the demand for emergency care is associated with real needs for that level of care, many other patients seek care in emergency settings for conditions that could be treated successfully in a primary care setting. This fact significantly complicates the ability of EMS systems to respond appropriately or adequately to all patients. The GAO (1993) reports that from 1985 through 1990, visits to EDs increased 19 percent overall, chiefly in hospitals with fewer than 100 beds (30 percent) and in rural or small urban areas (respectively, 27 and 24 percent). Of the nearly 100 million ED visits in 1990, only about 17 percent were for clearly life- or limb-threatening (emergency) problems; about 40 percent were for urgent problems (needing treatment within 12 hours but not threatening life or limb). The remaining 43 percent of patients did not need immediate care and could probably have been treated in a physician's office, but lack of a primary health care provider was the main explanation for ED use.

Lack of primary care increases the numbers of patients using emergency services in two ways. When children (or adults) do not receive appropriate treatment early in the course of an illness, their condition can deteriorate to a point at which urgent care is necessary. Lack of basic preventive care such as immunizations also contributes to this need for ED care. In addition, when primary care is unavailable (or difficult to obtain), parents seek care in the ED for their children's minor illnesses and injuries. (Conversely, however, providing alternative, accessible primary care services can change ED use [Paneth et al., 1979].)

Many factors can make primary care services difficult to get, particularly for working-poor and low-income families who may lack health insurance altogether. On a very practical level, clinic and office-based services may be unavailable in the evening, on weekends, or when working parents would more easily be able to bring their children for care (Glotzer et al., 1991). This leaves the ED as the most recognizable source of care. Even among families with adequate income and health insurance, the ED may serve as a backup to regular sources of care (Chessare, 1986; Smith and McNamara, 1988; Yarboro, 1990), and for some, the ED may be especially appealing when their primary care visits are not fully reimbursed by insurance. Insurance coverage for ED visits and not for physician visits is a strong financial incentive to use an ED rather than a primary care provider. Transportation obstacles or appointment requirements may discourage use of a primary care provider by an anxious parent who is able to reach the ED more easily. For some parents, lack of telephone service is a barrier to use of appointment-based services.

Difficulties in obtaining primary care services under Medicaid pose

special challenges to the EMS system (particularly EDs). Low reimbursement levels and a high administrative burden are limiting the number of physicians willing to participate in the program. Between 1978 and 1989, surveys found that the proportion of pediatricians caring for at least some Medicaid patients dropped from 85 percent to 77 percent (Yudkowsky et al., 1990). The average Medicaid reimbursement for a well-child visit was only 53 percent of their usual fees (Yudkowsky et al., 1990) and was roughly 80 percent of Medicare rates for comparable office visits (McManus et al., 1991). Perhaps not surprisingly, growth in ED use between 1985 and 1990 was greatest among Medicaid patients (34 percent) (GAO, 1993).

Higher reimbursement rates may increase the willingness of physicians to participate in Medicaid, but increased participation will improve access to care only if the additional services are in areas (such as inner cities) where patients can use them (McManus et al., 1991; Margolis et al., 1992). Furthermore, barriers to enrollment must still be overcome. Factors such as lengthy and detailed application forms, documentation requirements to verify information supplied, literacy and language difficulties, as well as the complexity of the Medicaid program itself (with multiple eligibility categories and income scales), lack of automation of the eligibility determination process, lack of outreach to provide assistance to potentially eligible individuals, and inadequate staffing in the Medicaid offices have been found to hinder Medicaid enrollment in the District of Columbia (GAO, 1992). Many of these problems are doubtless generalizable to other states and localities.

A Changing Role for Emergency Departments?

Nowhere are these issues—current demands on hospitals and the availability of primary care for children—felt more keenly than in the nation's EDs. As we have seen, many children, particularly those from disadvantaged families but increasingly middle-class children, lack adequate access to primary care and preventive services. EDs are called on more and more to provide those services. Several questions can be raised about this trend: Is this an appropriate role for EDs? Are they now equipped to fulfill it? If not, should they be?

Some proponents of a wider responsibility for EDs argue that patients in the pediatric age group will continue to constitute a significant portion of their workload. They take the view, therefore, that EDs ought to be prepared to render a broader range of services, specifically including those that are traditionally thought of in terms of office-based or clinic practice (such as immunizations). EDs may provide important care that children would not otherwise receive and may serve as a gateway to other health and social services that now reach entirely too few pediatric patients. In fact, several communities participating in a federally assisted effort to increase early

immunization of children have included ED access to immunization services in their plans (Woods and Mason, 1992).

To the extent that children receiving nonurgent care are insured (at least by Medicaid) and services are reimbursed by third parties at levels sufficient to cover the ED's costs, having the capacity to deliver primary care services may make it easier or more affordable for hospitals to acquire and maintain high-technology equipment and to have adequate numbers of specialists on the staff to cover true emergencies around the clock. Most agree, of course, that this is an expensive way to provide primary care. As was noted above, however, the financial incentives for patients and providers do little to encourage greater use of primary care: private insurance is more likely to cover ED visits than primary care visits and Medicaid reimbursements to primary care providers are significantly below their usual fees for office visits.

Others see little future in reshaping the role of the ED. The sheer impossibility of doing so, for already overstretched EDs in urban hospitals that cannot cope today with the volume of severely ill and injured patients they see, is one argument against trying to expand the role. Providing additional services to uninsured populations is clearly not financially viable for any sustained period. In facilities where maintenance of even standard ED capabilities (let alone capacities for, say, advanced trauma care) is threatened by increasing demand for basic emergency services, any move to greater primary care functions for the ED is likely to be unsustainable. The loss of core emergency care functions in an effort to address a broader social need is clearly not the outcome that the EMS and EMS-C communities would desire. Some make a different argument against expanding primary care services in EDs: providing those services because society will not take the steps to underwrite primary care in traditional settings simply postpones a day of reckoning about how this nation will care for its younger generations.

There was no consensus on these issues among the members of the committee, and addressing them formally was beyond the scope of the committee's charge. Nevertheless, the dilemma is clear. In some locales, primary care provided in hospital EDs may permit EMS-C interests to thrive; in others, primary care may swamp ED resources and erode capacity to meet true emergency needs. In the short-term at least, it will not be possible to expand the primary care system quickly or broadly enough to relieve burdens on hospital EDs, and those now under stress will doubtless continue to experience problems.

The committee did agree that the role of the ED in health care delivery in general and the implications of that role for delivery of genuine emergency care should be addressed explicitly in studies that may be done on the future of primary care, the future of case management and managed care

programs, the future of trauma systems, and the future of the American hospital. Similarly, it agreed that, as the role of EDs evolves, the ramifications for education and training of professionals who staff EDs will need to be better understood.

FINAL THOUGHTS

Attempts to ensure that children receive adequate emergency medical care are a recent development in the field of EMS. This committee takes the position that EMS-C efforts in the future must consider all the elements that constitute good emergency care *and* good health care generally, working through channels in both the public and private sector. The needs of children must be more widely recognized and made a genuine priority for policymakers at national, state, and local levels, particularly those in a position to influence the future directions of EMS and EMS-C. The committee intends for the conclusions and recommendations presented in this report to foster increased public attention and action at the highest levels toward an EMS-C system for the 21st century in which all parties can be confident and all can be proud.

NOTES

1. This report went to press before the Administration's health care reform proposals had been made public. The main outlines for this plan indicated it would be a form of managed competition under the discipline of global budgets, in which "health insurance purchasing cooperatives" (HIPCs) across the country would offer "accountable health plans" (AHPs) to most, if not all, individuals in their respective regions. AHPs might be expected to take the form of large managed-care organizations, sometimes referred to as Super-HMOs. AHPs would compete in part on the basis of a standard basic benefit package, which would be established by a National Board. Exactly where EMS services would fit in this benefit package is unclear. Many observers expect that the basic benefit package would emphasize primary care more comprehensively than in the past; if this is so, such an approach might dampen the current demand on EDs to provide primary care services.

2. The Robert Wood Johnson (RWJ) Foundation has taken a major lead in state health care reform, in a move perhaps reminiscent of its leadership in the EMS arena of two decades ago. RWJ will award sizable grants to 12 states (Arkansas, Colorado, Florida, Iowa, Minnesota, New Mexico, New York, North Dakota, Oklahoma, Oregon, Vermont, and Washington) to develop innovative ways to expand health insurance coverage and contain costs; program outcomes will be tracked over several years by an evaluation team headed by staff of the RAND Corporation and the Urban Institute.

3. In *Assessing Health Care Reform*, the Institute of Medicine gave its perspectives on health care reform to help clarify the critical issues in the debate (IOM, 1993b). Necessary steps include the following: making insurance compulsory if universal access is a goal; ending medical underwriting and continued segmentation of the risk pool if the private insurance market is to be a responsible part of the financing of health care; developing clearer and more realistic estimates of expenditures and genuine options for financing and for cost containment; enhancing efforts in quality assurance and improvement and practice guidelines; and attending

to certain infrastructure issues such as education and training for health care personnel, the future of public health programs, the knowledge base, and health services research. Two other IOM reports examine specific issues in greater detail. One addresses the complexities of employment-based health insurance, with particular emphasis on financing and cost-containment options (IOM, 1993c). The second identifies indicators of access to care, which will aid in evaluating progress in implementing health reform plans (IOM, 1993a).

4. Services from pediatric intensive care units (PICUs) are also at a premium. As noted elsewhere in this report, about 300 PICUs with about 2,900 beds operate across the country (American Hospital Association, 1991). One analysis indicates that these beds are unevenly distributed, and children in economically poorer states are less likely to have access to them (Cuerdon et al., 1991).

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Appendixes

Acronyms

AACN	American Association of Critical Care Nurses
AAOS	American Academy of Orthopaedic Surgeons
AAP	American Academy of Pediatrics
AAPCC	American Association of Poison Control Centers
ABEM	American Board of Emergency Medicine
ABP	American Board of Pediatrics
ACEP	American College of Emergency Physicians
ACGME	Accreditation Council for Graduate Medical Education
ACLS	Advanced Cardiac Life Support
ACS	American College of Surgeons
ADA	Americans with Disabilities Act
ADL	Activity of daily living
AHA	American Heart Association
AHCPR	Agency for Health Care Policy and Research
AIDS	Acquired immune deficiency syndrome
AIS	Abbreviated Injury Scale
ALI	Automatic location identification
ALS	Advanced life support
AMA	American Medical Association
ANI	Automatic number identification
APA	Ambulatory Pediatric Association
APACHE	Acute Physiology and Chronic Health Evaluation
APCO	Associated Public-Safety Communications Officers
APLS	Advanced Pediatric Life Support

ARN	Association of Rehabilitation Nurses
ASCOT	A Severity Characterization of Trauma
ASTM	American Society for Testing and Materials
ATLS	Advanced Trauma Life Support
BAT	Basic Aid Training
BLS	Basic life support
CAHEA	Committee on Allied Health Education and Accreditation
CDC	Centers for Disease Control and Prevention
CME	Continuing medical education
CNMC	Children's National Medical Center
CPR	Cardiopulmonary resuscitation
COBRA	Consolidated Omnibus Budget Reconciliation Act
CRAMS	Circulation, Respirations, Abdomen, Motor, Speech scale
DHEW	U.S. Department of Health, Education, and Welfare
DHHS	U.S. Department of Health and Human Services
DOD	U.S. Department of Defense
DOT	U.S. Department of Transportation
ED	Emergency department
EDAP	Emergency Department Approved for Pediatrics
EMS	Emergency medical services
EMS-C	Emergency medical services for children
EMSS	Emergency Medical Services Systems [Act]
EMT	Emergency medical technician
ENA	Emergency Nurses Association
FACT	First Aid for Children Today
FARS	Fatal Accident Reporting System
FCC	Federal Communications Commission
GAO	U.S. General Accounting Office
GCS	Glasgow Coma Scale
HCFA	Health Care Financing Administration
HMO	Health maintenance organization
HOME	Home Organizer for Medical Emergencies
HRSA	Health Resources and Services Administration
ICD-9-CM	International Classification of Diseases, 9th Revision, Clinical Modification

ICU	Intensive care unit
IHS	Indian Health Service
IOM	Institute of Medicine
ISS	Injury Severity Scale
IV	Intravenous
IVD	Interactive videodisc
JCAHO	Joint Commission on Accreditation of Healthcare Organizations
MADD	Mothers Against Drunk Driving
MCHB	Maternal and Child Health Bureau
MICN	Mobile intensive care nurse
MIEMSS	Maryland Institute for Emergency Medical Services Systems
MIS	Management information system
MISS	Modified Injury Severity Score
MTOS	Major Trauma Outcome Study
NACHRI	National Association of Children's Hospitals and Related Institutions
NAEMSP	National Association of EMS Physicians
NAEMT	National Association of Emergency Medical Technicians
NAS	National Academy of Sciences
NASEMSD	National Association of State EMS Directors
NASS	National Accident Sampling System
NCCAN	National Center on Child Abuse and Neglect
NCHS	National Center for Health Statistics
NCIPC	National Center for Injury Prevention and Control
NCVHS	National Committee on Vital and Health Statistics
NEISS	National Electronic Injury Surveillance System
NENA	National Emergency Number Association
NERA	National EMS-C Resource Alliance
NHTSA	National Highway Traffic Safety Administration
NICHD	National Institute of Child Health and Human Development
NICU	Neonatal intensive care unit
NINDS	National Institute for Neurological Diseases and Stroke
NLN	National League for Nursing
NPTR	National Pediatric Trauma Registry
NRC	National Research Council
OBRA	Omnibus Budget Reconciliation Act

ODPHP	Office of Disease Prevention and Health Promotion
OJJDP	Office of Juvenile Justice and Delinquency Prevention
OMH	Office of Minority Health
OTA	Office of Technology Assessment
PALS	Pediatric Advanced Life Support
PBLS	Pediatric Basic Life Support
PCCC	Pediatric Critical Care Center
PECCC	(California) Pediatric Emergency and Critical Care Coalition
PEMSTP	Pediatric Emergency Medical Services Training Program
PHI	Prehospital Index
PHTLS	Prehospital Trauma Life Support
PICU	Pediatric intensive care unit
PPO	Preferred provider organization
PRISM	Pediatric Risk of Mortality
PSAP	Public safety answering point
PSAT	Pediatric Severity Assessment Tool
PSI	Physiologic Stability Index
PTC	Pediatric trauma center
PTS	Pediatric Trauma Score
RMP	Regional Medical Program
RTS	Revised Trauma Score
RWJ	Robert Wood Johnson [Foundation]
SADD	Students Against Drunk Driving
SCCM	Society of Critical Care Medicine
SIDS	Sudden Infant Death Syndrome
TIPP	The Injury Prevention Program
TISS	Therapeutic Intervention Scoring System
TNCC	Trauma Nurse Core Curriculum
TRISS	Trauma Score, Injury Severity Score [analysis]
TS	Trauma Score
UCR	Uniform Crime Report
UHDDS	Uniform Hospital Discharge Data Set
WEDI	Workgroup on Electronic Data Interchange

B

Biographies of Committee Members

DONALD N. MEDEARIS, JR., M.D. (Chairman), is Charles Wilder Professor of Pediatrics, Harvard Medical School, and Chief of the Children's Service at Massachusetts General Hospital in Boston. He serves on the Division of Medical Ethics Steering Committee at Harvard Medical School and is a member of the Executive Committee of the Association of American Medical School Pediatric Department Chairmen. He served as Dean of the University of Pittsburgh School of Medicine and as Director of the Department of Pediatrics at Cleveland Metropolitan General Hospital. He also served on the President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research. Elected to the Institute of Medicine in 1983, Dr. Medearis has served on several IOM studies, most recently on the Committee on the Effects of Medical Liability on Maternal and Child Health Care.

RICHARD B. DONKER, Ed.D., has spent the past 15 years in a variety of executive positions with Memorial Hospitals Association (MHA), Modesto, California. From 1988 to 1992, he was Vice President of Clinical Services. Previous activities include development of one of the first helicopter ambulance services in the United States, of an early Preferred Provider Organization, and of a nascent "fast-track" emergency department. Prior to his employment with MHA, he was one of the first paramedics in Northern California. Dr. Donker is a frequent consultant, lecturer, and author on topics of EMS and EMS systems and health care planning. In 1992, he left health care to become the Managing Director of Global Business

Network, an international think tank and strategic planning consulting firm based in Emeryville, California.

MARTIN R. EICHELBERGER, M.D., is Director of Emergency Trauma Services and Attending Surgeon at Children's National Medical Center in Washington, D.C. He is Professor of Surgery and of Pediatrics at George Washington University School of Medicine and Clinical Professor of Surgery at F. Edward Hebert School of Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland. He is also a member of the National Advisory Council for Injury Control for the Centers for Disease Control and Prevention and a member of the American College of Surgeons' National Committee on Trauma. Dr. Eichelberger also serves as President of the National SAFE KIDS campaign, a nationwide voluntary effort to develop injury prevention programs.

J. ALEX HALLER, JR., M.D., retired in 1992 as the Children's Surgeon-in-Charge at The Johns Hopkins Hospital and the Robert Garrett Professor of Pediatric Surgery at The Johns Hopkins University School of Medicine. He is now Professor of Pediatric Surgery, Emergency Medicine, and Pediatrics at The Johns Hopkins University School of Medicine, as well as Professor of Surgery and Pediatric Surgery at The University of Maryland School of Medicine. Dr. Haller is also Associate Medical Director for Emergency Medical Services for Children in the Maryland Institute of Emergency Medical Services Systems. Dr. Haller serves on the Committee on Pediatric Emergency Medicine of the American Academy of Pediatrics, is a Fellow of the Surgical Section of the AAP, and is a Senior Member of the Committee on Trauma of the American College of Surgeons.

ROBERT L. HARMAN is Administrator of Grant Memorial Hospital in Petersburg, West Virginia, where he has served since 1965. He sits on the Board of Trustees of the West Virginia Hospital Association and the West Virginia Hospital Research and Education Foundation. He was a member of the Advisory Committee on "Strategic Options for Rural Hospitals Under 50 Beds" funded by the Pew Foundation for the Hospital Research and Educational Trust of the American Hospital Association. He also serves on the National Advisory Committee to the Office of Rural Health Policy, Department of Health and Human Services, Washington, D.C.; the Advisory Committee for the EACH/PCH Program, Office of Rural Health, Charleston, West Virginia; and the Region Policy Board of the American Hospital Association.

EDGAR B. JACKSON, JR., M.D., is Clinical Professor of Medicine at Case Western Reserve University School of Medicine in Cleveland, Ohio,

and Associate Chief of Staff for the University Hospitals of Cleveland. Dr. Jackson presently serves on the National Advisory Committee of the Program to Strengthen Hospital Nursing for Improved Patient Care under the aegis of The Robert Wood Johnson Foundation and Pew Charitable Trust and is also on the American College of Physicians Committee on Underrepresented Minorities. Dr. Jackson was elected as a member of the Institute of Medicine in 1991.

MARILYN A. KRUEGER is a County Commissioner in St. Louis County, Minnesota. She is the immediate past president of the Association of Minnesota Counties. Ms. Krueger currently chairs the Health Policy Steering Committee for the National Association of Counties and serves as a member of the Regional Coordination Board for Minnesota Care. Minnesota Care, created by state legislation passed in 1992, is intended to provide health care for all Minnesota residents.

JENNIFER LEANING, M.D., is Medical Director, Health Centers Division, of the Harvard Community Health Plan. She is an Instructor in Medicine at Harvard Medical School, Instructor in Health and Social Behavior at the Harvard School of Public Health, and Attending Emergency Physician at Brigham and Women's Hospital. Dr. Leaning is on the Board of Directors of Physicians for Human Rights and Physicians for Social Responsibility and is a member of the Steering Committee of the Metro Boston National Disaster Medical System.

SUSAN D. McHENRY is Director of the Office of Emergency Medical Services for the Virginia Department of Health and is responsible for the coordination and direction of the statewide emergency medical services program. She is a member and past president of the National Association of State Emergency Medical Services Directors and a founding member of the American Trauma Society. She is also a member of the National Highway Traffic Safety Administration's National Faculty for the Development of Trauma Systems Training Course and a member of the Acute Care Trauma Systems Panel for the National Center for Injury Prevention and Control of the centers for Disease Control and Prevention.

PATRICIA A. MURRIN, R.N., M.P.H., is Prehospital/Trauma Coordinator for the County of San Diego Department of Health Services, Division of Emergency Medical Services. Before accepting her position with the County in 1982, Ms. Murrin worked as a critical care/emergency nurse. She is a member of the California Emergency and Critical Care Coalition and serves on its steering committee. Ms. Murrin also serves on six of the ten committees of the California EMS-C targeted issues project, chairing

both the Prevention and Information Management Systems Committees. She is President of the Emergency Medical Services Administrators' Association of California and serves on Emergency Medical Advisory Boards of several community colleges in the area.

JAMES L. PATURAS, EMTP, has been Director, Emergency Medical Services, at Bridgeport Hospital in Connecticut since 1981. Previously, he was the Director of Prehospital Care Services for St. Luke's-Roosevelt Hospital Center in New York City. He served two terms as president of the National Association of Emergency Medical Technicians and was chairman of the Board of Trustees for the NAEMT Foundation. Mr. Paturas is a contributor to the American Heart Association's "1992 Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiac Care" and chairs the ACLS/PALS Committee in Connecticut. He serves as a member of the Board of Directors for the Commission on Accreditation of Ambulance Services. He has recently been appointed to the State of Connecticut's EMS Advisory Board Executive Committee and the Trauma Advisory Committee and chairs the EMS Public Information and Education Committee for the Department of Health.

BARRY G. RABE, Ph.D., is Associate Professor of Health Politics in the Department of Public Health Policy and Administration in the School of Public Health at the University of Michigan, Ann Arbor. He is also an Adjunct Assistant Professor in the Department of Political Science at the University. Dr. Rabe worked as a Staff Associate in the Governmental Studies Program at the Brookings Institution from 1984 to 1987. He is presently serving on the University of Michigan Provost's Task Force on Environmental Studies and the North American Environmental Assessment Panel. He has written extensively in the area of intergovernmental relations and health policy.

DONALD F. SCHWARZ, M.D., M.P.H., M.B.A., is Assistant Professor of Pediatrics at the University of Pennsylvania School of Medicine, Director of the Adolescent Clinic at Children's Hospital of Philadelphia, and Principal Coordinator of the Philadelphia Injury Prevention Program.

JAMES S. SEIDEL, M.D., Ph.D., is Professor of Pediatrics at the University of California, Los Angeles, School of Medicine and Chief of General and Emergency Pediatrics at Harbor-UCLA Medical Center. He is the past chair of the American Heart Association Subcommittee on Pediatric Resuscitation and one of the authors and developers of the Pediatric Advanced Life Support Course. For many years he was a member of the American Academy of Pediatrics' Committee on Pediatric Emergency Medicine

and helped develop the Advanced Pediatric Life Support Course, which is co-sponsored by the AAP and the American College of Emergency Physicians. He is presently Co-Director of the National Emergency Medical Services Resource Alliance, a federally funded national center developed to help municipalities, states, and regions improve their capacity to deliver emergency services to children.

CALVIN C.J. SIA, M.D., is Clinical Professor of Pediatrics at the School of Medicine, University of Hawaii, and maintains a full-time private practice in pediatrics. He is on the Board of Trustees of the Kapiolani Children's Medical Center and is chairman of the Interagency School Health Planning Group for the Department of Health and Department of Education for the state of Hawaii. He is a member of the American Academy of Pediatrics Committee on Pediatric Emergency Medicine, delegate for the AAP in the House of Delegates of the American Medical Association, and chair of the AMA's Section Council on Pediatrics. He initiated a variety of comprehensive health services programs for children and families in Hawaii and was instrumental in the passage of federal legislation authorizing the Emergency Medical Services for Children Demonstration Grant Program.

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Index

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N

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