EMERGENCY MEDICAL SERVICES

AGENDA FOR THE FUTURE

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MESSAGE FROM THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATOR

As NHTSA embarks on 30 years of leadership in the field of emergency medical services (EMS), our goal for the future is to focus community attention on the need to strengthen support for EMS systems in an ever changing health care environment. Our partnership with the Health Resources and Services Administration, Maternal and Child Health Bureau provided us with this opportunity to pursue that goal.

NHTSA realized the need for agencies, organizations, and individuals involved in EMS to evaluate their roles and chart a course to the future. The *EMS Agenda* for *the Future* provides an opportunity for all health care providers to examine what has been learned during the past 30 years. Its purpose is to outline the most important directions for future EMS development. During the process of creating this document, the *EMS Agenda* for *the Future* Steering Committee sought and incorporated input from a broad, multi-disciplinary spectrum of EMS stakeholders.

Ricardo Martinez, M. D.

As the Steering Committee points out, this agenda comes at an important time, when the nation's health care system is undergoing constant and rapid evolution. Resulting health care system changes will affect EMS and its health care delivery roles. As we look to the future it is clear that EMS must be integrated with other services and systems that are intended to maintain and improve community health and ensure its safety. We must also focus on aspects of EMS that improve its science, strengthen its infrastructure, and broaden its involvement in enhancing the health of our communities. The *Agenda* describes 14 EMS attributes and proposes continued development of them, enabling all of us to strive for a vision that emphasizes a critical role for EMS in caring for our nation's health.

Our EMS experiences over the past 30 years provide us with a basis on which to create the future. It is important, however, not to be held hostage to the past, but to look freely to the future. The *EMS Agenda for the Future* is an important tool for doing that. It will be a valuable resource for government officials and all health care providers and administrators, including EMS administrators, medical directors, managers, and all EMS providers. NHTSA is proud to have co-sponsored the project that led to completion of this document, and is indebted to the Steering Committee and all those who participated. As both NHTSA's administrator and an emergency physician, I wholeheartedly endorse the vision and the convictions to be found within the pages that follow.

NHTSA

People Saving People

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THE VISION

Emergency medical services (EMS) of the future will be community-based health management that is fully integrated with the overall health care system. It will have the ability to identify and modify illness and injury risks, provide acute illness and injury care and follow-up, and contribute to treatment of chronic conditions and community health monitoring. This new entity will be developed from redistribution of existing health care resources and will be integrated with other health care providers and public health and public safety agencies. It will improve community health and result in more appropriate use of acute health care resources. EMS will remain the public's emergency medical safety net.

EXECUTIVE SUMMARY

During the past 30 years, emergency medical services (EMS) in the United States have experienced explosive development and growth. Yet initiatives to create a system to provide emergency medical care for the nation's population began with limited knowledge about what constituted the most efficient processes for delivering ideal resources to the spectrum of situations encountered by contemporary EMS.

The *EMS Agenda for the* Future provides an opportunity to examine what has been learned during the past three decades and create a vision for the future. This opportunity comes at an important time, when those agencies, organizations, and individuals that affect EMS are evaluating its role in the context of a rapidly evolving health care system.

The *EMS Agenda for the Future* project was supported by the National Highway Traffic Safety Administration and the Health Resources and Services Administration, Maternal and Child Health Bureau. This document focuses on aspects of EMS related to emergency care outside traditional health care facilities. It recognizes the changes occurring in the health care system of which EMS is a part.

EMS of the future will be community-based health management that is fully integrated with the overall health care system. It will have the ability to identify and modify illness and injury risks, provide acute illness and injury care and follow-up, and contribute to treatment of chronic conditions and community health monitoring. EMS will be integrated with other health care providers and public health and public safety agencies. It will improve community health and result in more appropriate use of acute health care resources. EMS will remain the public's emergency medical safety net.

To realize this vision, the *EMS Agenda for the Future* proposes continued development of 14 EMS attributes. They are:

- Integration of Health Services
- EMS Research
- Legislation and Regulation
- System Finance
- Human Resources
- Medical Direction
- Education Systems
- Public Education
- Prevention
- Public Access
- Communication Systems
- Clinical Care
- Information Systems
- Evaluation

This document serves as guidance for EMS providers, health care organizations and institutions, governmental agencies, and policy makers. They must be committed to improving the health of their communities and to ensuring that EMS efficiently contributes to that goal. They must invest the resources necessary to provide the nation's population with emergency health care that is reliably accessible, effective, subject to continuous evaluation, and integrated with the remainder of the health system.

The *EMS Agenda for the Future* provides a vision for out-of-facility EMS. Achieving such a vision will require deliberate action and application of the knowledge gained during the past 30 year EMS experience. If pursued conscientiously, it will be an achievement with great benefits for all of society.

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INTRODUCTION

The year is 2009 and it's a Thursday evening. Joe S. is a 60-year-old male who emigratedfrom Russia in 1995 to work for a software company. He does not speak English very well. He has several cardiac risk factors including hypertension, elevated cholesterol, a history of smoking (a pack a week), and he is 20% overweight. For the past two days he has had mild, intermittent chest discomfort unrelated to exercise. However, at 11:OO PM,the discomfort suddenly becomes more severe. Joe's wife, worried and anxious, instructs their computerized habitat monitor (CHM) to summon medical help. Through voice recognition technology, the CHM analyzes the command, interprets it as urgent, and establishes a linkage with the appropriate public safety answering center (PSAC). At the PSAC, a "smart map" identifies and displays the location of the call. Richard Petrillo, the emergency medical communicator (EMC) notes the type of linkage that has been established (not a telephone, personal communicator device, television, or personal computer). He also knows what sort of query can be conducted through this linkage. Petrillo commands the PSAC computer to instruct the CHM to identify the potential patient, report his chief complaint, and provide his medical database identifiers. In the meantime, the "smart map" has identified the closest acute care response vehicle and Petrillo instructs the computer to dispatch it. The CHM provides the requested information and responding personnel are automatically updated via their personal digital assistants (PDAs). Petrillo accesses the patient's health care database, obtaining his current health problem list, most recent electrocardiogram, current medications, allergies, and primary care physician data. This information automatically is copied to the responding personnel's PDAs and to the medical command center (MCC) computer. The PSAC computer also downloads pre-arrival instructions to the CHM which provides them to Joe's wife.

Staffing the acute care response vehicle are Nancy Quam, Community Health Advanced Medical Practitioner (CHAMP) and Ed Perez, Community Health Intermediate Practitioner (CHIP). Nancy became a CHAMP because she recognized a declining need for physicians. She was credentialed following a four-year college degree program. Many of her colleagues were previous paramedics and nurses who became credentialed through career-bridging programs. Ed Perez was credentialed as a CHIP after a one-year academic program. He currently goes to school part-time, on a scholarship, working toward becoming a CHAMP. As Quam and Perez proceed toward Joe's home, a transponder in their vehicle changes alI traffic signals in their favor. Also, digital displays in all area vehicles are alerted that there is an emergency vehicle in their vicinity. The PSAC computer informs Quam and Perez that neither a personal risk analysis (PRA) nor a domicile risk analysis (DRA) has been performed in the past five years.

As Quam and Perez arrive at the home, four minutes after the initial linkage with CHM, they notice substandard lighting on the home's outside walkways and front-porch steps in need of repair. They also note that a maintenance light is illuminated on the CHM annunciator panel. As they greet the patient, they realize that he does not speak English well. Perez puts the translator module into his PDA, then he speaks to the PDA which translates his voice to Russian. The all-systems monitor is applied to the patient's arm and across his chest. Physiologic data is acquired by the monitor's computer chip, then it is analyzed on the scene and transmitted via burst technology to the medical command center 100 miles away. By communicating through their PDAs, Quam and Perez are able to acquire the patient's history. Through Quam's PDA video screen, she establishes a video connect with the MCC. The MCC EMS physician requests additional Level III monitoring which reveals the patient's carbon monoxide level to be 14%.

Analysis of all the data by the MCC computer and EMS physician suggests a 96% probability of acute myocardial ischemia. Quam and the EMS physician confer and the patient subsequently is administered short-acting thrombolytics and IV antioxidants. The nearest cardiac care center that is part of Joe's health network is identified and alerted by computer. Joe is transported there, even though other hospitals may be closer. He is examined very briefly in the emergency department and taken directly to the cardiac catheterization laboratory. There he undergoes complete laser debridement of his coronary arteries. Joe suffers no myocardial enzyme leak, there is no permanent cardiac damage, and he is discharged in two days.

Following Quam's and Perez's report, a PRA and a DRA are requested. Joe's health care network contracts with their agency to return to the home where

they learn that the *family did not completely understand the* CHM's *operations. Thus, when its carbon monoxide sensor had failed they were unaware. The health care network subsequently offers a matching* grant *to repair an aging furnace, the CHM, and the other environmental hazards noted by Quam and Perez. In follow-up, it was determined that Joe had been noncompliant with his previous medication instructions due to lack* of *understanding. A new caseworker is assigned who ensures that Joe understands his health care instructions and begins to minimize all his risk factors.*

Joe lives to 94 *years old.*

The roots of emergency medical services (EMS) are deep in history. The EMS chronology provides an overview of some important EMS developments (please refer to Appendix A for more detailed historical perspectives). During the past 30 years, EMS in the United States has experienced an explosive evolution. The predisposing factors for such development have been multifactorial, including an appreciation that better response might improve patient outcomes for some medical conditions. The initial EMS growth spurt began with a lack of knowledge about what constituted the most efficient processes for delivering the ideal resources to the spectrum of situations addressed by today's EMS systems.

We are now able to examine what has been learned during the past three decades, in order to refine contemporary EMS. This opportunity comes at a time when EMS systems and agencies and individuals responsible for EMS structure, processes, and outcomes are evaluating their roles within a rapidly evolving health care system and during an era of fiscal restraint. Recognizing its need and potential impact, the National Highway Traffic Safety Administration (NHTSA) and the Maternal and Child Health Bureau (MCHB) of the Health Resources and Services Administration (HRSA) provided funding to support completion of the EMS *Agenda for the* Future.

EMS CHRONOLOGY

1797	Napoleon's chief physician implements a prehospital system designed to triage and transport the injured from the field to aid stafions[1]
1860s	Civilian ambulance services begin in Cincinnati and New York City
1915	First known air medical transport occurs during the retreat of the Serbian army from Albania
1920s	First volunteer rescue squads organize in Roanoke, Virginia, and along the New Jersey coast
1958	Dr. Peter Safar demonstrates the efficacy of mouth-to-mouth ventilation
1960	Cardiopulmonary resuscitation (CPR) is shown to be efficacious
1966	The National Academy of Sciences, National Research Council publishes Accidental Death and Disability: The Neglected Disease of Modern Society
1966	Highway Safety Act of 1966 esfablishes the Emergency Medical Services Program in the Department of Transportation
1972	Deparfment of HealIh, Education, and Welfare allocates 16 million dollars to EMS demonstration programs in five states
1973	The Robert Wood Johnson Foundation appropriates 15 million dollars to fund 44 EMS projects in 32 states and Puerto Rico
1973	The Emergency Medical Services Systems /EMSS) Act provides additional federal guidelines and funding for the development of regional EMS systems; the law establishes 15 components of EMS systems
1981	The Omnibus Budget Reconciliation Act consolidates EMS funding into stafe preventive health and health services block grants, and eliminates funding under the EMSS Act
1984	The EMS for Children program, under the Public Health Act, provides funds for enhancing the EMS system to better serve pediatric patients
1985	National Research Council publishes Injury in America: A Continuing Public Health Problem describing deficiencies in the progress of addressing the problem of accidental deafh and disability
1988	The National Highway Traffic Safety Administration initiates the Statewide EMS Technical Assessment program based on ten key components of EMS systems
1990	The Trauma Care Systems and Development Act encourages development of inclusive trauma systems and provides funding to states for trauma system planning, implementation, and evaluation
1993	The Institute of Medicine publishes Emergency Medical Services for Children which points out deficiencies in our health care system's ability to address the emergency medical needs of pediatric patients
1995	Congress does not reauthorize funding under the Trauma Care Systems and Devefopment Act

PURPOSE

The purpose of the *EMS Agenda for the Future* is to determine the most important directions for future EMS development, incorporating input from a broad, multidisciplinary spectrum of EMS stakeholders. This document provides guiding principles for the continued evolution of EMS, focusing on out-of-facility aspects of the system.

ASSUMPTIONS

Implicit within this document are assumptions about the nature of the future and the environment in which EMS will exist. These assumptions are:

- **EMS represents the intersection of public safety, public health, and health care systems.** A combination of the principles and resources of each is employed by EMS systems.
- **The public expects that EMS will continue.** EMS is viewed as a standard, valuable community resource that must always be in place. The public has come to expect an EMS response when it is faced with a perceived out-of-facility medical emergency.
- **EMS will continue to exist in some form. The** complexion of EMS is subject to change dramatically in some aspects. Nevertheless, continued expectations for service by the public and its chosen leaders will ensure that, in some form, EMS will continue to exist and serve the emergency medical needs of communities.
- **EMS will continue to be diverse at the local level.** Heterogeneity among EMS systems is often a reflection of the diversity in the communities they serve. Guiding principles are applicable to all EMS systems. However, the methods for applying such principles and the ability to reach specific process benchmarks will continue to be influenced by the nature of communities and the resources they possess.
- **As a component of health care systems, EMS will be influenced significantly by their continuing evolution.** The U.S. health care system is undergoing constant evolution, which seems more rapid now than ever. Recent changes have occurred in terms of regional systems' organization and finance. An increasing proportion of the U.S. population is participating in health plans (e.g., managed care) that compel patients to seek specific medical care providers and place a greater emphasis on prevention and health maintenance. In many cases, both insurers and health care providers have established regional networks (e.g., managed care organizations) to enhance efficiency and reduce costs. Such changes will continue to occur and affect EMS health care delivery roles and logistical considerations.
- **There currently is a lack of information regarding EMS systems and outcomes.** Despite many years of experience, we continue to lack adequate information regarding how EMS systems influence patient outcomes for most medical conditions, and how they affect the overall health of the communities they serve. Emergency medical services-related research usually has focused on one disease or operations issue, and often is conducted in only one EMS system. The conclusions drawn may not be valid or applicable in other EMS systems.
- **It will be necessary to continue to make some EMS system-related decisions on the basis of limited information.** The current relative lack of knowledge regarding system and outcome relationships sometimes forces necessary decisions to be made with insufficient information. The time and resources required to complete the research necessary to produce such knowledge may be extensive. Therefore, unless progress is to be held hostage, in many cases, the need to make decisions will continue to precede the availability of all the information that might affect them.
- **The media will continue to influence the public's perception of EMS.** To date, the media has been the primary means for the public to develop awareness of EMS. Except for the few community members whom the EMS system contacts each year, the bulk of public perception regarding EMS-related issues will continue to be derived from television programs (fictional and documentary) and occasional news accounts.
- **Federal funding/financial resources will be decreasing.** The appropriation of federal funding had a significant impact on initial EMS development. In an era of governmental fiscal restraint it is likely that federal funding for EMS activities will continue to decrease. Financial support

for EMS systems will be, to an increasing extent, derived from unfound or undeveloped sources.

- **To make good decisions, public policy makers must be well-informed about EMS issues.** Attempts have been initiated to educate public policy makers regarding important EMS-related issues. These efforts will continue, and will include plans to educate members of the United States Congress and other federal, state and local officials able to effect public policy that improves community emergency health care.

EMERGENCY MEDICAL SERVICES ATTRIBUTES

The health system of today, with its emphasis on advanced technology and costly acute interventions to promote societal health, is transitioning to focus on the early identification and modification of risk factors before illness or injury strikes. This transition will lead to a more cost-effective medical management system and improved patient outcomes. EMS will mirror and, in many cases, lead this transition.

EMS of the future will be community-based health management that is fully integrated with the overall health care system. It will have the ability to identify and modify illness and injury risks, provide acute illness and injury care and follow-up, and contribute to treatment of chronic conditions and community health monitoring. This new entity will be developed from redistribution of existing health care resources and will be integrated with other health care providers and public health and public safety agencies. It will improve community health and result in more appropriate use of acute health care resources. EMS will serve as the public emergency medical safety net.

The focus of this document is the component of the EMS system which provides emergency care remote from a health care facility. This health care mission is accomplished utilizing principles of public health and public safety systems.

EMS certainly does not exist in isolation, but is integrated with other services and systems intended to maintain and enhance community health and ensure its safety. Therefore, EMS is affected by changes that occur within those arenas. Opportunities and challenges will be created by interacting with those responsible for overall maintenance of community health, including providers of continuous health care. Currently, the term "managed care organization" (MCO) describes the combination of insurer and health care provider. Although the future of the term "MCO" is unclear, the concept of large regional providers and underwriters of health care is becoming more pervasive. Opportunities exist for EMS systems to develop model relationships with other components of the health care system, while maintaining a commitment to public safety services to improve community health.

Emergency medical services have and will continue to raise the standards for community health care by implementing innovative techniques and systems to deliver the emergency care that is needed by the entire population. The following sections focus on important EMS attributes, and provide direction and guiding principles for future EMS development that will facilitate EMS systems' abilities to fulfill their health care mission.

The *EMS Agenda* for *the Future* presents a perspective from a single point in time. As the environment in which EMS exists is dynamic, this document is intended to serve as a guiding reference only until the next periodic re-evaluation of EMS issues. Planning for such evaluation should commence as implementation of the *Agenda* is contemplated.

Discussion of EMS attributes in any particular sequence, as in the text of this document, is not a statement regarding their relative importance. The vignettes of the future in each section are intended to be illustrative and thought-provoking. They are not meant to advocate specific actions or terminology.

INTEGRATION OF HEALTH SERVICES

Integration of health care services helps to ensure that the care provided by EMS does not occur in isolation, and that positive effects are enhanced by linkage with other community health resources and integration within the health care system.

EMS provides out-of-facility medical care to those with perceived urgent needs. It is a component of the overall health care system. EMS delivers treatment as part of, or in combination with, systematic approaches intended to attenuate morbidity and mortality for specific patient subpopulations.

The future: Ella is 78 years old, and she trips and falls in her living room. Although initially she is unable to get herself up, she summons EMS via a voice recognition habitat monifor. The EMS providers do not find serious injuries, but suspect an ankle sprain. They schedule an appointment for Ella later that day with her primary care source, via a palm-size computer. They also are able to request transporfafion for her after consultation with the medical command center. *While at* Ella's, *the EMS providers note fhaf her home is oppressively hof due to a malfunctioning air* conditioner, *and that there are numerous risk factors* for *future falls. Using their computer, they arrange* for *social services to follow-up, they notify her primary care provider, notify her building maintenance supervisor,* and *they schedule an EMS return visit to check* on *progress. Ella avoids an emergency department visit, is treated for her ankle sprain, and she receives attention that reduces her numerous risk factors for future health problems.*

"Out-of-facility care is an integral component of the health care system. EMS focuses on out-of-facility care and also supports efforts to implement cost-effective community health care. By integrating with other health s ystem components EMS improves health care for the entire community, including children, the elderly, and others with special needs."

Alasdair K.T. Conn, MD

WHERE WE ARE

As a component of the health care delivery system, EMS addresses all possible injuries and illnesses, and treats all ages. It is a component of, and is also comprised by, systems intended to provide care for specific diseases and population segments.

Contemporary EMS systems were created to meet the immediate needs of the acutely ill and injured; to provide "stabilization" and transportation. EMS, in general, meets these objectives in relative isolation from other health care and community resources. Reports have been published regarding public health surveillance by EMS personnel and referral to social services agencies.[50,51,69] However, most EMS systems are disconnected from other community resources, except perhaps other public safety agencies, and are not involved in the business of ensuring follow-up by social service agencies or other community agencies/resources potentially able to intervene when patients need support. Thus, the potential positive effects of EMS, in terms of improved health for individual patients and the community, remain unrealized.

EMS providers, in general, do not provide or ensure medical follow-up for patients who are not transported. Failure to obtain such care in a timely fashion may be an issue responsible for suboptimal patient outcomes and litigation involving EMS systems and personnel. Lack of integration with other health care providers limits the ability of EMS to coordinate aftercare for its patients.

Except for familiarity with medical direction facilities and emergency departments, EMS personnel in general, do not have substantial working knowledge of the practices of other community health care providers and the policies of regional health care organizations. Thus, they are unable to integrate their care with sources for patients' continuing health care.

A model for incorporating EMS systems and health monitoring referral systems has been described.[61] Some EMS systems are conducting pilot projects to determine the benefits of collaboration and routine communication with patients' health care providers, organizations and networks. Other

projects are exploring an expanded role for EMS regarding the clinical care it provides.115

WHERE WE WANT TO BE

For its patients and the community as a whole, EMS provides care and service that is integrated with other health care providers and community health resources. Thus, EMS patients are assured that their care is considered part of a complete health care program, connected to sources for continuous and/or follow-up care, and linked to other potentially beneficial health resources.

Out-of-facility care is considered to be an integral component of the health care system. The attributes or elements of out-of-facility care are shared by the other health care components. Each EMS attribute applies to all groups of potential EMS patients, addressing the needs of all community members. Furthermore, the borders among patient groups, system attributes, and health care components are not discrete and are shared (Figure 1).

EMS focuses on out-of-facility care and, at the same time, it supports efforts to implement cost-effective community health care. Out-of-facility care is a component of the comprehensive health care system, and EMS shares structural and process elements common to all health care system components. Furthermore, EMS is a resource for community health care delivery.

EMS maintains liaisons, including systems for communication with other community resources, such as other public safety agencies, departments of public health, social service agencies and organizations, health care provider networks, community health educators, and others. This enables EMS to be proactive in affecting people's long-term health by relaying information regarding potentially unhealthy situations (e.g., potential for injury), providing referrals to agencies with a vested interest in maintaining the health of their clients. Multiple dispositions are possible when a call is received at a public safety answering point; additional multiple dispositions are available following patient evaluation by EMS personnel. EMS is a community health resource, able to initiate important follow-up care for patients, whether or not they are transported to a health care facility.

EMS is integrated with other health care providers, including health care provider organizations and networks, and primary care physicians. As a health care provider, EMS, with medical direction, facilitates access for its patients to appropriate sources of medical care. Integration ensures that EMS patients receive appropriate follow-up medical care, and that the episodic care provided by EMS is considered a component of each patient's medical history that affects the plan for continuing health care.

EMS integrates with other health system components to improve its care for the entire community, including children, the elderly, those who are chronically dependent on medical devices, and others. This ensures that the population is better served, and that the special needs of specific patients are addressed adequately.

Efforts to improve EMS care for specific segments of the population recognize the need for, and advocate implementation of, system enhancements that benefit the entire population. These efforts often include attention to functional system design, health care personnel education, and equipment and facility resources.

HOW TO GET THERE

EMS must expand its public health role and develop ongoing relationships with community public health and social services resources. Such relationships should result in systems of communication that enable referrals and subsequent follow-up by those agencies. Relationships should benefit all parties by improved understanding of factors contributing to issues being addressed. Reports of the effectiveness of these relationships should be disseminated.

EMS must become involved in the business of community health monitoring, including participation in data collection and transmittal to appropriate community and health care agencies. Long-term effects of such efforts must be widely reported.

EMS systems must seek to become integrated with other health care providers and provider organizations and networks. Integration should benefit patients by enhancing and maintaining the continuum of care. Communications systems, including confidential transmittal of patient-related data, should be developed. These should explore the utility of continuing communications technological ad-

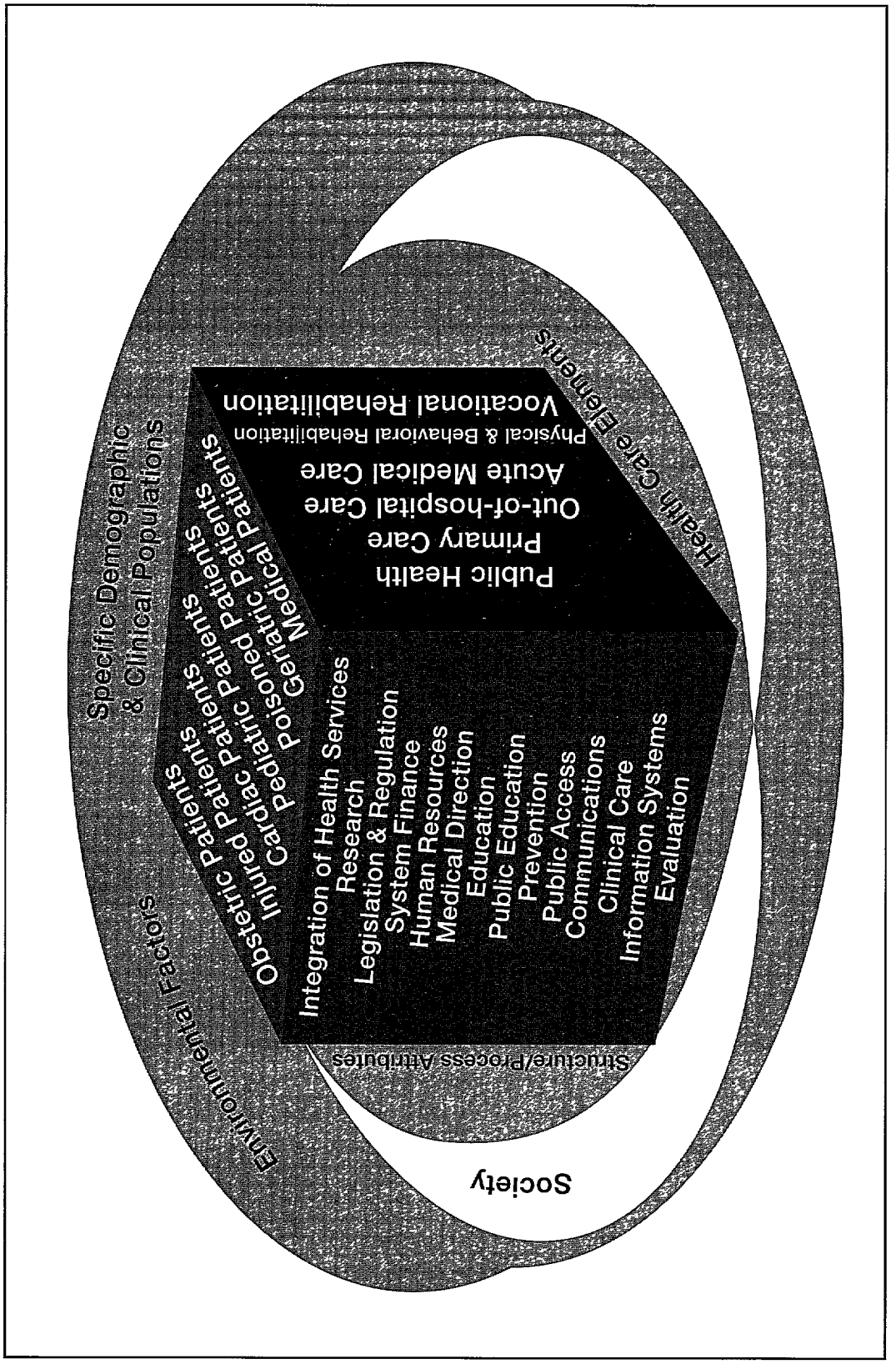

Figure 1. EMS: Part of the Health Care System

vances. Mutually acceptable clinical guidelines regarding patient treatment and transport also must be developed.

Health care provider organizations and networks must incorporate EMS within their structures to deliver quality health care. They must not impede the community's immediate access to EMS when a perceived emergency exists.

EMS medical direction must be cognizant of the special medical needs of all population segments and, through continuous processes, ensure that EMS is integrated with health care delivery systems striving to optimally meet these needs. An EMS physician, collaborating with other community physicians (including pediatricians, surgeons, family practitioners, internists, emergency physicians, and others) and health care professionals (including nurses, nurse practitioners, physician's assistants, paramedics, administrators, and others), should ultimately be responsible and have authority for EMS medical direction and, in partnerships with system administrators, effect system improvements.

EMS must incorporate health systems that address the special needs of all population segments served (e.g., pediatric, geriatric, medical device-dependent; and other patients in urban, suburban, rural, and frontier areas). Such systems or plans should include education, system design, and resource components. They must be developed with input from members of the community. Groups unable to represent themselves, such as children, must be represented by others who are familiar with their needs.

Emergency medical services leaders must continue to identify issues of interest to policy makers to address specific aspects of EMS, and improve the system as a whole. Attention paid to EMS components should be done with consideration of the entire system.

Research and pilot projects should be conducted with regard to expanded services that may be provided by EMS. Efforts to enhance services should focus foremost on improving those currently delivered by EMS, and might also lead to services that enable patients to seek follow-up care in a less urgent manner and/or facility. These projects should address objective meaningful patient outcomes, EMS staffing requirements, personnel education issues, quality evaluations, legal issues, and cost-effectiveness. They must also include logistical evaluations such as the ongoing capabilities of EMS to respond to critical emergencies (e.g., cardiac arrests). These studies must precede widespread adoption of such practices and results should be disseminated and subjected to scrutiny.

INTEGRATION OF HEALTH SERVICES:

- Expand the role of EMS in public health
- Involve EMS in community health monitoring activities
- Integrate EMS with other health care providers and provider networks
- Incorporate EMS within health care networks' structure to deliver quality care
- Be cognizant of the special needs of the entire population
- Incorporate health systems within EMS that address the special needs of all segments of the population

EMS RESEARCH

Research involves pursuit of the truth. In EMS, its purpose is to determine the efficacy, effectiveness, and efficiency of emergency medical care. Ultimately, it is an effort to improve care and allocation of resources.

The future: A new pharmacologic agent becomes available and might potentially decrease the morbidity of stroke. Theoretically, the sooner the medication is-administered after symptom onset, the more effective it is likely to be. However, it is expensive and has accompanying risks. Therefore, a multi-EMS system study is funded by the National Institutes of Health (NIH). Over the course of two years, information is collected from the participating EMS systems about control patients and those who were treated with the new medication in the fieId. The information includes out-of-facility EMS data that is linked with hospital and rehabilitation data. Subsequently, the cost-effectiveness and risks of administering the medication in the field are determined and EMS practices are adjusted accordingly.

> *"The future of* ***EMS is indelibly linked to the*** *future of* ***EMS*** *research.* ***This reality provides EMS with its greatest opportunities, its greatest risks, and its greatest single need to depart from the ways of the past. EMS must*** *grasp* ***this quickly closing window of opportunity."***
>
> *Daniel W. Spaife, MD*

WHERE WE ARE

EMS has evolved rapidly over the past 30 years despite slow progress in developing EMS-related research. System changes frequently prompt research efforts to prove they make a difference, instead of the more appropriate sequence of using research findings as a basis for EMS improvements.

Most of what is known about EMS has been generated by researchers at a small number of medical schools, generally in midsized cities, that have ongoing relationships with municipal EMS systems. The volume of EMS research is low and the quality often pales in comparison with other medical research.

Most published EMS research is component-based, focusing on a single intervention or health problem, and rarely addressing the inherent complexities of EMS systems.119 With few exceptions, there has been little emphasis on systems analysis. Development of the "chain of survival" concept for cardiac emergencies provides the best evidence of completed systems research.22,94 Trauma-related research comprises the only other EMS research emphasis.[119] However, study methods have not been as extensively developed, and experimental designs often limit abilities to compare studies and reach meaningful

Other clinical conditions have not been scientifically studied with a systems approach. Component-based analyses often lead to conclusions that are incorrect, or at least cannot be supported, when they are considered in the context of the entire EMS system.119,120 Thus, in many cases, our poor understanding of systems research models has led to the development of wrong assumptions with regard to EMS care.

Currently there are five major impediments to the development of quality EMS research:

- inadequate funding
- lack of integrated information systems that provide for meaningful linkage with patient outcomes
- paucity of academic research institutions with long-term commitments to EMS systems research
- overly restrictive informed consent interpretations
- lack of education and appreciation by EMS personnel regarding the importance of EMS research.

Without dramatic progress on these five fronts, there will not be a significant increase in the quantity of well-done, meaningful EMS research.

Significant barriers to collecting relevant, meaningful, and accurate EMS data exist.120 EMS data often are not collected in a rigorous fashion that allows academic evaluation. Linkage with hospital and other data sets, which is required to

determine EMS effectiveness, is difficult and infrequently accomplished.

A national agenda for EMS-related research does not exist, and there is no central source for EMS research funding. The EMS-C program has invested in system development and research affecting not only pediatric issues, but all of EMS.[39] Other federal agencies, including the Health Resources Services Administration, Agency for Health Care Policy and Research, and NHTSA have also sponsored EMS-related investigations. Additional support often is sought from private and corporate interests. However, funding frequently is directed only toward component-based studies. Overall, financial support for EMS-related research is inadequate to address the many systems issues requiring study.

Overly restrictive informed consent interpretations create additional barriers to conducting EMS research. They do not consider the clinical and environmental circumstances of field EMS investigations, and impede institutional review board approval of meaningful resuscitation research and other field trials.

EMS education curricula do not include adequate research-related objectives. Thus, very few EMS personnel, including system administrators and managers, have a sufficient baseline understanding and appreciation of the critical role of EMS research. Unlike most other clinical fields, EMS research often is conducted without significant participation by its own practitioners, relying instead on others.

The rationale for many routine EMS interventions is based on in-hospital studies, and not on scientific investigation of their out-of-hospital effectiveness. The effectiveness of most EMS interventions and of EMS systems, in general, has not been well established with outcome criteria.[35] Furthermore, the outcome criterion most studied is death, which, although important, is not pertinent to most EMS clinical situations.[35,45]

WHERE WE WANT TO BE

The essential nature of quality EMS research is recognized. A sufficient volume of quality research is undertaken to determine the effectiveness of EMS system design and specific interventions.

EMS evolves with a scientific basis. Adequate investigations of EMS interventions/treatments and system designs occur before they are advocated as EMS standards. The efficacy, effectiveness and cost- effectiveness of such interventions and system designs are determined. This includes the identification of patients who are appropriate for transport, and evaluation of the effects of alternative dispositions for patients when they are not transported to health care facilities.

As much as possible, EMS research employs systems analysis models. These models use multidisciplinary approaches to answer complex questions. They consider many issues that impact a system to help ensure that findings are accurate within the context of multifaceted EMS systems.

The National Institutes of Health (NIH) are committed to EMS-related research. NIH participates in setting a national agenda and provides EMS-related research funding.

Integrated information systems provide linkages between EMS and other public safety services and health care providers. They facilitate the data collection necessary to determine EMS effectiveness.

Several academic centers have long-term commitments to EMS research. They serve as a nucleus of activity that involves many EMS systems with different characteristics and all personnel levels, including field providers, managers, administrators, nurses, and physicians.

Informed consent rules account for the clinical and environmental circumstances of EMS research. They enable credible resuscitation and other out-of-facility investigations to be conducted.

EMS personnel of all levels and credentials appreciate the role of EMS research in terms of creating a scientific basis for EMS patient care. All individuals with some responsibility for EMS structure, process, and/or outcomes are involved, to some extent, with EMS research.

EMS research examines multiple outcome criteria. Thus, it is pertinent to most EMS clinical situations, which do not involve a likelihood of death.

HOW TO GET THERE

Public and private organizations responsible for EMS structures, processes, and/or outcomes must collaborate to establish a national EMS research agenda. They should determine general research goals and assist with development of research funding sources.

The major impediments to EMS research must be addressed:

- Federal and state policy makers must allocate funds for a major EMS systems research thrust. This should include involvement of the NIH in setting a national EMS research agenda and providing research funding.
- Integrated information systems must be developed to provide linkage between EMS and various public safety services and other health care providers to facilitate the data collection that is necessary to determine EMS effectiveness.
- Academic institutions and medical schools must consider making long- term commitments to EMS-related research. They should support EMS-interested faculty members, collaborate with EMS systems, and involve EMS personnel of all levels in conducting credible systems research.
- The Department of Health and Human Services and the Food and Drug Administration must continue to revise their interpretations of informed consent rules so that they enable credible resuscitation and other out-of-facility research to be conducted. Informed consent interpretations should account for the clinical and environmental circumstances inherent in conducting EMS research.
- All individuals with some responsibility for EMS structures, processes, and outcomes must be involved in and/or support quality EMS systems research. They must recognize the need for quality information that demonstrates the effects of EMS for the patient population served, and provides the scientific basis for EMS patient care.

EMS must be designated as a subspecialty for physicians and other health professionals. The development of well-trained EMS researchers must be an integral component of the EMS subspecialty, just as it is in other subspecialties. Those with subspecialty credentials should be integrally involved in advancing the knowledge base of EMS.

EMS field providers and managers, as part of their routine education, must learn the importance and principles of conducting EMS-related systems research. The objectives need not be to develop EMS researchers, but to help personnel understand the research that is being conducted and enable them to participate and be supportive.

EMS researchers must enhance the quality of published research. Study methods should employ systems analysis methods and meaningful outcome criteria, and determine cost-effectiveness. Research meetings should include forums to educate those wanting to improve their research skills.

EMS systems, medical schools, other academic institutions, and private foundations must develop collaborative relationships. Such relationships should facilitate implementation of significant EMS research projects required to determine, among other things, efficacy, effectiveness and cost-effectiveness.

State EMS lead agencies must evolve from being primarily regulatory to providing technical assistance. They should be involved in promoting public health services research, and facilitating the development of relationships and resources necessary for such studies.

EMS **RESEARCH:**

- Allocate federal and state funds for a major EMS systems research thrust
- Develop information systems that provide linkage between various public safety services and other health care providers
- Develop academic institutional commitments to EMS-related research
- Interpret informed consent rules to allow for the clinical and environmental circumstances inherent in conducting credible EMS research
- Develop involvement and/or support of EMS research by all those responsible for EMS structure, processes, and/or outcomes
- Designate EMS as a physician subspecialty, and a subspecialty for other health professions
- Include research related objectives in the education processes of EMS providers and managers
- Enhance the quality of published EMS research
- Develop collaborative relationships between EMS systems, medical schools, other academic institutions, and private foundations

LEGISLATION AND REGULATION

Issues relating to legislation, and its resulting regulations, are central to the provision of EMS in the public's behalf. Legislation and regulations affect EMS funding, system designs, research, and EMS personnel credentialing and scope of practice.

The future: In the town of Gaston, out-of-facility emergency care is provided exclusively by Medstat EMS, a non-profit corporation. Medstaf merges with a larger company that, for numerous reasons, abruptly decides to cease operations in Gaston. Fortunately, the state EMS agency uses its authority to compel the service to continue its operations, at least for emergency care, until adequate temporary arrangements are made with neighboring local EMS systems to provide Gaston with quality EMS. The agency then works with Gaston community leaders to develop a long-term solution. During the interim period, when Medstat would have otherwise ceased to operate in Gaston and temporary arrangements were initiated, Medstat EMS personnel were able to resuscitate a three-year-old near-drowning victim due, in part, to their rapid response to the scene.

WHERE WE ARE

All states have legislation that provides a statutory basis for EMS activities and programs. States have found that it is within the public's interest to assure that EMS is readily available, coordinated, and of acceptable quality. However, during 35 state evaluations by NHTSA technical assessment teams, only 40% of states reported comprehensive enabling EMS legislation for development of a statewide EMS system.[118] Only 20% of states had an identified lead agency, meeting the standard of the assessment teams, that provided central coordination for EMS system activities.[118] State laws vary greatly in the way they describe EMS system components. Some laws permit greater flexibility on the part of the lead or regulatory agencies than others.

"Injuries and illnesses requiring an EMS response represent a public health problem that can only be addressed through the combined efforts of all levels of government and private organizations. Government mustmaintain its traditional role of assuring the existence of an EMS safety net, and at the same time partner with others to build new models for improving EMS."

Dan Manz

In some cases, local governments also have passed ordinances to delineate EMS standards for their communities. These may relate to system components or define process standards.

Legislation leads to rules and regulations designed to carry out the intent of the law. State and regional authorities responsible for implementing regulations, are, in general, extensively involved in personnel licensing, training program certification, EMS vehicle licensing, and record keeping.

WHERE WE WANT TO BE

There is a federal lead EMS agency. The agency is mandated by law, sufficiently funded and credible, and is recognized by the health care and public safety systems. It directs nationwide EMS development, provides coordination among federal programs/agencies affecting EMS, serves as a central source for federal EMS-related research and infrastructure creation funding, provides an information clearinghouse function, and oversees development of national guidelines.

All states have a single EMS lead agency, established in law, responsible for developing and overseeing a statewide EMS system. Each state's agency is adequately funded to ensure its effectiveness. Lead agency enabling legislation allows flexibility; the ability to adapt and be responsive to the health care and public safety environment. It is a facilitator, a clearinghouse for information, a developer of guidelines, and a promotor and educator. This helps ensure that statewide EMS system development continues, that its development and oversight are efficient, and that EMS of acceptable quality is available to the entire population.

State legislation provides a broad template that allows local medical directors to determine the specific parameters of practice for their EMS systems and to conduct credible research and pilot

projects. This ensures substantial uniformity within states, but provides the degree of flexibility necessary to ensure that EMS systems, given their resources, are able to optimally meet the health care needs of their communities. Justification for practice parameters are required, as is maintaining minimum quality standards.

In addition to regulating EMS, state lead agencies provide technical assistance to EMS systems. They provide coordination and geographic integration among local EMS systems, and provide technical expertise that may not be available within individual systems. They facilitate credible EMS research and innovative pilot projects. Lead agencies rely, to an increased extent, on national certifying and accrediting bodies to ensure adequate quality of some EMS system components, thus enabling enhancement of their roles as facilitators.

State and local EMS lead agencies have the authority and means to ensure the reliable availability of EMS to the entire population. Such authority is exercised to act on the public's behalf when eventualities occur, such as potential changes in the health care system or EMS structural or financial circumstances, and threaten its quality or availability to the entire population.

HOW TO GET THERE

Collectively, those responsible for EMS must convince legislators in the U.S. Congress to authorize and sufficiently fund a lead federal EMS agency. This agency should be health care based and credible to public safety interests, responsible for coordinating all federal initiatives for national EMS development, overseeing development of national guidelines, and serving as a national EMS clearinghouse.

All states must pass, and periodically review, enabling legislation that supports innovation and integration, and establishes and sufficiently funds an EMS lead agency. This agency should be responsible for developing and maintaining a comprehensive statewide EMS system.

State EMS agencies must enhance their abilities to provide facilitation and technical assistance to local EMS systems. Although states may retain responsibility for licensing, they should increase reliance on available national resources for certification and accreditation of EMS providers and some EMS system components.

Each state must establish and fund the position of State EMS Medical Director, delineate the authority of all EMS medical directors within the state, and establish qualifications for various medical director positions in the state. Medical directors, within broad guidelines, should be responsible for determining the parameters of EMS practice within their systems.

State and local EMS authorities must be authorized to act on the public's behalf in cases of threats to the availability of quality EMS to the entire population. Actions should ensure that some segments of the population are not underserved, or denied immediate access to EMS due to socioeconomic or other factors.

States should implement laws that provide protection from liability for EMS field and medical direction personnel when dealing with unexpected and/or unusual situations falling outside the realm of current protocols. These should include provisions for in-depth review of such cases, and not alter liability for grossly negligent conduct.

LEGISLATION AND REGULATION:

- Authorize and sufficiently fund a lead federal EMS agency
- Pass and periodically review EMS enabling legislation in all states that supports innovation and integration, and establishes and sufficiently funds an EMS lead agency
- Enhance the abilities of state EMS lead agencies to provide technical assistance
- Establish and fund the position of State EMS Medical Director in each state
- Authorize state and local EMS lead agencies to act on the public's behalf in cases of threats to the availability of quality EMS to the entire population
- Implement laws that provide protection from liability for EMS field and medical direction personnel when dealing with unusual situations

SYSTEM FINANCE

Emergency medical services systems, similar to all public and private organizations, must be financially viable. In an environment of constant economic flux, it is critical to continuously strive for a solid financial foundation.

The future: A consortium of regional hospitals form the Optimal Health Network, a managed care provider/insurer organization. As its membership increases, the network establishes collaborative relationships with EMS agencies in the members' communities. Based on a formula that accounts for patient care standards, EMS system preparedness, and expectations of both the network and the EMS systems, the network's support for EMS is proactively determined and EMS assumes a role in the access of the network's members to efficient health care.

"The future of EMS is indivisibly linked to how it is funded. In order to optimize the positive influence of EMS on community health we must move to a system of finance that is proactive, accounting for the costs of emergency safety net preparedness and aligning EMS financial incentives with the remainder of the health care system."

David R. Miller

WHERE WE ARE

Providing the nation with EMS is a multibillion dollar effort each year. While all the costs are not exactly known, Hawaii's EMS system provides a basis for estimation. Out-of-facility EMS in Hawaii is completely state-funded. The annual cost of EMS for the state's 1.2 million residents is $32,460,605.[76] This includes funding for training, communications, ambulance services, quality improvement, data collection, and other aspects of the system, and amounts to approximately $27 per capita per year. Extrapolating that cost to the entire U.S. population (249,632,692 in 1990) yields an estimate of $6.75 billion per year. Of course, such an estimate might not account for some costs or fail to factor in cost-savings (e.g., volunteers). However, EMS clearly represents a large investment.

The overall cost of EMS for a discreet geographic area includes the costs of all the infrastructure and activities required to provide service. For example, communications systems, vehicle/equipment acquisition and maintenance, personnel training and continuing education, first response and ambulance operations, medical direction, and licensing and regulation activities all contribute to EMS costs. Also, process (e.g., response time) standards and staffing requirements greatly influence these costs. In total, the combined costs of all EMS components and activities, the overall cost of EMS, is equivalent to the cost of preparedness, and it is greatly affected by community requirements.

EMS systems are funded by a combination of public and/or private funds. Primary revenue streams include governmental subsidy via tax dollars, subscription revenue, and fees generated by providing service. For those EMS systems supported directly by tax dollars, subsidies vary greatly and may exceed $20 per capita in some areas. Additionally, many states fund EMS development from specific revenue sources, such as vehicle or driver licensing, motor vehicle violations, and other taxes.[128]

Subscription programs allow the public to pre-purchase EMS system services in one of two forms. A subscription, depending on the program, is a contract to provide EMS without additional charges to the consumer, or fixes the price and pre-pays any potential insurance deductible. With the latter, third party payors may be billed, but there are still no additional charges to the consumer.

Fee for service revenue comes from five main sources: Medicare, Medicaid, private insurance companies, private paying patients, and special service contracts.[125] Of these, Medicare, Medicaid, and private insurance company revenues are probably the most important. Rates of payment, in general, are based on customary charges and the prevailing charge in the area. However, rules vary significantly among insurance carriers, and payment can be affected by what neighboring systems charge.

Those EMS systems relying on third party payors for significant revenue must, in general, provide

transportation in order to charge for their services. In other words, if the EMS system provides treatment, but does not actually transport a person to a hospital, third party payors are not obliged to pay for the service provided. Furthermore, payment is often based on the level of care required during transport. It ignores that more advanced resources may have been initially required by the patient, based on the first available information, but that less advanced resources were required for transport.

Treatment followed by transport (by the EMS system) to a hospital is not always necessary or the most efficient means of delivering needed care. However, current EMS financial incentives may not be aligned with efforts of the health care system as a whole to optimize out-of-facility care and enhance health care efficiency. With current payment policies, decreasing the percentage of transports per patient assessed or treated results in decreased EMS system revenue, reduced operating margin, and impaired ability to shift costs.

The primary determinants of EMS cost relate to system preparedness, or the cost of maintaining the resources necessary to meet a benchmark for emergency response. On the other hand, the primary determinant of payment (one source of revenue) is patient transport. Thus, the driving forces for cost and payment are not aligned.

In some cases health care insurers or providers stipulate to their subscriber patients that authorization must precede utilization of EMS. Refusal to pay EMS for services provided may be based on lack of preauthorization or claims that the patient condition did not represent an emergency. Furthermore, regional health care providers (e.g., managed care organizations) frequently require their patients to seek care at specific facilities. EMS systems are then requested to provide transport to locations that are not always geographically convenient. Accommodation of these requests may require additional resources, with their associated costs, to be deployed by EMS systems.

WHERE WE WANT TO BE

In as much as EMS is a component of the health care delivery system, and provides health care services, it is consistently funded by mechanisms that fund other aspects of the system. These mechanisms are proactive and recognize the value of treatment that is provided without transport. Transport is not a prerequisite for funding. Payment for EMS is preparedness-based (i.e., the cost of maintaining a suitable state of readiness), and depends on service area size and complexity, utilization, and pre-determined quality standards (i.e., staffing, level of care, response time, and others). This provides EMS with financial incentives that encourage, as appropriate, provision and/or direction of EMS patients to efficient care or other resources. It links finance to value, as determined by community consumers, and aligns cost and payment drivers.

The continued development of EMS systems on regional, state-wide, and national bases is facilitated by regional, state, and federal governments. Sufficient funds are allocated to ensure EMS preparedness, including its first response functions.

HOW TO GET THERE

EMS systems must continually determine and improve their cost-effectiveness and evaluate trends within the health care system as a whole. Evaluations should enable optimization of financial resources to provide improved care.

EMS systems must develop proactive relationships with health care insurers and other providers. Such relationships should include implementing pilot projects that determine ways for EMS and other health care organizations to collaborate to increase the efficiency of patient care delivery. These could address such issues as patient and system outcomes when patients are not transported to an emergency department. The results of such pilot projects must be widely disseminated.

Health care insurers and provider organizations must compensate EMS as a component of the health care system caring for their clients/subscribers/members/ patients/consumers. Model formulas for use among these entities should be developed. Criteria for payment, that are preparedness-based, do not necessarily require patient transport, and are not volume driven, must be developed between EMS systems and insurers/provider organizations.

Health care insurers/provider organizations must allow immediate access to EMS for their patients who believe that a medical emergency exists. They must recognize an emergency medical con-

dition as a medical condition, with a sudden onset, that manifests itself by symptoms of sufficient severity, such that a prudent layperson, possessing an average knowledge of health and medicine, could reasonably expect the absence of immediate medical attention to result in placing the person's health in serious jeopardy. Such a condition should serve as sufficient cause to access EMS.

Governmental agencies responsible for health care finance policy must incorporate divisions that address issues relevant to EMS. Such issues should include reimbursement for services when transport does not occur, and development of preparedness-based or other alternative, proactive criteria for EMS reimbursement/finance.

Local, state, and federal governments must commit to funding agencies primarily responsible for facilitating coordinated EMS development and evolution. Such funding should be from stable sources that enable future planning to occur. It should provide resources for infrastructure development, EMS evaluation and research, and pilot project implementation.

SYSTEM FINANCE:

- Collaborate with other health care providers and insurers to enhance patient care efficiency
- Develop proactive financial relationships between EMS, other health care providers, and health care insurers/provider organizations
- Compensate EMS on the basis of a preparedness-based model, reducing volume-related incentives and realizing the cost of an emergency safety net
- Provide immediate access to EMS for emergency medical conditions
- Address EMS relevant issues within governmental health care finance policy
- Commit local, state, and federal attention and funds to continued EMS infrastructure

HUMAN RESOURCES

The task of providing quality EMS care requires qualified, competent, and compassionate people. The human resource, comprised of a dedicated team of individuals with complimentary skills and expertise, is the most valuable asset to EMS patients.

The future: Hannah is a paramedic in the northeast U.S. She becomes interested in a new position in a Georgia city. The new position, paramedic-community health specialist, involves all of her current duties, but also requires some knowledge and skills Hannah does not currently use. She is accepted for the job, and through routine mechanisms involving credential checks, is authorized by Georgia's lead EMS agency to work there. Her new employer verifies clinical competency through medical direction and provides access to the educational programs Hannah needs to be comfortable and proficient in her new role. Her credentials are part of a permanently accessible record in the event she chooses to relocate in the future.

"Regardless of how integration with other health care services and increased use of advanced technology changes the picture of EMS, human resources remain our most precious commodity. Without effective "care" of our human resources, this exercise becomes academic."

John L. Chew

WHERE WE ARE

Many people with greatly diverse backgrounds contribute to the efficient operations of EMS systems. In addition to citizen bystanders, these include public safety communicators and emergency medical dispatchers, first responders, emergency medical technicians (EMTs) of various certification levels, nurses, physicians, firefighters, law enforcement officers, other public safety officials, administrative personnel, and others. Among local EMS systems, specific contributions by different categories of personnel may vary significantly.

The vast majority of out-of-hospital EMS care is provided by paramedics and other levels of EMTs. Estimates of the total number of EMS providers vary, but one indicated that there are more than 70,000 paramedics and 500,000 other levels of EMTs.66 Across the country, more than 40 different levels of EMT certification exist. However, the *National EMS* Education *and Practice Blueprint* has established standard knowledge and practice expectations for four levels of EMS providers: First Responder, EMT-Basic, EMT-Intermediate, and EMT-Paramedic.89 Much of the nation's EMS is provided by volunteers with diverse occupational backgrounds. They serve more than 25% of the population. The economic value of their contribution is However, for many possible reasons, the number of EMS volunteer organizations is decreasing.40

Nurses continue to be involved in EMS systems in educational, administrative, and care delivery capacities. The most frequently employed crew configurations for air medical services include at least one nurse.124 Nursing education regarding out-of-facility emergency care is variable. However, many nurses engaged in out-of-facility EMS patient care activities also are certified as EMTs at some level.' Several states have created curricula specifically for the purpose of educating, and thus credentialing, nurses who wish to be EMS field providers. Additionally, the Emergency Nurses Association has developed national standard guidelines for prehospital nursing curricula.106

Many other groups of health care workers also collaborate to effect the patient care provided by EMS. They include physicians (emergency physicians, family practitioners, pediatricians, surgeons, cardiologists, and others), nurses with various areas of special expertise, nurse practitioners, physician's assistants, respiratory therapists, and others. Their roles may involve EMS personnel education, system planning, evaluation, research and/or direct provision of care.

Perennial EMS personnel-related issues include the difficulties of recruitment and retention. Occupational risks, often limited mobility (e.g., credential reciprocity), suboptimal recognition, and inadequate compensation contribute to these prob-

lems. Both volunteer and career (i.e, paid personnel) systems are affected.

EMS personnel experience stressors and risks that are unique to other health care workers and, no doubt, to other public safety workers, Among these stressors is exposure to highly traumatic events or experiences. Emergency personnel are at least twice as likely as the general population to suffer from post traumatic stress disorders.[81, 82] However, there is a paucity of literature describing systematic approaches intended to further understand the spectrum of EMS workforce stressors.[11,13,95,105] Instead, most descriptions of EMS personnel stress and subsequent "burnout" are anecdotal.

Exposure to bloodborne pathogens is a significant risk for EMS personnel. Exposure to HIV and hepatitis viruses are the greatest concerns.[42] Reports indicate that between 6 and 19 per 1,000 "ALS" EMS responses involve a contaminated needle stick injury to EMS personnel.[58,103] The average hepatitis B virus seroprevalance rate among EMS personnel is 14%, which is 3-5 times higher than the general population.[80] Furthermore, the widespread resurgence of tuberculosis poses an additional threat of serious occupation related infection to EMS workers.[42]

Other work related injuries also are common. EMS personnel, especially those in urban areas, are subject to assault.[48] Back injury is the single largest category of occupational injuries, and frequent mechanisms of injury include lifting, falling, assaults, and motor vehicle crashes.[49,60,111]

EMS workers often suffer from lack of full recognition as members of the health care delivery system. They frequently lack a satisfactory career ladder. Providers are also limited in terms of their mobility, as there is no uniform system of credential reciprocity among all states. Barriers also exist between regions in some states. Furthermore, the environment in which EMTs and, in particular, paramedics may practice is in many cases limited by state statutes and regulations.

Among EMS systems, the numbers and types of personnel who staff EMS vehicles vary greatly. Some literature addresses the value of a physician in specific circumstances and as part of an air medical transport team.[9,54,112] However, evaluations of other desirable personnel attributes, in terms of numbers and combined levels of education and experience to provide specific services/interventions, have not been systematically performed and reported.

WHERE WE WANT TO BE

People attracted to EMS service are among society's best, and desire to contribute to their community's health. The composition of the EMS workforce reflects the diversity of the population it serves. The workforce receives compensation, financial or otherwise, that supports its needs and is comparable to other positions with similar responsibilities and occupational risks.

A career ladder exists for EMS personnel, and it includes established connections to parallel fields. EMS personnel may use accumulated knowledge and skills in a variety of EMS-related positions, and neither advancing age or disability prevent EMS providers from using their education and expertise in meaningful ways.

Standard categories of EMS providers are recognized on a national basis. Such levels provide the basis for augmentation of knowledge and patient care skills that may be desirable for specific regional circumstances.

Reciprocity agreements between states for standard categories of EMS providers eliminates unreasonable barriers to mobility. This enhances career options for EMS workers and their ability to relocate whether for personal or professional reasons.

There is an understanding of the occupational issues, including both physical and psychological, unique to EMS workers. All EMS personnel receive available immunizations against worrisome communicable diseases, appropriate protective clothing and equipment, and pertinent education. They also have ready access to counseling when needed., The value of supporting the well-being of the workforce is recognized, and workforce diversity is considered during the design of strategies to address occupational issues.

EMS personnel are prepared to provide the level of service and care expected of them by the population served. Preparation includes physical resources, adequate personnel resources, and requisite knowledge and skills. This helps ensure that the quality of care provided meets an acceptable community standard.

EMS personnel are readily recognized as members of the health care delivery team. This is congruent with recognition of the role EMS plays in providing out-of-facility care to the population, and its function as an initial treatment provider and facilitator of access to further care at times of acute injury or illness.

Health care workers with special competency in EMS are readily identifiable. This includes physicians, nurses, administrators, and others whose practices involve EMS. Recognition of special competency helps ensure quality of knowledge and expertise for health care workers who are sought to affect EMS and its ability to provide quality care for its patients.

Provider skills and patient care interventions are evaluated continuously to determine which skills and interventions positively impact EMS patient coutcomes. This ensures that providers are appropriately educated and distributed within EMS systems so that they are able to deliver optimal care to the population.

HOW TO GET THERE

Adequate preparation, in terms of both knowledge and skills acquisition, must precede changes in the expectations of services to be provided by EMS personnel. EMS systems administrators, managers and medical directors are responsible for ensuring such preparation. Requisite knowledge and skills should be estimated *a priori* and continuously evaluated.

Those responsible for EMS structures, processes and outcomes, including EMS education, must adopt the principles of the *National Emergency Medical Services Education and Practice Blueprint*. [89] This will provide greater national uniformity among EMS workers and enhance recognition of their expertise and roles within health care.

State EMS directors must work together to develop a system of reciprocity for credentialing EMS professionals who relocate from one state to another (e.g., the National Registry of Emergency Medical Technicians). Although states may have specific criteria for authorizing EMS providers to practice, it is not acceptable to require professionals to repeat education that has already been acquired. This will ensure that EMS providers may take advantage of professional opportunities to which they are otherwise entitled.

EMS systems should develop relationships with academic institutions. This will facilitate access to resources necessary to conduct occupational health studies and provide education opportunities for personnel. Education opportunities sought should include recognized management course work for EMS system managers/administrators.

Researchers in EMS systems should collaborate to conduct occupational health studies regarding EMS personnel (e.g., long-term surveillance studies, national database, and others). Such studies must be designed to yield an improved understanding of occupational hazards for EMS workers and strategies for minimizing them.

EMS systems must become affiliated with or implement a system for critical incident stress management. The potential effects of overwhelmingly tragic events on EMS workers cannot be ignored, and must be addressed to the greatest extent possible.

EMS must be developed as a subspecialty for physicians, nurses, and other health care professionals with an EMS focus. This will facilitate recognition of health care professionals with special competency in EMS.

HUMAN RESOURCES:

- Ensure that alterations in expectations of EMS personnel to provide health care services are preceded by adequate preparation
- Adopt the principles of the *National EMS Education and Practice Blueprint*
- Develop a system for reciprocity of EMS provider credentials
- Develop collaborative relationships between EMS systems and academic institutions
- Conduct EMS occupational health research
- Provide a system for critical incident stress management

MEDICAL DIRECTION

Medical direction involves granting authority and accepting responsibility for the care provided by EMS, and includes participation in all aspects of EMS to ensure maintenance of accepted standards of medical practice. Quality medical direction is an essential process to provide optimal care for EMS patients. It helps to ensure the appropriate delivery of population-based medical care to those with perceived urgent needs.

Thefuture: In Quinton, the EMS medical director, after input from other community physicians, wishes to add follow-up visits for certain discharged emergency department patients to her system's practice parameters. The medical direction staff and other physicians are formally consulted, and justification is provided to the state EMS lead agency. After extensive education and granting of clinical privileges to a number of system personnel, the plan goes into effect. The medical command center coordinates communication between field personnel and patients' primary care providers. The medical direction staff conducts a continuous evaluation of the new activity and its effects on the system's emergency response capabilities.

"Medical direction brings to EMS all the traditions of patient care, research and lifelong learning inherent in Medicine. The ethical foundation of medical practice must be the foundation for providing medical care in the streets. Medical directors are made, not born. Making' them is not always easy; programs for them must reflect field problems and field resources, and in a planned way should take place under conditions in the street."

Ronald D. Stewart, OC, MD

WHERE WE ARE

Administrative and medical direction management components, working in concert, are required to ensure quality state-of-the-art EMS. Physicians affiliated with EMS systems serve at varying extents, from informal system medical advisors to full-time medical directors and system administrators. With respect to EMS events, medical direction includes activities that are prospective (e.g., planning, protocol development), contemporaneous, and retrospective.

In most states, medical direction of EMS systems that provide advanced levels of care is mandated by law. Many basic level EMS systems (i.e., those without EMT-Intermediates or EMT-Paramedics) do not maintain continuous medical direction, but a growing number are now being required to establish formal relationships with responsible physician medical directors."* The Emergency *Medical Technician: Basic, National Standard Curriculum* emphasizes the role of medical direction during EMT-B education and practice.[34]

In many states, the majority of on-line medical direction, referring to the moment-to-moment contemporaneous medical supervision of EMS personnel caring for patients in the field, is provided by emergency physicians.[118] It occurs via radio, telephone, or on-scene physicians. Within any given EMS system, on-line medical direction may emanate from a central communications facility or one or more designated hospitals or other health care facilities. Some areas utilize staff other than physicians, such as mobile intensive care nurses (MICN) to communicate with field EMS personnel and affect patient management.

Although on-line medical direction may be important for selected patients, its systematic application for the majority of EMS patients remains controversial. Several investigators have examined the issue of prolonged out-of-hospital times when radio contact with a physician was required.[36,52,62,100] The results have been mixed. However, linkage to objective, relevant outcomes has been incomplete. In the majority of cases on-line medical direction does not result in orders for care beyond what has been directed via protocol, but such communication is nevertheless felt to be helpful by EMS personnel.[36,59,131,142]

Medical direction activities that do not involve contemporaneous direction of EMS personnel in the field include development and timely revision of protocols and medical standing orders, implementation and maintenance of quality improvement systems, personnel education, development

and monitoring of communications protocols, attention to the health and wellness of personnel, and addressing equipment and legislative issues. Such activities are critical for ensuring optimal EMS.

The task of medical direction involves many people in addition to the EMS medical director. Medical direction staffs, medical control authorities and other oversight agencies or boards often include other physicians (emergency physicians, pediatricians, surgeons, internists, family practitioners, and others), nurses and nurse practitioners, physician's assistants, paramedics and other EMTs, administrative staff, and others. Medical direction results from a collaborative effort of all to positively affect the patient care delivered by EMS systems.

The medical director's role is to provide medical leadership for EMS. Those who serve as medical directors are charged with ultimate responsibility for the quality of care delivered by EMS, must have the authority to effect changes that positively affect quality, and champion the value of EMS within the remainder of the health care system. The medical director has authority over EMS medical care regardless of providers' credentials. He or she is responsible for coordinating with other community physicians to ensure that their patients' issues and needs are understood and adequately addressed by the system.

Medical directors evolve from several medical disciplines. In some areas, emergency physicians provide the majority of medical direction. During their residency training, emergency physicians are exposed to the principles of providing medical direction. A model curriculum for EMS education within emergency medicine residency programs has been published.[129] However, not all emergency physicians are EMS physicians, nor are all EMS physicians emergency physicians. Furthermore, not all EMS physicians are EMS medical directors. Nevertheless, no matter what other clinical expertise they possess, these physicians are knowledgeable regarding EMS systems and clinical issues. They provide input to their communities' EMS systems, affect the care that is delivered by EMS, and participate in local, state, and/or national EMS issues resolutions. A growing number of EMS fellowships are being created to facilitate development of special competency in EMS among physicians, but no subspecialty certification by the American Board of Medical Specialties yet exists.

Currently, medical direction is often provided by physicians and staffs on behalf of hospitals who donate, to some extent, their resources. As the structure of the health care delivery system as a whole evolves, and financial incentives for medical care providers change, hospitals' incentives for engaging in EMS medical direction are diminishing. The potential of a crisis may exist for medical direction in its current form, involving physician expertise that is often volunteered or compensated by hospitals.

WHERE WE WANT TO BE

All EMS providers and activity have the benefit of qualified medical direction. This is true regardless of the level of service provided, and helps ensure that EMS is delivering appropriate and quality health services that meet the needs of individual patients and the entire population.

The effects of on-line medical direction are understood, including identification of situations that are significantly influenced by on-line medical direction, and the effects of various personnel providing it. This helps ensure that on-line medical direction is available and obtained for those situations when it is likely to have a positive effect for EMS patients.

Medical direction is provided by qualified physicians and staffs with special competency in EMS. Recognition of competency, by virtue of acquisition of knowledge and skills relevant to the delivery of EMS care and administration of EMS systems as population-based health care systems, is available in the form of subspecialty certification for physicians, nurses and administrators. This helps ensure that medical direction, which ultimately affects the care provided to patients in the community, is provided by knowledgeable and qualified individuals.

Every state has a state EMS Medical Director who is an EMS physician. This helps ensure appropriate medical direction for states' EMS systems. It acknowledges EMS as a component of the health care system serving patients' needs and requiring physician leadership. States recognize that out-of-facility medical care must be supervised by a qualified physician.

Resources available to the medical director(s) are commensurate with the responsibilities and size

of the population served. This ensures that resources (e.g., personnel, equipment, funding, and others) are sufficient to carry out the responsibilities and authorities incumbent upon the medical director and medical direction staff. The cost of such resources is included with those of system preparedness.

EMS medical directors, in consultation with other medical direction participants, are responsible for determining EMS systems' practice parameters. They maintain authority for all care provided by EMS, and they have responsibility for granting clinical privileges to EMS providers. The medical director and other medical direction personnel ensure that EMS providers are prepared, in terms of education and skills, to deliver the system's patient care.

Medical direction provides leadership for EMS systems and personnel. The medical director ensures collaboration between EMS and other health care partners, and actively seeks contributions from other community physicians so that the interests and needs of the entire population served (e.g., children, senior citizens, and others with special health care needs) are addressed. EMS medical directors are in a position to positively influence systems and the care delivered through their knowledge of the complexities of EMS, the spectrum of issues related to population-based care, the occupational health concerns of EMS personnel, the optimal care for the spectrum of EMS patients, and the principles of clinical research.

HOW TO GET THERE

EMS provider agencies, of all levels of sophistication, must formalize a relationship with a medical director(s) for the purpose of obtaining medical direction. Medical direction must be available and provided to all EMS processes, including emergency medical dispatching and education. In some cases, local or state legislation may be appropriate to compel such relationships.

EMS systems must ensure that medical direction is appropriated sufficient resources to justify its accountability to the systems, communities, and patients served. The cost of such resources should be included with those of system preparedness.

All individuals who provide on-line medical direction must be appropriately credentialed. This should be accomplished, in part, through formal orientation to the principles of on-line medical direction and specific characteristics of local EMS systems.

EMS physicians and researchers must conduct investigations of adequate quality to elucidate the effects of on-line medical direction. Effects studied should address objective, relevant patient outcomes and systems costs.

Interested organizations must continue their work to develop the basis for EMS as a physician subspecialty. Such work should include encouragement of institutions to develop resources necessary to implement EMS fellowships, so that the number of qualified EMS physicians will grow.

EMS authorities and systems should designate a physician(s) responsible for overall medical direction within the jurisdiction. Such an appointment should be made with the intent of facilitating uniformity of medical oversight policies and practices throughout the jurisdiction. Additionally, medical director(s) should be charged with the responsibility of, and accountable for, collaborating with other community physicians to ensure the best possible care for the population.

All states must appoint a statewide EMS medical director. This physician ultimately will be responsible for statewide EMS medical direction, providing leadership and guidance for the state's EMS system that is based on sound medical practice.

MEDICAL DIRECTION:

- Formalize relationships between all EMS patterns and medical directors
- Appropriate sufficient resources for EMS medical direction
- Require appropriate credentials for all those who provide on-line medical direction
- Develop collaborative relationships between EMS systems and academic institutions
- Develop EMS as a physician and nurse subspecialty certification
- Appoint state EMS medical directors

EDUCATION SYSTEMS

As EMS care continues to evolve and become more sophisticated, the need for high quality education for EMS personnel increases. Education programs must meet the needs of new providers and of seasoned professionals, who have a need to maintain skills and familiarity with advancing technology and the scientific basis of their practice.

The future: Tom Klowska is a paramedic in a municipal EMS system. He started his career as an EMT-Basic after completing a standard accredited course at the community college. He received academic credit for his one-year paramedic program, which he completed two years ago. Currently, he has a partial scholarship and is pursuing a degree in community health, which will qualify him as a Community Health Advanced Medical Practitioner, and result in his ability to assume a new position (with higher compensation) within the EMS system.

Many of his classmates have similar experiences. Some are nurses and other health professionals transitioning to out-of-facility positions.

"Education systems of the future will make maximum use of technology to reach students in outlying areas and those who otherwise have difficulty reaching traditional classrooms. Textbooks will seldom be made of paper; videos, satellite television, and computer linkages and programs will provide the bulk of study materials. Educational bridge programs will make it easier to advance one's knowledge without repeating previous classroom and practical experiences."

E. Marie Wilson, RN, MPA

WHERE WE ARE

Currently, EMS education programs primarily prepare those who are interested for certification as an EMT at various levels. The *National EMS Education and Practice Blueprint* describes the standard knowledge and practice expectations for four levels of EMS providers.89 However, there are currently more than 40 different types of EMT certification, in terms of requisite knowledge and skills, available across the United States. Such variation among states and local jurisdictions impedes efforts to develop agreements for credentialing reciprocity. The National Registry of Emergency Medical Technicians (NREMT) offers certification examinations for First Responder, EMT-Basic, EMT-Intermediate, and Paramedic levels, which are accepted by many states as evidence of competency.

Settings for EMS education include hospitals, community colleges, universities, technical centers, private institutions, and fire departments.130 Program quality and improvement efforts can be achieved in all settings. Ninety-four paramedic education programs currently ark accredited by the Joint Review Committee on Educational Programs for the EMT-Paramedic. Additionally, increasing numbers of colleges offer bachelor's degrees in EMS.101 However, overall there is inadequate availability of EMS education opportunities in management, public health, and research principles.

Curricula developed by the U.S. Department of Transportation (DOT) provide the bases for education of first responders, EMT-Basics, EMT-Intermediates, and EMT-Paramedics. Education of military EMS personnel also follows these curricula, and they often may provide a resource pool for civilian EMS systems.

Standardized brief educational programs, with specific objectives that address treatment of segments of the population, also have been developed. They include courses in cardiac, trauma, and pediatric life support. Such programs are frequently incorporated into, or used to supplement, EMS education plans. Many reports discuss education of EMS providers to perform specific skills.6, 16, 43, 70, 71, 102, 133, 140. 141 However, there have not been systematic analyses of the suitability of EMS education with regard to expectations for EMS personnel to provide a spectrum of public safety and health care services. Additionally, issues related to knowledge and skill degradation have not been addressed extensively. While some EMS providers seek further educational opportunities, others, for various reasons, do not wish to do so.130

WHERE WE WANT TO BE

EMS education employs sound educational principles and sets up a program of lifelong learning for EMS professionals. It provides the tools necessary for EMS providers to serve identified health care needs of the population. Education is based on research and employs adult learning techniques. It is conducted by qualified instructors.

Educational objectives for EMS providers are congruent with the expectations of health and public safety services to be provided by them. This ensures that acquired knowledge and skills are those that adequately prepare providers to meet expectations for personnel of their stature.

Education programs are based on the national core contents for providers at various levels. Core contents provide infrastructure for programs, which might be augmented as appropriate for local circumstances (e.g., wilderness rescue). They provide national direction and standardization of education curricula, which facilitates recognition by credentialing agencies while allowing adequate opportunity for customization as indicated by local necessity.

Higher level EMS education programs are affiliated with academic institutions. EMS education that is academically-based facilitates further development of EMS as a professional discipline. It increases the availability of educational opportunities that acknowledge previous EMS educational/academic achievements, provides more academic degree opportunities for EMS personnel, augments the management skills among EMS professionals, and protects the value of personal and societal resources invested in education.

Interdisciplinary and bridging programs provide avenues for EMS providers to enhance their credentials or transition to other health care roles, and for other health care professionals to acquire EMS field provider credentials. They facilitate adaptation of the work force as community health care needs, and the role of EMS, evolve.

Institutions of higher learning recognize EMS education as an achievement worthy of academic credit. They welcome affiliations with EMS education programs, and assist them to strengthen the academic basis of EMS education.

HOW TO GET THERE

Any change in the vision of EMS should prompt an analysis of new tasks required by that vision, providing the basis for determining the education needs of the EMS workforce. Alterations of EMS education core contents should then follow accordingly.

EMS education researchers must investigate curricula adequacy and alternative education techniques. Such investigations should be designed to provide improved understanding of the education that is optimal for serving various EMS roles. The results of such investigations should be widely disseminated.

Objectives of education programs must be updated sufficiently and frequently so that the needs of EMS patients are met. Modifications should ensure that objectives serve the current needs of EMS patients and the personnel who care for them, so community standards of practice can be achieved. Higher level EMS education programs must incorporate learning objectives regarding research, quality improvement, and management. The scientific basis of EMS practice, basic principles of clinical research, the importance of ongoing EMS research, and the principles of quality improvement and management should be included.

All EMS education must be conducted with the benefit of qualified medical direction. The physician medical director(s) should be involved in education program planning, presentation, and evaluation, including evaluation of faculty, and participants.

The federal EMS lead agency should commission the development of national core contents for various levels of EMS providers. Core contents should replace current curricula. These should be updated on a predetermined schedule to ensure their ongoing utility.

EMS education programs should seek accreditation by a nationally recognized accrediting agency. Accreditations should be sought to demonstrate that the educational programs provided meet a predefined national standard of quality.

Public funds for education should be directed preferentially toward EMS education programs that

are accredited. This includes student financial aid (e.g., state and federal).

Providers of EMS education should seek to establish relationships with academic institutions (e.g., colleges, universities, academic medical centers). Such relationships should enhance the academic basis of EMS education and facilitate recognition of advanced level EMS education as an accomplishment worthy of academic credit.

EMS education providers and academic institutions should develop innovative solutions that address cultural variation, rural circumstances, and travel and time constraints. These should include programs that incorporate, for example, distance learning and advancing technology. Reports of such programs should be made widely available. In some cases, these institutions should develop their own EMS education programs that offer academic credit.

EMS educators must develop bridging and transitioning programs. These programs should offer mechanisms for EMS providers to enhance their credentials or transition to new health care roles. They should also provide other health care personnel the ability to transition to out-of-hospital EMS roles.

EDUCATION SYSTEMS:

- Ensure adequacy of EMS education programs
- Update education core content objectives frequently enough so that they reflect patient EMS health care needs
- Incorporate research, quality improvement, and management learning objectives in higher level EMS education
- Commission the development of national core contents to replace EMS program curricula
- Conduct EMS education with medical direction
- Seek accreditation for EMS education programs
- Establish innovative and collaborative relationships between EMS education programs and academic institutions
- Recognize EMS education as an academic achievement
- Develop bridging and transition programs
- Include EMS-related objectives in all health professions' education

PUBLIC EDUCATION

Public education, as a component of health promotion, is a responsibility of every health care provider and institution. It is an effort to provide a combination of learning experiences designed to facilitate voluntary actions leading to health.

The future: Nine-year-old Sara and her friends are swimming at the neighborhood pool when they hear a siren. They run to the parking lot to discover an ambulance, not responding to an emergency call, but "on scene" to brief kids about bicycle safety. At fhe end of the program each child receives a family safety checklist. Once completed with their parents, if is redeemable for food and drinks at the pool snack bar. Children also receive information about how fhey and their parents can use their home computers to learn more about safety, first aid, and EMS in their town, and at the same time win coupons redeemable for ice cream cones and other treats. Later that week Sara crashes her bicycle as she tries to avoid a squirrel in her path. Although she strikes her head, she is fortunately wearing her new helmet and suffers no injuries.

"EMS has not yet begun to realize its potential as an important public educator. It should accept the challenge to explore innovative ways for educating the broadest Possible spectrum of society with regard to prevention EMS access and appropriate utilization, and bystander care. EMS must also educate the public and those that purchase services as consumers, so they are enabled to make informed EMS-related decisions for their communities."

Patricia J. O'Malley, MD

WHERE WE ARE

Public education is an essential activity for every EMS system. Yet, as a tool for providing public education, EMS is woefully underdeveloped. A great deal of what the public knows about its EMS system and about dealing with medical emergencies originates from the media, including television programs intended for entertainment and not education. The media does not prepare the public to evaluate or ensure the quality of EMS.

Education, with all its various dimensions, is the linchpin for health promotion. As a component of health promotion, education facilitates development of knowledge, skills, and motivation that lead to reduction of behavioral risks and more active involvement of people in community affairs. This includes greater participation in effecting health and social policy and advocacy for improved health systems.[53]

Public education is often a focus of other public safety divisions. Examples include fire service campaigns regarding the importance of smoke detectors, and police educational efforts regarding impaired driving, traffic and highway safety, and personal safety. In general, EMS has not optimally engaged itself in providing education that improves community health through prevention, early identification, and treatment

Certainly there are examples of EMS public education initiatives. In some areas EMS-C funds have been utilized to develop programs regarding childhood illness and injury.[39] The U.S. Fire Administration (USFA)/National Highway Traffic Safety Administration (NHTSA)/Maternal and Child Health Bureau (MCHB) "Make the Right Call" campaign and other community-wide efforts have focused on timely access and appropriate utilization of the EMS system.[57,84] Additionally, numerous EMS systems have assumed a leadership role in disseminating CPR and "bystander care" education to the public. The NHTSA Public Information and Education Relations (PIER) program seeks, in part, to augment EMS provider public education skills

However, planned and evaluated EMS public education initiatives remain sporadic. This is despite the interest and role of EMS in improving community health, its stature and visibility within the community, and its potential ability-to educate individual patients and family members during periods of care and follow-up.

WHERE WE WANT TO BE

Public education is acknowledged as an essential ongoing activity of EMS. Such programs support the role of EMS to improve community health and provide valuable information regarding prevention of injuries and illnesses, appropriate access and utilization of EMS and other health care services, and bystander care. It realizes the advantages of EMS as a community-based resource with broad expertise and capacity for contributing to community health monitoring and education dissemination.

EMS and public education programs address the needs of all members of the community. This includes school-age children, adults, senior citizens, and other members of the community with special needs.

EMS systems educate the public as consumers. The importance of the public's knowledge of EMS-related issues, including funding, level of care provided, equipment, and system expectations and standards is acknowledged. Purchasers of health care services, whether individual, corporate, or public, are well-informed about EMS issues, including evaluating and ensuring optimal EMS.

EMS systems explore innovative techniques to conduct their public education missions. These include, among others, follow-up visits to patients and their families, exploration of new technologies (e.g., computers, worldwide web), and media formats.

HOW TO GET THERE

EMS should collaborate with other community resources and agencies to determine public education needs. Such assessments will enable development of education programs with specific objectives appropriate for the community.

EMS must engage in continuous public education. Such efforts should focus on areas of prevention, early identification and health care service access, and initial treatment.

EMS must educate the public as consumers. Targets for such efforts should include at-large community members, other members of the health care system, policy makers, lawmakers, and health care service purchasers.

EMS must explore new techniques and technologies to effect public education. Efforts should be made to reach the broadest possible population in the community.

Public education efforts must be scrutinized by an evaluation process. Such evaluation helps ensure that program objectives are being met and provides guidance for program modification.

PUBLIC EDUCATION:

- Acknowledge public education as a critical activity for EMS
- Collaborate with other community resources and agencies to determine public education needs
- Engage in continuous public education programs
- Educate the public as consumers
- Explore new techniques and technologies for implementing public education
- Evaluate public education initiatives

PREVENTION

Prevention provides an opportunity to realize significant reductions in human morbidity and mortality-all with a manageable investment. Engaging in prevention activities is the responsibility of every health care practitioner, including those involved with the provision of EMS.

The future: EMS *personnel analyzing uniform patient care records realize that a disproportionate number of motor vehicle crash victims originate from a particular road intersection. Many of the crashes occurred during the morning rush hours as motorists exited their neighborhood. The information is relayed to the local law enforcement agency and community groups, which form a coalition to evaluate the problem. At civic association meetings, neighborhood residents are advised of a safer route that avoids the dangerous intersection, and congestion there decreases.. Speed limit enforcement on the main highway is increased. Also, new signs near the intersection and radio traffic reporters remind drivers of the potential danger spot so that they exercise caution and stay attentive. Soon thereafter, crash incidence and resulting injuries decrease at that intersection.*

"In the future the success of EMS systems will be measured not only by the outcomes o j their treatments, but also by the results of their prevention efforts. Its expertise, resources, and positions in communities and the health care system make EMS an ideal candidate to serve linchpin roles during multi-disciplinary, community-wide prevention initiatives. EMS must seize such responsibility and profoundly enhance its positive effects on community health."

Theodore R. Delbridge MD, MPH

WHERE WE ARE

As a whole, the health care system is evolving from an emphasis on providing highly technologic, curative care to improving health through prevention and wellness. The objective is to prevent people from ever requiring costly medical care.

In this era, injury prevention has taken on a new dimension for both improving the nation's health and truly controlling health care costs.[77] Injury is the third leading cause of death and disability in all age groups and accounts for more years of potential life lost (YPLL) than any other health problem.[8] Following consideration of such information, a consensus panel has advocated addition of injury prevention modules to the *National EMS Education and Practice Blueprint.*[47]

Other public safety services have demonstrated their effectiveness at public education and prevention activities. These include fire service efforts to effect engineering, enforcement, and education that decrease the number of fires and fire-related burns and deaths. Police departments have implemented deliberate efforts to decrease traffic-related injuries and deaths through aggressive enforcement of impaired driving laws.

EMS is not commonly linked to the public's prevention consciousness. However, the potential role of EMS in prevention has previously been recognized." EMS providers are widelydistributed throughout the population, often reflect the composition of the community, and generally enjoy high credibility.[47] In some regions, EMS personnel currently are taught principles of injury prevention.[117] EMS-initiated prevention programs have been successful in reducing drownings in Pinellas County, Florida, and Tucson, Arizona, and falls from height in New York.[39,55,96] EMS patients also may benefit from linkage between the EMS system and other community services able to provide specific education and prevention initiatives.[39,50,55,61] Such linkages remain rare, however.

Early efforts are underway to implement Safe Communities projects.[110] The Safe Communities concept involves undertaking a systematic approach to address all injuries, and emphasizes the need for coordination among prevention, acute care, and rehabilitation efforts. The Centers for Disease Control and Prevention is developing the concept of "Safe America" and is working with NHTSA to integrate prevention, acute care and rehabilitation for all types of injuries among the many public and

private partners involved in injury control.107 EMS systems are crucial to these efforts as collectors of important injury-related data, as community partners that help study the injury problem and design risk reduction strategies, and as health practitioners who provide acute care.

WHERE WE WANT TO BE

EMS systems and providers are continuously engaged in injury and illness prevention programs. Prevention efforts are based on regional need; they address identified community injury and illness problems.

EMS systems develop and maintain prevention-oriented environments for their providers, individually and collectively. An atmosphere of safety and well- being, established through EMS system initiatives, provides the foundation for EMS prevention efforts within the community.

EMS providers receive education regarding prevention principles (e.g., engineering, enforcement, education, economics). They develop and maintain an understanding of how prevention activities relate to themselves (e.g., while performing EMS-related duties and at other times) and to their outreach efforts.

EMS systems continuously enhance their abilities to document and analyze circumstances contributing to injuries and illnesses. This information is provided to other health care and community resources able to help evaluate and attenuate injury and illness risk factors for individual patients and the community as a whole.

HOW TO GET THERE

Emergency medical services providers/systems must collaborate with other community agencies and health care providers which possess expertise and interest in injury and illness prevention (e.g., other public safety agencies, safety councils, public health departments, health care provider groups, colleges and universities). The intent of such collaboration is to identify appropriate targets for prevention activities and share the tasks of implementation.

EMS systems should support the Safe Communities and Safe America concepts. For the sake of the health of the communities they serve, EMS systems must identify their potential roles within partnerships to reduce preventable injuries and illnesses.

EMS providers and systems must advocate for legislation that potentially results in injury and illness prevention (e.g., through engineering improvements, enhanced enforcement, better education, and economic incentives). This advocacy acknowledges the fiduciary responsibility that EMS has for its communities' health, in recognition of the high costs of preventable injuries and illnesses. Such costs are not only monetary, but include lost productivity and the human suffering that affects individual patients and the entire community.

Prevention begins at home. Protecting the well-being of the workforce is a logical step toward the development and implementation of prevention initiatives within the community.

EMS education core contents must include the principles of prevention and its role in improving individual and community health. Such education will better enable EMS to fulfill its prevention role as a health care and public safety provider.

EMS must continue to improve its ability to document illness and injury circumstances and convey this information to others. These efforts capitalize on the unique position of EMS providers to observe illness and injury scenes, and to identify potential contributing factors within the community.

PREVENTION:

- Collaborate with community agencies and health care providers with expertise and interest in illness and injury prevention
- Support the Safe Communities concept
- Advocate for legislation that potentially results in injury and illness prevention
- Develop and maintain a prevention-oriented atmosphere within EMS systems
- Include the principles of prevention and its role in improving community health as part of EMS education core contents
- Improve the ability of EMS to document injury and illness circumstances

PUBLIC ACCESS

The focus of public access is the ability to secure prompt and appropriate EMS care regardless of socioeconomic status, age, or special need. For all those who contact EMS with a perceived requirement for care, the subsequent response and level of care provided must be commensurate with the situation.

The future: During a severe winter storm 24-year-old Mary is driving home from work late in the evening. On a rural road her car skids and crashes in to a tree. Mary's legs are entrapped beneath the dash, but her torso and head are uninjured due to her car's airbag. The car's engine is smoldering, making the passenger compartment smoky. A sensor in the vehicle's intelligence system detects the crash and estimates its force and the likelihood of occupant injury. The appropriate PSAP for the location is automatically notified by the vehicle's communications computer. Help is promptly dispatched to Mary, who is extricated from the car and transported to the regional mid-level trauma center. Although she suffered a fractured leg as a result of the crash, additional morbidity due to environmental factors, including smoke and extreme cold, was avoided because emergency assistance was summoned immediately instead of requiring eventual discovery by another motorist.

"Public access to EMS is closer to being universal than any other health service. Yet, barriers to securing prompt and appropriate care may still exist for many. It is incumbent upon all of us who share responsibility for leading our communities, planning their emergency health care, and appropriating resources to strive to achieve true universal public access to EMS."

Jack J. Krakeel, MBA

WHERE WE ARE

In the United States, most people access EMS by telephone. For nearly 30 years, 9-l-l has been designated as the national emergency telephone number. The first 9-l-l telephone call was made in Halleyville, Alabama, in 1968. Currently, approximately 25% of the U.S. geography is covered by 9-1-1, making it available to 78% of the U.S. population.[72,90] At many 9-l-l communication centers, call-takers are automatically provided with the caller's telephone number and location; automatic number identity (ANI); and automatic location identity (ALI). Such systems are known as enhanced 9-l-l or 9-l-1E. Seventy-nine percent of the most populous U.S. cities utilize 9-1-1E.[14] However, within individual states, as much as 85% of the population may not have access to 9-l-l. In some states as many as 12% of housing units are without telephones. Obviously, occupants of those homes do not have immediate access to emergency services via 9-l-l.

When 9-l-l is the emergency telephone number, 85% of the public knows it, compared to 36-47% when the emergency telephone number is seven digits.[28] Additionally, 74% of people successfully access EMS on their first attempt when 9-l-l is the emergency telephone number, compared to 40% when the number is seven digits.[78] People living in communities where 9-l-l service is not available, but adjacent to communities where it is, may experience delays in getting emergency help by inadvertently calling 9-l-l instead of a designated seven digit telephone number.

The single most important piece of information provided during an emergency call is the location of the person(s) requiring help. Yet, addresses are lacking for housing units and work sites in many areas.

Highway call boxes, citizens band (CB) radio, amateur radio, and cellular telephones provide alternative means of accessing emergency help in some regions. Accuracy of 9-l-l cellular telephone calls, in terms of reaching the appropriate public safety answering point (PSAP), has been reported to be 80% in one region. In the remaining 20%, the PSAP that was contacted forwarded the necessary information to the appropriate dispatching center.[85] However, in many areas cellular telephone users cannot be assured of reaching the appropriate PSAP for their location. Callers may be advised that they are unable to use 9-1-1, or they may experience significant delays while call recipients determine where to route their calls.

In some instances financial barriers limit access to 9-l-l for appropriate emergency care. Economic conditions may result in lack of a telephone. In other cases, health care provider organizations may impose penalties for their patients who do not obtain prior authorization or access emergency care through an alternative designated telephone number, even when 9-l-l is available.

Presently, EMS is unsophisticated in terms of its ability to allocate appropriate resources to match the nature of calls. Numerous EMS systems triage calls depending on how long a situation can wait before a response is initiated. However, the eventual response is not necessarily commensurate with circumstances (e.g., an over-response is generated) because calling a PSAP does not facilitate access to actually needed services.

WHERE WE WANT TO BE

Implementation of 9-l-l is nationwide. From any land-line telephone in the U.S., a caller can dial 9-l-l, or push an emergency icon, in order to contact the appropriate PSAP for his/her location. In a mobile society, this facilitates timely access to emergency services regardless of location and familiarity with local telephone number requirements. Furthermore, potential barriers to emergency services access are decreased for children, elderly, mentally disabled, foreign visitors, and others with special needs.

Alternative access to 9-l-l is made available to individuals unable to pay for telephone services where they routinely exist. In cases where the routine spectrum of telephone services is not provided because of an inability to pay, limited service that merely enables emergency services access via 9-l-l is nevertheless made available. This helps facilitate access to emergency medical care for the financially disadvantaged, members of society who also are often medically disadvantaged.

Cellular telephones uniformly provide a means of accessing EMS via 9-l-l. Cellular telephones are in widespread use, and may provide a convenient means of accessing emergency services, especially from vehicles, in areas within a "cell" but where a land-line telephone is not readily available. To facilitate timely access by cellular telephone users, "9-l-l" is available wherever the cellular telephone might be in service. Cellular telephone technology (e.g., link to a global positioning system) ensures that all emergency calls are routed to the appropriate communications center.

Every call for emergency services is automatically accompanied by location identifying information. Within metropolitan areas, unique location address codes suffice. For all calls originating from roadways, rural, frontier, backcountry, and wilderness areas, exact locations derived from a geographic information system are provided. This acknowledges location identifiers as the most important information obtained by emergency call recipients and that techniques for accurately enhancing information transfer facilitates timely access to emergency services. Such mechanisms also attenuate barriers to access that might otherwise be experienced by children and others who have difficulty defining their locations.

No financial, legal, social, and age-related barriers to accessing appropriate care via 9-l-l exist for those who perceive an emergency. The subsequent EMS response and level of care provided match the need regardless of other factors. Equal access to 9-l-l and timely emergency care is provided to all members of society.

Systems for accessing EMS and other emergency services employ communications technology advances that reduce barriers to access imposed by geography, age of the caller, specific disabilities, language, and other phenomena. Such systems include mechanisms for computerized automatic PSAP notification in cases of motor vehicle and other types of crashes, utilize personal status monitors and communications devices, instantaneously translate languages, provide the ability to electronically visualize callers (e.g., interactive video communications processes), and incorporate computers to receive and transmit data between the caller, call recipient, EMS provider, other public safety agencies, and other health care services.

EMS access includes allocation of appropriate system resources for the circumstances. Calls received at access points are triaged (e.g., to an emergency communicator, medical advice program, social worker, primary health care provider, other public safety services, and other community resources) so that the resulting output, given available options, provides the most appropriate response (Figure 2).

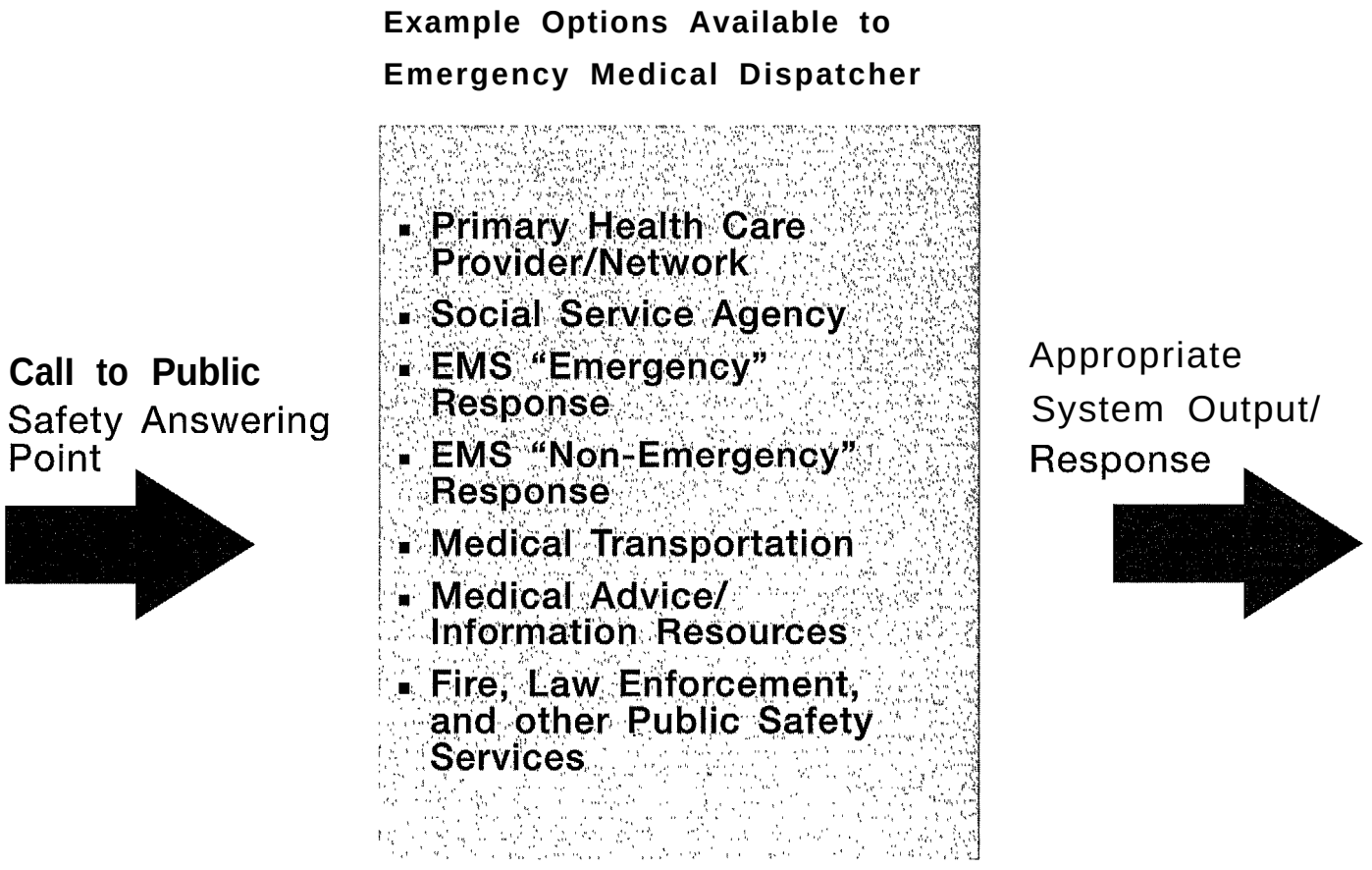

Figure 2. Public Access to an Appropriate EMS Response

HOW TO GET THERE

Organizations with an interest in EMS and all with responsibility for EMS structures, processes, and outcomes must continue to encourage implementation of 9-l-l in all areas. When necessary, resolution of political disputes delaying 9-l-l implementation must be facilitated. Legislation should be adopted that requires implementation of 9-1-1 and/or implementation should be mandated by public utility commissions.

Local governments and public utility commissions must ensure that those who cannot afford telephone service, that would routinely be available in their housing units, are nevertheless able to immediately access emergency services. For example, they might compel provision of minimum telephone service that only enables 9-l-l calls, facilitate strategic placement of public telephones, provide cable calling systems, or develop other services that facilitate access to emergency care.

Utility companies (e.g., telephone, cable) and governmental authorities must continue initiatives to assign unique geographic location codes or addresses to all telephone numbers and housing units, and implement systems to continuously and reliably update such information.

Technology should be employed so that data derived from geographic information systems is automatically supplied to the PSAP regardless of where a call originates. Communication centers must prepare themselves to receive and utilize such information.

Cellular telephone service companies and 9-l-1 PSAPs must engage in cooperative ventures to develop the necessary funding and technology to achieve implementation of cellular 9-l-l service. Within "cells," 9-l-I calls should receive priority so that delays are not experienced due to other cellular activity. Calls from cellular telephones should be locatable with a geographic information system to facilitate linkage with the appropriate PSAP and provide timely response of emergency services to the correct location. Such efforts should be facilitated by the Federal Communications Commission (FCC) and appropriate public utility commissions.

Communications centers, EMS providers, and other public safety agencies must continue to evaluate the appropriateness of communications technology advances which may enhance system access and benefit the efficiency of emergency medical care. Pilot projects that exploit technological advances must be conducted, and the results of such projects must be made public.

EMS access points must improve their abilities to triage calls, providing linkage with other community health resources, so that the system's response is tailored to patients' needs. Such efforts should incorporate the input of community members and community health care providers and resources.

PUBLIC ACCESS:

- Implement 9-l-l nationwide
- Provide emergency telephone service for those who cannot otherwise afford routine telephone services
- Ensure that all calls to a PSAP, regardless of their origins, are automatically accompanied by unique location-identifying information
- Develop uniform cellular 9-l-l service that reliably routes calls to the appropriate PSAP
- Evaluate and employ technologies that attenuate potential barriers to EMS access
- Enhance the ability of EMS systems to triage calls, and provide resource allocation that is tailored to patients' needs.

COMMUNICATION SYSTEMS

Communication steers all organizations, including EMS systems. It provides the transfer of information that enables decisions to be made.

The future: A neighbor finds John, a 65-year-old rural farmer, unconscious in his house and summons EMS. At the communications center John's health provider information is available automatically. The patient's health database is accessed and his current problem list, medications, and allergies are downloaded to the responding personnel's personal digital assistants. EMS personnel find John in severe shock and in critical condition. They learn from his health database that he suffers *from* severe *adrenal insufficiency, and suspect that an intercedent illness or inability to take his medication has led to John's current condition. By computer this information is relayed to the medical command center 50 miles away, and the decision is made to administer a stress dose* of *hydrocortisone in addition to other resuscitative treatment. The patient's primary care provider is also identified* from *the database, is updated directly from the EMS unit, and is able to provide additional helpful information to emergency department staff prior to John's arrival there. John is much improved by then, and he recovers fully.*

"As EMS becomes better integrated with other health services, the needs for efficient information transfer among system partners will increase. Communication systems provide the links that make information transfer possible, and they should exploit technology that enhances their efficiency."

Bob Bailey

WHERE WE ARE

Contemporary EMS systems and their personnel rely as heavily on their communications systems as they do on any other resource available to them. Effective communications networks provide: access to the EMS system, dispatch of EMS and other public safety agencies, coordination among EMS and other public safety agencies, access to medical direction, communications to and between emergency health care facilities, communications between EMS and other health care providers, and outlets for disseminating information to the public.[24]

Within public safety answering points (PSAP), calls for EMS are answered by personnel with greatly varying levels of education, experience, ability to provide potentially life-saving instructions via telephone, and medical direction. Emergency medical dispatchers (EMD) have been advocated as essential personnel at all EMS dispatching centers, and a national standard curriculum is available.[7,18,19,32,888] They are able to query callers and determine the appropriate resources to be dispatched.[126] Furthermore, EMDs are able to provide dispatch life support via pre-arrival instructions for appropriate patients.[17] Pre-arrival instructions are thought to be a cost-effective mechanism for improving survival from out-of-hospital cardiac arrest.[138] However, there is a paucity of published well-constructed, objective studies addressing the effectiveness of EMS dispatching component.

Once EMS units are dispatched, they frequently are isolated from other emergency services, impeding abilities to coordinate appropriate actions. The spectrum of communications equipment currently in use is broad, ranging from antiquated radios to mobile data terminals mounted inside the emergency vehicles. Specific radio frequency utilization by EMS systems varies significantly, including CB, very high frequency (VHF) low and high bands, ultra high frequency (UHF), and 800 and 900 MHZ trunking systems. The latter provide some degree of management for congested radio frequencies, but are also becoming overburdened in some metropolitan areas. Additionally, trunking system costs are greater than other systems, so they are most effective for large metropolitan jurisdictions or multiple cooperating systems. Cellular telephones also are commonly used. They provide an alternative to busy radio frequencies, enhance communication system coverage with cellular-satellite technology, enable data transfer (e.g., 12 lead ECG), and provide for more privacy than routine radio communications.

At the hub is a communications center, with variable control over EMS system status, depending on the operations theory being employed.127 Automatic vehicle location (AVL) technologies are utilized by many emergency services to facilitate continuous vehicle (and system) status updates and to increase efficiency. However, in general, EMS systems are not the sole proprietors of the communications networks they utilize. Currently, only 14 states have a comprehensive EMS communications plan in place.118

From a communications perspective, EMS personnel are, for the most part, isolated from the rest of the health care delivery system. They rarely have access to meaningful medical history data (e.g., medications, previous illnesses, results of previous evaluations/diagnostic tests, and others) about their patients that might enable implementation of efficient decisions. Many EMS systems employ on-line medical direction (direct medical control) as part of their overall medical direction. However, communications often are via crowded VHF frequencies, and are easily monitored. Therefore, potentially confidential information cannot be securely transmitted. Additionally, terrain and limitations of the communications system, including cellular telephone systems, may limit the ability to obtain on-line medical direction at all. Although electrocardiogram (ECG) data may be transmitted via telemetry (marginal quality) or cellular telephone (not yet widely available), other patient data is not transmitted real-time. Also, communications with other health care services, beyond the medical direction facility, is often cumbersome.

WHERE WE WANT TO BE

Calls for emergency medical care are received by personnel with the requisite combination of education, experience, and resources necessary to enable optimal query of the caller, make determination of the most appropriate resources to be mobilized, and implement an effective course of action. The EMS response is appropriate, optimal care is delivered, and utilization of resources is efficient. All callers to EMS are provided dispatch life support by qualified and credentialed personnel. This entails pre-arrival life saving instructions via protocol and with medical direction.

EMS communications networks incorporate other providers of medical care. Such networks enable the EMS system to receive and transmit patient-related information from and to other providers responsible for patients' continuous care. These networks employ useful technological advances, such as transmission of computerized records to maintain confidentiality, so that EMS personnel may make improved decisions with regard to patient care, follow-up care, and transport destination (if necessary). Such communication networks facilitate integration of EMS with other health care services.

EMS communications systems incorporate other public service agencies. Such agencies include departments of public health, social services, and others able to address unhealthy or undesirable circumstances identified by EMS personnel while caring for their patients.

EMS communications systems ensure reliable availability of on-line medical direction and enable transmission of relevant real-time patient data to a receiving medical facility. Such capabilities potentially may allow medical decisions of greater complexity to be made in the field, permit a greater degree of preparation at the receiving facility, enhance EMS system data collection, and facilitate commencement of patients' medical records earlier in the course of their injuries/illnesses.

Communications networks are geographically integrated and based on functional need to enable routine and reliable communications among EMS, fire, law enforcement, and other public safety agencies. This facilitates coordinated responses during both routine and large scale operations, and effects optimal utilization of resources on a large geographic basis. Issues related to disaster preparedness are addressed.

Communications networks for EMS do not stand alone, but EMS is a full partner in the communications system. EMS has the ability to impact network design and function in order to better serve its patients' needs. In some areas, this includes utilization of AVL technology and development of interactive video communications between the public, EMS, fire, law enforcement, other public safety agencies, and other health care providers.

HOW TO GET THERE

Research and pilot projects must be conducted to assess the effectiveness, including patient out-

comes, of various personnel and resource attributes for EMS dispatching. Results of these projects should be made available so that the roles of such personnel within an evolving health care and EMS system can be optimized.

Standards for emergency medical dispatching must be promulgated and updated by public safety communications and other EMS interested organizations, and be commensurate with system needs. In some cases, state legislation will be appropriate in order to ensure that EMDs obtain the education, experience, and resources necessary to perform their intended tasks safely and effectively.

States should legislate immunity from liability for EMDs providing service and following standards at a pre-designated level. Relevant organizations should develop model legislation.

Communications centers and health care providers must commit to cooperative ventures aimed at improving the exchange of confidential patient-related data, in a timely manner. Such efforts must be accompanied by integration of practices and policies so that optimal patient care is achieved.

Research and pilot projects should be conducted to determine the benefits of real-time patient data transfer (e.g., via cellular communications, satellite, interactive video, and others) relative to its costs. As advancing technology is explored, the results of such projects must be made public.

Funds must be appropriated on federal, state, and regional levels to further develop and update communications systems that are geographically integrated and functionally based. States must continue to develop statewide EMS communications plans.

The FCC must reform policies regarding EMS communications. The radio frequency spectrum reserved for EMS utilization must be expanded. The FCC must facilitate exploration of advancing communications technology for potential use by EMS (e.g., personal communication devices, satellite and cellular communications, interactive video, and others). The interest of EMS patients must be considered a priority as changes in federal communications structures are implemented.

EMS systems should collaborate with private interests to effect shared purchasing of communications technology, developing economies of scale. Such pooling of resources will provide an increased ability to explore potential uses of technologic communications advances.

COMMUNICATION SYSTEMS:

- Assess the effectiveness of various personnel and resource attributes for EMS dispatching
- Receive all calls for EMS using personnel with the requisite combination of education, experience, and resources to optimally query the caller, make determination of the most appropriate resources to be mobilized, and implement an effective course of action
- Promulgate and update standards for EMS dispatching
- Develop cooperative ventures between communications centers and health providers to integrate communications processes and enable rapid patient-related information exchange
- Determine the benefits of real-time patient data transfer
- Appropriate federal, state, and regional funds to further develop and update geographically integrated and functionally-based EMS communications networks
- Facilitate exploration of potential uses of advancing communications technology by EMS
- Collaboration with private interests to effect shared purchasing of communication technology

CLINICAL CARE

EMS provides care to those with perceived emergency needs and, when indicated, provides transportation to, from, and between health care facilities. Mobility and immediate availability to the entire population distinguish EMS from other components of the health care system.

The future: In rural America, EMS personnel are evaluating a 65-year-old woman with chest pain. After consultation with the medical command center (80 miles away), short-acting thrombolytics are administered for a suspected acute myocardial infarction. Because of the anticipated duration of transport, anti-oxidants also are administered. The patient's pain begins to subside. Although air medical transport would get the patient to her hospital destination sooner, previous studies have demonstrated deleterious effects for acute cardiac patients. Thus, the patient is taken by ground to the cardiac center (100 miles away), where she is immediately met by the cardiologist who performs definitive intra-coronary debridement. She fully recovers.

"'Advances in technology and provider education will enable EMS systems of the future to provide increasingly sophisticated clinical care. The menu of state-of-the-art interventions available to patients will be limited primarily by relevant outcomes data and community needs."

Robert *E.* Suter DO, *MHA*

WHERE WE ARE

The clinical care delivered by EMS has evolved significantly over the past 30 years. To some extent it has capitalized on the availability of new pharmacologic agents and technology, developed means to deliver life-saving care faster (e.g., layperson CPR, use of automatic external defibrillators by lesser trained personnel, dispatch life support, and others), and begun to systematically address the particular needs of specific groups of patients. EMS systems vary remarkably with regard to the sophistication of out-of-facility care they provide and the tools they utilize. Variation exists due to state legislation and regulations, availability of local resources, and the functional needs and expectations of communities.

Currently, there is no standard baseline of care that is provided by all EMS systems. Historically, "basic life support" (BLS) EMS systems have provided only non-invasive care (e.g., oxygen therapy, splinting, dressing, CPR, etc.). However, due to variations in requirements for EMS provider credentialing and for EMS system component (e.g., ambulance service) licensing, potential EMS patients cannot expect the same standard of "BLS" care in all communities. Furthermore, the terms "BLS" and "advanced life support" (ALS) have become antiquated, as providers, once assigned the designations "basic" are in some areas now providing interventions once thought to be "advanced" (e.g., defibrillation, intubation, and others).

Just as the floor of EMS care is not even, neither is the ceiling. The scope of EMS care differs among states and often between localities. The interventions paramedics may perform, the equipment available to them, and the medications they carry varies greatly.[25,44] The care delivered by EMS makes intuitive sense, in that it is similar to emergency department care -sooner. However, with the exception of a few clinical situations (e.g., cardiac arrest, certain trauma), the effects of EMS care are not adequately known. In some areas, EMS clinical care variations may be the result of adapting to meet the health care needs of communities.

The Red River, New Mexico project, as it is known, is an example of adapting EMS clinical care to meet the health care needs of a rural community.[115] In one community the EMS system was able to augment its services, thus improving the health care available within the town. Other similar projects also have been launched.

For the most part, regardless of its sophistication, EMS clinical care is intended to get patients to a hospital. For most EMS patients, their care entails transportation to a medical facility (e.g., hospital emergency department). For those EMS providers who seek payment for their services, payment usually is based on the patient transport

and retrospective determination of medical necessity.

Patient transport is mostly effected by ground ambulances. Design specifications for such vehicles have been developed and revised by the General Services Administration.[38] Ambulances are equipped and staffed to provide care ranging from non-invasive monitoring and support to sophisticated interventions and pharmacotherapy during transport. Essential equipment for ambulances, including minimum guidelines for "ALS" and pediatric equipment and medications, has been defined.[3,4,37,113] Other modes of transportation (e.g., helicopter, fixed wing aircraft, boat, and others) also are often used.

Transportation of patients to non-emergency medical care facilities, or between facilities may be accomplished by EMS providers or ambulance services operating outside the EMS system. Out-of-facility EMS providers must assume different roles with respect to primary and secondary transport.[20] Currently, these differences are not always clearly delineated in EMS regulations. Specialty ground transport vehicles, often staffed and maintained by hospitals, sometimes are utilized for interfacility transport of patients with special needs, such as critical care, high risk obstetrical, neonatal and cardiac.[124] These vehicles frequently are staffed by personnel with specific expertise, and may include paramedics, nurses, respiratory therapists, cardiopulmonary technologists, and physicians. Medical direction for the transporting team may emanate from different sources that are not always linked to the rest of the EMS system.[20]

WHERE WE WANT TO BE

EMS provides a defined baseline of clinical care and services in all communities. Expansion of care and services occurs in response to community health care needs and availability of resources.

Out-of-facility EMS clinical care is optimal for patients' circumstances, so that it positively impacts patient outcomes. In some cases, the care that is provided is intended to avoid the patient's need for immediate transport to a hospital. The effects of EMS care, in terms of outcomes, for specific conditions are continuously evaluated. This helps facilitate appropriate distribution of health care resources, including equipment, personnel, and education.

Therapeutic technology and pharmaceutical advances are evaluated in terms of their impact on patient outcomes and appropriateness for EMS use (e.g., portable, effective, information-adding, and others) prior to their deployment. EMS clinical care evolves as new diagnostic and therapeutic tools become available, but those that do not provide demonstrable benefit are not used.

As much as possible, transportation modalities are allocated according to patients' conditions so that resources are not overutilized. The composition and expertise of transport teams matches the needs of complex patients undergoing secondary transport. Transport of individuals not requiring sophisticated equipment or supervision does not consume those resources which could be made available elsewhere.

Patient transport activities are integrated with the total health care system. EMS is capable of facilitating access to hospital emergency departments and other health care sources designated by medical direction in consideration of patients' providers of continuous care. Requisite for such facilitation is working knowledge of and agreements with other health care partners.

Staffing patterns, in terms of available skills and expertise, for interfacility or secondary transports result from an understanding of potential care required for specific types of patients. The authority and responsibility for medical direction during such transports is clear.

EMS clinical care and transportation systems are networked. Providers of non-acute, acute, specialty, and air medical transport are closely linked so that communications are smooth and patient transfers, including accompanying data, appear seamless. Communications within networks allow instantaneous assessment of the availability and locations of out-of-facility clinical care and transportation resources.

HOW TO GET THERE

EMS organizations and those responsible for EMS structures, processes, and outcomes must commit to a common definition of what constitutes baseline out-of-facility community EMS care. Such

a definition should address, for example, minimum personnel qualifications and resources/equipment available to them.

EMS should work with national organizations and associations to help determine its role in enhancing identification and treatment of various clinical conditions (e.g., myocardial infarction). EMS clinical care must be subjected to ongoing evaluation to determine its impact on patient outcomes. New services and treatments should be implemented only after their effects have been demonstrated. Furthermore, changes in clinical care should be justifiable based on community health care needs.

Research and pilot projects must be conducted to determine the effects of patient outcomes after specific care and transport via various modalities. This should include investigations regarding the relative effects of ground and air transport on patients with a variety of conditions. The cost effectiveness and relative safety of transport should be addressed.

Research must be conducted and published regarding treatments that can be administered safely during transport by various personnel configurations. Such projects should include interfacility/secondary transfers, when patients are being moved to a different level of care or to access providers responsible for ongoing care.

Task analyses must be conducted to determine the needs for availability of specific skills and expertise during transport of various types of patients. Such analyses should determine optimal personnel configurations for interfacility/ secondary patient transfers.

Local and state EMS lead agencies should facilitate development of arrangements that render delineation of medical direction authority and responsibility unambiguous during interfacility/secondary patient transfers. EMS medical directors should strive to reach consensus among physicians (e.g., on-line medical direction providers, intensivists, trauma surgeons, cardiologists, pediatricians, and others including referring and receiving physicians) and others regarding their roles during interfacility transfers.

The Health Care Finance Administration (HCFA), and others responsible for establishing policy with regard to EMS payment, must eliminate patient transport as a requirement for compensating EMS systems. Patient assessment and care delivered, regardless of whether or not transport occurred, must be recognized and compensated appropriately. Additionally, the cost of system preparedness (e.g., readiness costs) should be recognized. Alternative models for determining rates of reimbursement must be developed.

EMS systems should seek to establish proactive relationships with other providers (e.g., primary care providers, managed care organizations, health clinics) within the health care delivery system. Such relationships should seek to establish understandings of the perspectives of all providers, and to develop mutual policies that enhance the delivery of efficient care to patients. Reports of the effects of these relationships must be disseminated.

EMS systems must establish regional collaborative networks with all potential transportation resources. Networks should include clarification of medical direction roles during primary and secondary patient transport. State and local EMS authorities should facilitate establishment of such networks.

CLINICAL CARE:

- Commit to a common definition of what constitutes baseline community EMS care
- Subject EMS clinical care to ongoing evaluation to determine its impact on patient outcomes
- Employ new care techniques and technology only after shown to be effective
- Conduct task analyses to determine appropriate staff configurations during secondary patient transfers
- Eliminate patient transport as a criterion for compensating EMS systems
- Establish proactive relationships between EMS and other health care providers

INFORMATION SYSTEMS

The raw material for information is data. Information systems collect and arrange data to service particular purposes.

The future: Erin, a nineteen-year-old woman, calls EMS *because she is experiencing abdominal pain. When* EMS *personnel evaluate her, she complains of some left lower abdominal tenderness. However, she states that her pain has somewhat subsided, and* for *that and* other *reasons she refuses to be transported. The personnel update her medical "smart card" , and their computer also advises Erin's primary care network of the call and their findings and request that she receive* follow-*up. During the primary care follow-up telephone call, four hours* later, *Erin is not well. She explains that her pain has mostly gone, but that she is too lightheaded to stand. Again, EMS is called, although different personnel respond. Enroute, they are-updated via their personal digital assistants. Erin is no* longer *able to converse, and her blood pressure is low. Because of* the *previous call, which was recorded in the EMS information system and on Erin's "smart card", personnel* suspect *a ruptured ectopic pregnancy. She is resuscitated and transported to the nearest hospital with gynecologic services. There, she is met by a physician already familiar* with *her care to this point. Following emer-*gency surgery, *Erin does well. She credits EMS and the* follow-up call from her *primary care health network for saving her life.*

> ***"Finding desperately needed answers to many important questions in EMS is hopeless without the development of new ways to collect, link, and analyze valid, meaningful information. This is the very foundation of the future of EMS!"***
>
> *Daniel W. Spaite, MD*

WHERE WE ARE

Systems for data collection and information management have developed slowly within EMS. Several recent initiatives have focused on the development of improved techniques for collecting EMS-related data. The Trauma Care Systems Planning and Development Act of 1990 emphasized the need for collection of data for the evaluation of emergency care for serious injuries.132 The 1993 Institute of Medicine report, *Emergency Medical Services for Children,* recommended that states collect and analyze uniform EMS data needed for planning, evaluation, and research of EMS for children.27 During the 1993 Uniform Pre-hospital Emergency Medical Services Data Conference, potential data elements were discussed and determined to be essential or desirable.135 Perhaps even more important, the conference resulted in standard definitions for data elements.

There is no central database, at a national level for example, that relates to the current practice of EMS. The data required to completely describe an EMS event exists in separate disparate locations. These include EMS agencies, emergency departments, hospital medical records, other public safety agencies, and vital statistics offices.104 In most cases, meaningful linkages between such sites are nonexistent.

The purpose of collecting EMS data is to evaluate the emergency medical care of individuals with illnesses and injuries in an effort to improve access and reduce morbidity and mortality. The lack of organized information systems that produce data which are valid, reliable, and accurate is a significant barrier to coordinating EMS system evaluation, including outcomes analyses.35,120

Lack of information systems that are integrated with EMS and other health care providers and community resources severely limits the ability to share useful data. Patient-related data are not shared to allow EMS care to be part of a continuum, accounting for past care and considered during future care. Furthermore, within EMS agencies themselves, data systems generally do not provide readily accessible information about previous EMS patient contact and care.

Research efforts are hindered by underdeveloped information systems. In general, the data derived from an information system may be inadequate for research purposes. However, it is extremely useful for hypothesis generation and may require only minimal supplementation. Integrated information systems serve as multisource databases which

have been advocated as useful tools for conducting EMS cardiac arrest research.[56]

WHERE WE WANT TO BE

EMS systems share integrated information systems with other health care providers, including provider networks, and other public safety agencies. These systems enable EMS to access patient-related data necessary to optimize care (e.g., clinical care, transport disposition and destinations, arrangements for follow-up, and others). They provide mechanisms for EMS to use data, and the ability to transmit useful information to other health care providers and community resources that are part of patients' continuums of care.

EMS information systems incorporate uniform data elements. These are derived from the uniform prehospital data set and use standard definitions.[135] This enables evaluation across multiple EMS systems.

Information systems support data collection for continuous EMS evaluation and for EMS-related research. Generated data are of sufficient validity, reliability, and accuracy. The data necessary to describe entire EMS events are available within information systems that link multiple source databases.

HOW TO GET THERE

EMS must adopt uniform data elements and definitions, and incorporate these into information systems. Such efforts should be directed toward realizing a degree of commonality that facilitates multisystem evaluations and collaborative research.

EMS must develop mechanisms to generate and transmit data that are valid, reliable, and accurate. These factors should be considered during the design and enhancement of information systems. Periodic evaluation should focus on these aspects of data integrity.

EMS must develop and refine information systems that describe entire EMS events. They should link multiscore databases so that patient outcomes can be determined following EMS treatment. They should readily support ongoing systems evaluation and EMS-related research. This is necessary if the cost-effectiveness of EMS is to be determined.

EMS should collaborate with other health care providers and community resources to develop integrated information systems. Such efforts should provide each participant with patient-related data that potentially affects the continuum of care, facilitates access for patients to appropriate care and attention, enhances clinical care decision making, and facilitates follow-up care.

Information system users must provide feedback to those who generate data. Feedback should include, but be not limited to, results of evaluations and research.

INFORMATION SYSTEMS:

- Adopt uniform data elements and definitions and incorporate them into information systems
- Develop mechanisms to generate and transmit data that are valid, reliable, and accurate
- Develop information systems that are able to describe an entire EMS event
- Develop integrated information systems with other health care providers, public safety agencies, and community resources
- Provide feedback to those who generate data

EVALUATION

Evaluation is the essential process of assessing the quality and effects of EMS, so that strategies for continuous improvement can be designed and implemented.

The future: In collaboration with the area's major health care provider/insurer groups, one year ago the EMS system began an injury prevention initiative. Light duty personnel perform domicile risk analyses during patient follow-up visits, upon request of home dwellers, and at randomly selected senior citizens' homes. Continuous evaluation has revealed a decrease in the incidence of falls in the home resulting in hospitalization. The cost savings to the health care system (not including human suffering costs) are much greater than the activity's costs. Furthermore, community satisfaction regarding the program has been high, especially among those whose elderly parents live alone. Evaluation results are being analyzed to explore ways to further enhance the program.

"The ability of EMS to optimally meet communities' and individual patients' needs in the future is dependent on evaluation processes that assess and improve the quality of EMS. Continuous evaluation is essential and should pervade all aspects of every EMS system."

Theodore R. Delbridge MD, MPH

WHERE WE ARE

EMS systems are evaluated using structural (input), process, and outcome measures. Structural evaluation is the least complex and easily replicated, however, its relationship to outcome is uncertain. Process evaluation assesses aspects of care delivered, including its presumed appropriateness, patterns of delivery, technical intervention success/failure rates, and others. Fractile response times are process measures often utilized to evaluate EMS systems. Although these factors might influence ultimate patient outcomes, their relationships are also ambiguous. Furthermore, the reliability of sources for data required for these analyses is often questioned. The relative lack of consistently reliable and accurate data, and its importance for EMS systems analyses, has only recently become appreciated.[21,121,139]

Assessment of patient outcomes is part of comprehensive EMS evaluation. Ultimate patient outcomes may be insensitive to variations in EMS care. Therefore, intermediate outcome measures, which have a closer temporal relationship to EMS care, often are utilized.[15] Intermediate patient outcomes can be used to determine the effects of different phases of EMS care. Utilization of tracer conditions has been advocated for evaluating EMS systems and other aspects of health care.[15,67,75] Cardiac arrest has been the most widely used EMS tracer condition to determine the overall effects of EMS systems.[29] Trauma also has served as a tracer condition, comparing actual survival to survival probability based on injury severity scores (ISS).[5,116] Other than cardiac arrest and trauma conditions, there is a paucity of literature evaluating the effects of EMS systems.

Similarly, there has been little attempt to determine the cost-effectiveness of EMS. Estimates of EMS costs for saving the life of a cardiac arrest victim are similar to those for other life-saving medical treatments.[136,137] However, such estimates are locality specific and do not necessarily apply to all EMS systems. The cost-effectiveness of very few interventions delivered by EMS is known.[46,64,138] Models for determining EMS system effectiveness and cost-effectiveness are lacking.

EMS systems evaluation and EMS research both rely on information systems as sources of data (Figure 3). However, research although very important, is an optional activity for every system. Furthermore, research seeks to enhance the knowledge base by answering new questions. On the other hand, continuous evaluation is essential for every EMS system, and it should be a pervasive part of the environment. It seeks to determine the outcome changes that occur with application of new knowledge and system alterations.

WHERE WE WANT TO BE

Continuous comprehensive evaluation of EMS assesses all aspects of the system. Such evaluations include structural, process (i.e., key points in EMS

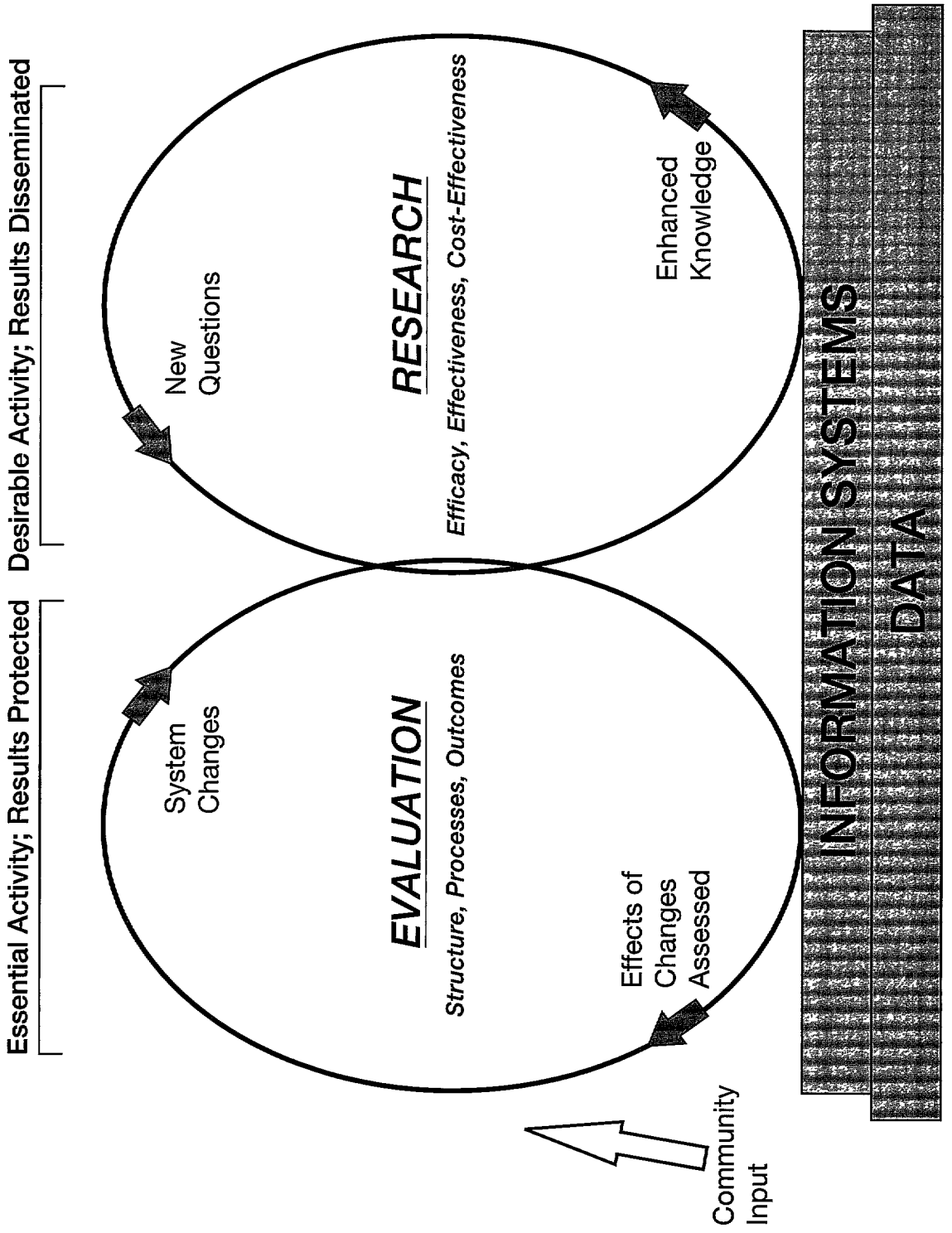

Figure 3. EMS Evaluation and Research: Supported by Information Systems

processes), and outcome measures, and are undertaken with consideration of confidentiality issues. Evaluation is integral to quality improvement systems that continuously measure, maintain, and improve the efficiency of EMS. These system analyses help determine optimal design and effect enhancements to meet individual patient and community health care needs.

Evaluation involves many clinical conditions. Thus, the value of EMS is determined relative to the medical needs of an expanded portion of the population served.

Other outcomes, in addition to death, are utilized to determine the effects of EMS. These include disease, disability, discomfort, dissatisfaction, and destitution.41 This enables appreciation of the complete spectrum of EMS effects for the community.

The cost-effectiveness of EMS is evaluated. This includes the cost- effectiveness of system preparedness (e.g., maintaining a state of readiness that is suitable to the mission) and the cost-effectiveness relative to various illness/injury conditions and to specific treatments. This helps determine the value related to EMS as a continued health care expenditure.

Public satisfaction and consumer input is a focus of EMS evaluation. The interests of consumers are acknowledged as paramount. This helps to ensure that EMS is adequately meeting the expectations of the population it serves.

HOW TO GET THERE

EMS system administrators and researchers must develop valid models for EMS evaluations. Such models should include structural, process, and outcome features. Furthermore, outcomes should be objective and relevant to EMS care.

EMS system administrators and researchers must develop tracer conditions, in addition to cardiac arrest and trauma, for the purposes of evaluation. Evaluation for several conditions, including cardiac arrest, should be continuous in all EMS systems. Such evaluation should be facilitated, via technical assistance, by EMS lead agencies. These agencies should also facilitate development of "report cards" for EMS systems.

Models must be standardized and EMS system evaluations should incorporate multiple outcome categories. Evaluations must seek to determine system effects for several outcome determinants if the full impact of EMS is to be appreciated.

EMS system administrators and researchers must determine the cost- effectiveness of EMS. This should include analyses relative to specific illnesses and injuries, specific interventions, and system preparedness.

EMS evaluation processes must incorporate consumer input. Such input may be sought in various forms (e.g., follow-up, surveys, focus groups, layperson representation in evaluation councils, and others) and should determine if patient and community needs and expectations are being met by the EMS system.

EVALUATION:

- Develop valid models for EMS evaluations
- Evaluate EMS effects for multiple medical conditions
- Determine EMS effects for multiple outcome categories
- Determine EMS cost-effectiveness
- Incorporate consumer input in evaluation processes

EMS HISTORICAL PERSPECTIVES

EARLY EMS

The development of EMS has been based on tradition and, to some extent, on scientific knowledge. Its roots are deep in history. For example, the Good Samaritan bound the injured traveler's wounds with oil and wine at the side of the road, and evidence of treatment protocols exists as early as 1500 B.C.12

Although the Romans and Greeks used chariots to remove injured soldiers from the battlefield, most credit Baron Dominique-Jean Larrey, chief physician in Napoleon's army, with institution of the first prehospital system (1797) designed to triage and transport the injured from the field to aid stations. Flying ambulances (dressing stations) were made to effect transport, and protocols dictated much of the treatment.13 In the United States, organized field care and transport of the injured began after the first year of the Civil War, when neglect of the wounded had been abysmal.l23

Military conflicts have provided the impetus for many of the innovations for treating and transporting injured people. Among the most obvious of these is the use of aircraft for medical transport. The first known air medical transport occurred during the retreat of the Serbian army from Albania in 1915. An unmodified French fighter aircraft was used. 74 During World War I mortality was linked to the time required to get to a dressing station. Additionally, application of a splint devised by Sir Hugh Owen-Thomas resulted in a reduction of mortality due to femur fractures from 80% to 20%.123 The use of rotary wing aircraft for rapid evacuation of casualties from the field to treatment areas was demonstrated during later conflicts, especially in Korea and Vietnam.

Civilian ambulance services in the United States began in Cincinnati and New York City in 1865 and 1869, respectively.122 Hospital interns rode in horse drawn carriages designed specifically for transporting the sick and injured. The first volunteer rescue squads organized around 1920 in Roanoke, Virginia, and along the New Jersey coast. Gradually, especially during and after World War II, hospitals and physicians faded from prehospital practice, yielding in urban areas to centrally coordinated programs. These were often controlled by the municipal hospital or fire department, whose use of "inhalators" was met with widespread public acceptance. 122 Sporidically, funeral home hearses, which had been the common mode of transport, were being replaced by fire department, rescue squad and private ambulances.

By 1960, new advances to care for the sickest patients were being made. The first recorded use of mouth-to-mouth ventilation had been in 1732, involving a coal miner in Dublin, and the first major publication describing the resuscitation of near drowning victims was in 1896. However, it was not until 1958 that Dr. Peter Safar demonstrated mouth-to-mouth ventilation to be superior to other methods of manual ventilation.109 Of note, Dr. Safar used Baltimore firefighters in his studies to perform ventilation of anesthetized surgical residents. In 1960, cardiopulmonary resuscitation (CPR) was shown to be efficacious.68 Shortly thereafter, model EMS programs were developed based on successes in Belfast, where hospital-based mobile coronary care unit ambulances were being used to treat prehospital cardiac patients.97 American systems relied on fire department personnel trained in the techniques of cardiac resuscitation. These new modernized EMS systems spurred success stories from cities such as Columbus, Los Angeles, Seattle, and Miami.

MODERN EMS IN THE U.S.

Demonstration of the effectiveness of mouth-to-mouth ventilation in 1958 and closed cardiac massage in 1960 led to the realization that rapid response of trained community members to cardiac emergencies could help improve outcomes.68,109 The introduction of CPR provided the foundation on which the concepts of advanced cardiac life support (ACLS), and subsequently EMS systems, could be built. The result has been EMS systems designed to enhance the "chain of survival" 22,94

The 1966 white paper, *Accidental Death and Disability: The Neglected Disease* of *Modern Society* prepared by the Committee on Trauma and Committee on Shock of the National Academy of Sciences-National Research Council, provided great

impetus for attention to be turned to the development of EMS.[87] This document pointed out that the American health care system was prepared to address an injury epidemic that was the leading cause of death among persons between the ages of 1 and 37. It noted that, in most cases, ambulances were inappropriately designed, ill-equipped, and staffed with inadequately trained personnel; and that at least 50% of the nation's ambulance services were being provided by 12,000 morticians.[87]

The paper made 29 recommendations for ultimately improving care for injured victims; 11 related directly to out-of-facility EMS. They were:[87]

- Extension of basic and advanced first aid training to greater numbers of the lay public;
- Preparation of nationally acceptable texts, training aids, and courses of instruction for rescue squad personnel, policemen, firemen, and ambulance attendants;
- 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;
- Delineation of radio frequency channels and of equipment suitable to provide voice communication between ambulances, emergency department, and other health-related agencies at the 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; and
- Active exploration of the feasibility of designating a single nationwide telephone number to summon an ambulance.

In the same year, the Highway Safety Act of 1966 which established the Department of Transportation (DOT) was passed.[91] The DOT was given authority to improve EMS, including program implementation and development of standards for provider training. States were required to develop regional EMS systems, and costs of these systems were funded by the Highway Safety Program. Over the next 12 years the DOT contributed more than $142 million for EMS system development.[86]

The Highway Safety Act of 1966 included funds to create an appropriate training course for emergency care providers, as recommended in *Accidental Death and Disability: The Neglected Disease,* and the first nationally recognized EMT-A curriculum was published in 1969. Shortly thereafter paramedic education began, but training focused heavily on cardiac care and cardiac arrest resuscitation, almost to the exclusion of other problems. Although national curricula have been developed and revised, training standards and certification requirements have continued to vary significantly in communities throughout the nation.

In 1972 the Department of Health, Education, and Welfare allocated $16 million to EMS demonstration programs in five states. Funds were used to develop regional EMS systems. In 1973, The Robert Wood Johnson Foundation appropriated $15 million to fund 44 EMS projects in 32 states and Puerto Rico.

Title XII to the Public Health Service Act, *The* Emergency *Medical Services Systems Act of 1973* , provided additional federal guidelines and funding for the development of regional EMS systems.[33] In total, more than $300 million were appropriated for EMS feasibility studies and planning, operations, expansion and improvement, and research.[86] By 1978, states had identified 304 EMS regions. The law established that there should be 15 components

of the EMS systems. They are commonly referred to as:

- Manpower
- Training
- Communications
- Transportation
- Facilities
- Critical care units
- Public safety agencies
- Consumer participation
- Access to care
- Patient transfer
- Coordinated patient record keeping
- Public information and education
- Review and evaluation
- Disaster plan
- Mutual aid

Funding under the EMS Systems Act essentially ended with the *Omnibus Budget Reconciliation Act* of 1981 , which consolidated EMS funding into state preventive health and health services block grants. Thus, states gained greater discretion in funding statewide EMS activities and regional EMS systems, and many of the regional EMS management entities established by federal funding quickly dissolved. Others continued, becoming more the part of technical assistants and enablers while seeking improved EMS quality.

The development of emergency medicine as a medical specialty has paralleled that of EMS. The first residency program to train new physicians exclusively for the practice of emergency medicine was established in 1972 at the University of Cincinnati. By 1975 there were 32 such programs, and there are currently 112 accredited emergency medicine residency programs graduating in excess of 800 emergency medicine physicians each year. Since the late 1970s, pediatric emergency medicine fellowships have provided physicians with specialized training in the management of childhood emergencies. Pediatric emergency medicine became officially recognized as a subspecialty of pediatrics and emergency medicine in 1992. To varying degrees, emergency physicians in training are exposed to the principles and practices of providing medical direction for EMS systems, and the Society of Academic Emergency Medicine has published a model EMS education curriculum for physicians.[98,129] Although emergency physicians often fulfill the medical direction needs of EMS systems, other groups of physicians continue to significantly and positively influence EMS. They include pediatricians, cardiologists, surgeons, intensivists, family practitioners, and others.

Efforts to improve EMS care for specific groups of patients have included development and successful implementation of standardized courses as components of EMS curricula or to supplement personnel education in focused areas. These include cardiac, pediatric, and trauma life support courses.

The American Heart Association, through adoption and promotion of the "Chain of Survival" concept, has provided leadership to improve emergency cardiac care.[31] It continues to explore ways to increase survival from cardiac emergencies.[30]

Federal legislation established the Emergency Medical Services for Children (EMS-C) program in 1984, as issues relating to children's emergency care required attention.[113,114] Emergency Medical Services for Children projects have represented the largest federal funding outlay for EMS development since consolidation of funds in block grants. During the first 10 years of the EMS-C program, the Maternal and Child Health Bureau (MCHB) of the Health Resources and Services Administration (HRSA) funded projects in 40 states, Puerto Rico, and the District of Columbia.[39] Project efforts have involved systems development, injury prevention, research and evaluation, improved training and education, and other aspects of EMS. The results have been EMS improvements benefitting not only children, but the entire population. The program commissioned the 1993 Institute of Medicine Report, *Emergency Medical Services for Children* which pointed out continuing deficiencies in our health care system's abilities to address the emergency medical needs of pediatric patients.[27] It noted that in 1988, 21,000 people under the age of 20 died from injuries; thousands more were hospitalized and millions more were treated in emergency departments.[27] The report indicated that although EMS systems and emergency departments are widely assumed to be equally capable of caring for chil-

dren and adults, this is not always the case. For too many children important resources were not available when needed. The EMS-C program continues to work to ensure that pediatric issues are better integrated into the EMS system.[26,27,134]

In 1985, the National Research Council's *Injury in America: A Continuing Public Health Problem* described deficiencies in the progress of addressing the problem of accidental death and disability.[93] Development of trauma care systems became a renewed focus of attention with passage of the Trauma Care Systems Planning and Development Act of 1990.[132] HRSA Division of Trauma and EMS (DTEMS) was created to administer this legislation, which supported the concept of a trauma system that addresses the needs of all injured patients and matches them to available resources. The act encouraged the establishment of inclusive trauma systems and called for the development of a model trauma care system plan, which was completed in 1992.[83] More inclusive trauma care better serves the population's needs.[63,108] Local EMS authorities assumed responsibility for establishing trauma systems and designating trauma centers in an effort to improve care for trauma victims.[2] However, one survey concluded that by 1993 only five states met criteria for having a complete trauma system.[10] Although interest in developing inclusive trauma care systems remains, DTEMS was disbanded in 1995.

The National Highway Traffic Safety Administration implemented a statewide EMS technical assessment program in 1988. During assessments, statewide EMS systems are evaluated based on 10 essential components.[92] They are:

- Regulation and policy
- Resource management
- Human resources and training
- Transportation
- Facilities
- Communications
- Public information and education
- Medical direction
- Trauma systems
- Evaluation

It is impossible to overestimate the influence of the media on the evolution of EMS. In 1971, the television program "Emergency" caught the attention of the country — it was visionary in itself. The program suggested to the public that paramedics existed everywhere. In reality, they did not. Additionally, it portrayed paramedics as frequent lifesavers when they were part of an integrated EMS system. In reality, they did save lives, though not as readily. The vision continues in current programs such as "Rescue 911", where all callers dial "911" for help and all calls are answered by personnel able to provide lifesaving instructions over the telephone. In fact, much of the country cannot access EMS help by calling "911" and pre-arrival instructions are not uniformly provided. As in the 1970s, the media continues to create public interest and effect perception and expectations regarding EMS. Responses to the public's expectations may secondarily prompt EMS system changes. However, the value of the media's effect is uncertain. While the media might hasten change, we cannot be certain that the changes created are those that would have been chosen had the impetus been different.

DEVELOPMENT OF THE AGENDA

The need for the *EMS Agenda for the Future* was initially recognized in 1992 by the National Association of EMS Physicians (NAEMSP) and the National Association of State EMS Directors (NASEMSD). A project task force with members from several organizations first met in 1993. In January 1994, the National EMS Alliance also expressed support for the project. Actual work on the document began in June 1995, after the National Highway Traffic Safety Administration (NHTSA) and the Maternal and Child Health Bureau (MCHB) of the Health Resources and Services Administration (HRSA) authorized funding for the project.

The process used to develop the *EMS Agenda* for *the Future* was a modification of the National Institutes of Health (NIH) Technology Assessment and Practice Guidelines Forum.99 Initial drafts of the EMS *Agenda* for *the Future* were prepared by a steering committee, whose expertise was derived from diverse backgrounds and EMS-related experiences (Appendix G). The steering committee first met in July 1995 in Big Sky, Montana. The first draft of the document was completed, and the committee met again in August 1995 in Pittsburgh, Pennsylvania to make revisions and begin a second draft. Additional steering committee meetings were held in October and December 1995 and March 1996 to revise the *Agenda* in accordance with comments received during peer review processes.

As part of its mission, the steering committee sought the broadest possible input from EMS stakeholders. The second draft was sent to 500 EMS-interested organizations and individuals for peer review. Of these, 178 reviewers supplied comments via peer review forms or telephone calls. These comments were analyzed by the steering committee and subsequent revisions to the *Agenda* were discussed at a Blue Ribbon Conference.

The *EMS Agenda for the* Future Blue Ribbon Conference was held on December l-3, 1995, in McLean, Virginia. One hundred and thirty-three individuals participated (Appendix I). Following opening remarks by Dr. Ricardo Martinez and Dr. Jean Athey, steering committee members presented background information and individual sections of the draft document. After listening to three to five section presentations, conference participants attended breakout sessions to further review the individual document sections and provide feedback. A facilitator was assigned to each breakout session, and one to three steering committee members also attended each session. Thirty-two breakout sessions were held, each addressing a specific section of the draft document. In a general session at the end of the conference, facilitators provided an overview of feedback received during their breakout sessions.

The steering committee met after the Blue Ribbon Conference to incorporate participants' feedback. The revised draft was sent to the Blue Ribbon Conference participants in mid-February for their final comments. These were reviewed and final changes were made during the last steering committee meeting on March *5-7, 1996.* The *EMS Agenda* for *the Future* was submitted NHTSA and MCHB on April 16, 1996.

SUMMARY OF RECOMMENDATIONS

HOW TO GET "WHERE WE WANT TO BE"

Integration of Health Services

- Expand the role of EMS in public health
- Involve EMS in community health monitoring activities
- Integrate EMS with other health care providers and provider networks
- Incorporate EMS within health care networks' structure to deliver quality care
- Be cognizant of the special needs of the entire population

Incorporate health systems within EMS that address the special needs of all segments of the population

EMS Research

- Allocate federal and state funds for a major EMS systems research thrust
- Develop information systems that provide linkage between various public safety services and other health care providers
- Develop academic institutional commitments to EMS-related research
- Interpret informed consent rules to allow for clinical and environmental circumstances inherent in conducting credible EMS research
- Develop involvement and/or support of EMS research by all those responsible for EMS structure, processes, and/or outcomes
- Designate EMS as a physician subspecialty, and a subspecialty for other health professions
- Include research related objectives in the education processes of EMS providers and managers
- Enhance the quality of published EMS research

Develop collaborative relationships between EMS systems, medical schools, other academic institutions, and private foundations

Legislation and Regulation

- Authorize and sufficiently fund a lead federal EMS agency
- Pass and periodically review EMS enabling legislation in all states that supports innovation and integration, and establishes and sufficiently funds a EMS lead agency
- Enhance the abilities of state EMS lead agencies to provide technical assistance
- Establish and fund the position of State EMS Medical Director in each state
- Authorize state and local EMS lead agencies to act on the public's behalf in cases of threats to the availability of quality EMS to the entire population
- Implement laws that provide protection from liability for EMS field and medical direction personnel when dealing with unusual situations

System Finance

- Collaborate with other health care providers and insurers to enhance patient care efficiency
- Develop proactive financial relationships between EMS, other health care providers, and health care insurers/provider organizations
- Compensate EMS on the basis of a preparedness-based model, reducing volume-related incentives and realizing the cost of an emergency safety net
- Provide immediate access to EMS for emergency medical conditions
- Address EMS relevant issues within governmental health care finance policy

Commit local, state, and federal attention and funds to continued EMS infrastructure development

Human Resources

- Ensure that alterations in expectations of EMS personnel to provide health care services are preceded by adequate preparation
- Adopt the principles of the national EMS Education and Practice Blueprint
- Develop a system for reciprocity of EMS provider credentials
- Develop collaborative relationships between EMS systems and academic institutions
- Conduct EMS occupational health research

Provide a system for critical incident stress management

Medical Direction

- Formalize relationships between all EMS systerns and medical directors
- Appropriate sufficient resources for EMS medical direction
- Require appropriate credentials for all those who provide on-line medical direction
- Develop EMS as a physician and nurse subspecialty certification

Appoint state EMS medical directors

Education Systems

- Ensure adequacy of EMS education programs
- Update education core content objectives frequently enough so that they reflect patient EMS health care needs
- Incorporate research, quality improvement, and management learning objectives in higher level EMS education
- Commission the development of national core contents to replace EMS program curricula
- Conduct EMS education with medical direction
- Seek accreditation for EMS education programs
- Establish innovative and collaborative relationships between EMS education programs and academic institutions
- Recognize EMS education as an academic achievement
- Develop bridging and transition programs
- Include EMS-related objectives in all health professions' education

Public Education

- Acknowledge public education as a critical activity for EMS
- Collaborate with other community resources and agencies to determine public education needs
- Engage in continuous public education programs
- Educate the public as consumers
- Explore new techniques and technologies for implementing public education

Evaluate public education initiatives

Prevention

Collaborate with community agencies and health care providers with expertise and interest in illness and injury prevention

- Support the Safe Communities concept
- Advocate for legislation that potentially results in injury and illness prevention
- Develop and maintain a prevention-oriented atmosphere within EMS systems
- Include the principles of prevention and its role in improving community health as part of EMS education core contents

Improve the ability of EMS to document injury and illness circumstances

Public Access

- Implement 9-l-l nationwide
- Provide emergency telephone service for those who cannot otherwise afford routine telephone services
- Ensure that all calls to a PSAP, regardless of their origins, are automatically accompanied by unique location-identifying information
- Develop uniform cellular 9-l-l service that reliably routes calls to the appropriate PSAP
- Evaluate and employ technologies that attenuate potential barriers to EMS access

= Enhance the ability of EMS systems to triage calls, and provide resource allocation that is tailored to patients' needs

Communications Systems

= Assess the effectiveness of various personnel and resource attributes for EMS dispatching

■ Receive all calls for EMS using personnel with the requisite combination of education, experience, and resources to optimally query the caller, make determination of the most appropriate resources to be mobilized, and implement an effective course of action

= Promulgate and update standards for EMS dispatching

■ Develop cooperative ventures between communications centers and health providers to integrate communications processes and enable rapid patient-related information exchange

■ Determine the benefits of real-time patient data transfer

= Appropriate federal, state, and regional funds to further develop and update geographically integrated and functionally-based EMS communications networks

= Facilitate exploration of potential uses of advancing communications technology by EMS

Collaborate with private interests to effect shared purchasing of communication technology

Clinical Care

= Commit to a common definition of what constitutes baseline community EMS care

= Subject EMS clinical care to ongoing evaluation to determine its impact on patient outcomes

. Employ new care techniques and technology only after shown to be effective

. Conduct task analyses to determine appropriate staff configurations during secondary patient transfers

. Eliminate patient transport as a criterion for compensating EMS systems

· Establish proactive relationships between EMS and other health care providers

Information Systems

■ Adopt uniform data elements and definitions and incorporate them into information systems

. Develop mechanisms to generate and transmit data that are valid, reliable, and accurate

. Develop information systems that are able to describe an entire EMS event

. Develop integrated information systems with other health care providers, public safety agencies, and community resources

Provide feedback to those who generate data

Evaluation

■ Develop valid models for EMS evaluations

. Evaluate EMS effects for multiple medical conditions

■ Determine EMS effects for multiple outcome categories

■ Determine EMS cost-effectiveness

. Incorporate consumer input in evaluation processes

GLOSSARY

Academic	Based upon formal education; scholarly; conventional.
Academic Institution	A body or establishment instituted for an educational purpose and providing college credit or awarding degrees.
Accreditation	The granting of approval by an official review board after specific requirements have been met.
Advanced Directive	Written instructions by an individual providing directions to medical personnel in the event of critical illness with regard to the extent of resuscitative measures to be pursued.
Air Medical Transport	Emergency transport via rotor or fixed wing aircraft; may be from the scene (primary transport) or interfacility (secondary transport).
Automatic Vehicle Location	Technology or method used to track or determine a vehicle's location or position and report the position, usually by radio, to a communications or command center. Methods include geo- positioning satellite (GPS), electronic sensed sign-posts, loran navigation, and inertial guidance computer mapped systems.
Bridging Program	An abbreviated educational program resulting in credentials that build on prior credentials in a related field; *EMT certification for registered nurses.*
Bystander	A citizen responder, not part of the EMS response team, on the scene of an illness or injury incident irrespective of training.
Chain of Survival	The four components of EMS response to out-of-facility cardiac arrest that are thought to effect the most optimal patient outcome. The four components include early recognition and EMS access, early CPR, rapid defibrillation, and advanced life support.
Command and Control Center	(Central Communications Center) - A place where responsibility rests for establishing communications channels and identifying the necessary equipment and facilities to permit immediate management and control of an EMS patient. This operation provides access and availability to public safety resources essential for efficient management of the immediate EMS problem.
Communication	The act of communicating. The exchange of thoughts, messages or information, as by speech, signals, writing or behavior. The art and technique of using words effectively and with grace in imparting one's ideas. Something communicated; a message.
Communications	A means of communicating, especially: a system, such as mail, telephone, television or radio, for sending and receiving messages. A network of routes or systems for sending messages. The technology employed in transmitting messages.
Community Health Resource	Capability that may be offered within a neighborhood or community to aid in the detection, surveillance, and support of community health. This may include a municipal organization such as the fire service or EMS, department of public health, social service organization, volunteer organization, and others.

Component	An individual element, aspect, subgroup, or activity within a system. Complex systems (such as EMS) are composed of many components.
Computerized Record	Data maintained on computer for easy access, manipulation, refinement and review.
Core Content	The central elements of a professional field of study and relations involved; does not specify the course of study.
Cost-effective	Providing the maximal improved health care outcome improvement at the least cost.
Cost-effective Analysis	Analysis that determines the costs and effectiveness of an intervention or system. This includes comparing similar alternative activities to determine the relative degree to which they obtain the desired objective or outcome. The preferred alternative is the one that requires the least cost to produce a given level of effectiveness or provides the greatest effectiveness for a given level of cost.
Credentialing Agency	Organization which certifies an institution's or individual's authority or claim to confidence for a course of study or completion of objectives.
Curriculum	A particular course of study, often in a special field. For EMS education it has traditionally included detailed lesson plans.
Customary Charge	The amount that an individual company charges in the majority of claims for a specific item or service.
Data	Crude, isolated, nonanalyzed measures that reflect the status or degree of a measured attribute of a component or system.
Educational Affiliation	An association with a learning institution(s) (academic), the extent of which can vary greatly from recognition to integration.
Educational Objective	The outcome/goal of the teaching/training conducted; the desired knowledge to be imparted.
Effective	Capable of producing or designed to produce a particular desired effect in "real world" circumstances.
Efficacy	The effect of an intervention or series of interventions on patient outcome in a setting that is most likely to be positive (e.g., the laboratory or other "perfect" settings).
Efficiency	The effect or results achieved in relation to the effort expended (resources, money, time). It is the extent to which the resources used to provide an effective intervention or service are minimized. Thus, if two services are provided that are equally effective, but one requires the expense of fewer resources, that service is said to be more efficient.
Emergency Medical Dispatch	The function of providing prompt and accurate processing of calls, for emergency medical assistance by trained individuals, using a medically approved dispatch protocol system and functioning under medical supervision.

Emergency Medical Dispatcher (EMD)	A trained public safety telecommunicator with additional training and specific emergency medical knowledge essential for the efficient management of emergency medical communications.
Emergency Medical Technician (EMT)	A member of the emergency medical services team who provides out-of-facility emergency care; includes certifications of EMT-Basic, EMT-Intermediate, and EMT-Paramedic progressively advancing levels of care.
Emergency Physician	A physician specialized in the emergency care of acutely ill or injured patients.
EMS Personnel	Paid or volunteer individuals who are qualified, by satisfying formalized existing requirements, to provide some aspect of care or service within the EMS system.
EMS Physician	A physician with specialized knowledge and skills in the area of emergency medical services, including clinical care and systems management; a physician who specializes in emergency medical services system management, in which the provision of direct patient care is only one component.
EMS Protocol	Written medical instructions or algorithms authorized by an EMS medical director to be used by personnel in the field without the necessity of on-line or real-time consultation with the physician or nurse providing medical direction.
EMS System	Any specific arrangement of emergency medical personnel, equipment, and supplies designed to function in a coordinated fashion. May be local, regional, state, or national.
Enabling EMS Legislation	Law that grants authority to specific entities to undertake activity related to the provision or establishment of an EMS system. Generally, enabling legislation represents a legislature's delegation of authority to a state agency to regulate some or all aspects of an EMS delivery system. This may include technical support, funding, or regulation.
Episodic care	An acute, relatively brief, intervention representing a segment of continuous health care experience.
Expanded Role/Expanded Scope	Increased dimensions of the services, activities, or care provided by EMS.
Federal Communications Commission (FCC)	A board of five commissioners appointed by the president under the Communications Act of 1934 to formulate rules and regulations and to authorize use of radio communications. The FCC regulates all communications in the United States by radio or wireline, including television, telephone, radio, facsimile, and cable systems, and maintains communications in accordance with applicable treaties and agreements to which the United States is a party.
First Responder	The initial level of care within an EMS system as defined by the EMS Education and Practice Blueprint, as opposed to a bystander.

Health Care Delivery System	A specific arrangement for providing preventive, remedial, and therapeutic services; may be local, regional, or national.
Health Care Facility	A site at which dedicated space is available for the delivery of health care. This may include physicians' offices and urgent care centers, as well as hospitals and other medical facilities.
Health Care Provider Network	Conglomerate of both community and hospital resources participating in a common contractual agreement to provide all health care needs to individual members of society.
Information	A combination of data, usually from multiple sources, used to derive meaningful conclusions about a system (health resources, costs, utilization of health services, outcomes of populations, etc.). Information cannot be developed without crude data. However, data must be transformed into information to allow decision making that improves a given system.
Informed Consent	Voluntary consent by a given subject, or by a person responsible for a subject, for participation in an investigation, treatment program, medical procedure, etc., after being informed of the purpose, methods, procedures, benefits, and potential risks. Awareness of risk is necessary for any subject to make an informed choice.
Infrastructure	The basic facilities, equipment, services, and installations needed for functioning; the substructure, components, or underlying foundation of a community or system.
Injury Control	A systematic approach to preventing and mitigating the effects of all injuries.
Injury Prevention	Activities to keep injuries from ever occurring (primary), or reducing further injury once it has occurred through acute care (secondary) and rehabilitation (tertiary).
Legislation	Lawmaking; the procedure of legislating; law or laws made by such a procedure.
Licensing	The act of granting an entity permission to do something which the entity could not legally do absent such permission. Licensing is generally viewed by legislative bodies as a regulatory effort to protect the public from potential harm. In the health care delivery system, an individual who is licensed tends to enjoy a certain amount of autonomy in delivering health care services. Conversely, the licensed individual must satisfy certain initial proficiency criteria and may be required to satisfy ongoing requirements which assure certain minimum levels of expertise. A license is generally considered a privilege and not a right.
Linkage	Connected; combining crude data from various sources to provide information that can be analyzed. This analyzed information allows meaningful inferences to be made about various aspects of a system. (An example would be linking EMS dispatch records, out-of-hospital patient care records, and hospital discharge data.)

Medicaid	A federal program, administered by the states, designed to provide health care coverage to the indigent. Established by Title XIX of the Social Security Act.
Medical Direction	The provision of management, supervision, and guidance for all aspects of EMS to assure its quality of care.
Medical Director	The physician who has the ultimate responsibility and authority to provide management, supervision, and guidance for all aspects of EMS in an effort to assure its quality of care (may be on a local, regional, state, and national level).
Medical Facility	A stationary structure with the purpose of providing health care services (e.g., hospital, emergency department, physician office, and others).
Medical Oversight	The ultimate responsibility and authority for the medical actions of an EMS system.
Medicare	A federal program designed to provide health care coverage to individuals 65 and over. Established on July 30, 1965, by Title XVIII of the Social Security Act.
Network	A formal system linking multiple sites or units.
Noninvasive Monitoring	Measurement/scanning accomplished without penetrating the viscera or superficial tissues.
On-line Medical Direction	The moment-to-moment contemporaneous medical supervision/guidance of EMS personnel in the field, provided by a physician or other specialty qualified health professional (e.g., mobile intensive care nurse), via radio transmission, telephone, or on the scene.
Out-of-facility EMS	Remote from a medical facility. In the case of EMS it pertains to those components of the emergency health care delivery system that occur outside of the traditional medical settings (e.g., prehospital care, transportation, and others).
Outcome	The short, intermediate, or long-term consequence or visible result of treatment, particularly as it pertains to a patient's return to societal function.
Perceived Emergent Need	A medical condition for which a prudent layperson possessing an average knowledge of health care believes there is a necessity of rapid medical treatment.
Personnel Configuration	Specific way of staffing or organizing members of the work force.
Pilot Project	A systematic planned undertaking which serves as an experimental model for others to follow.
Preparedness Based Payment	Reimbursing EMS agencies for the cost of being prepared to respond to an emergency.
Prevailing Charge	The amount that falls within the range of charges most frequently billed in the locality for a particular service.
Protocol	The plan for a course of medical treatment; the current standard of medical practice.

Provider	An individual within an EMS system with a specific credential(s) that defines a specific level of competency (i.e., first responder, EMT- Basic, EMT-Intermediate, EMT-Paramedic, or other).
Public Education	Activities aimed at educating the general public concerning EMS and health related issues.
Public Health	The science of providing protection and promotion of community health through organized community effort.
Public Safety Answering Point (PSAP)	A facility equipped and staffed to receive and control 9-l-l emergency telephone calls.
Public Safety Telecommunicator	An individual trained to communicate remotely with persons seeking emergency assistance, and with agencies and individuals providing such assistance.
Real-time Patient Data	Current patient information provided by a field technician at the patient location to a physician or health care facility at a remote site, potentially for the purpose of assisting the physician to make a better informed decision on patient treatment and/or transport-
Reciprocity	The ability for a license or certificate to be mutually interchangeable between jurisdictions.
Regional EMS System	A systematic approach to the delivery of Emergency Medical Services defined by distinct geographic boundaries that may or may not cross state boundaries.
Regulation	Either a rule or a statute which prescribes the management, governance, or operating parameters for a given group; tends to be a function of administrative agencies to which a legislative body has delegated authority to promulgate rules/regulations to "regulate a given industry or profession. Most regulations are intended to protect the public health, safety and welfare.
Reimbursement	To compensate; to repay.
Research	The study of questions and hypotheses using the scientific method.
Safe Communities	An integrated injury control system-incorporating prevention, acute care, and rehabilitation-to understand and solve injury problems, and identify new partners to help develop and implement solutions.
Scope of Practice	Defined parameters of various duties or services which may be provided by an individual with specific credentials. Whether regulated by a rule, statute, or court decision, it tends to represent the limits of what services an individual may perform.
Stabilizing Care	The medical attention needed to achieve physical equilibrium in a person.
Standardized Nomenclature	An authoritative system of designated names for a specific item or configuration.
State-of-the-art	The highest use of technology or technique known at the time.

Statute	An act of a legislative body which has been adopted pursuant to constitutional authority, by certain means and in such form that it becomes a law governing conduct or actions.
Subscription Program	A prepayment program; a prepayment made to secure future events; a prepayment made to secure a reduced ambulance bill either through assignment or discount. Must be actuarially sound.
System Preparedness	Efforts necessary to ensure the readiness to provide a specific standard of care.
Systems Analysis	The research discipline that evaluates efficacy, effectiveness, and efficiency based upon all relevant components that contribute to a system. This entails the examination of various elements of a system to ascertain whether the proposed solution to a problem will fit into the system and, in turn, effect an overall improvement in the system.
Telephone Aid	Ad-libbed telephone instructions provided by either trained or untrained dispatchers, differing from "dispatch life support pre-arrival instructions in that the instructions provided to the caller are based on the dispatcher's knowledge or previous training in a procedure or treatment without following a scripted pre-arrival instruction protocol. They are not medically pre-approved since they do not exist in written form.
Telephone Treatment Protocol	Specific treatment strategy designed in a conversational script format that direct the EMD step-by-step in giving critical pre-arrival instructions such as CPR, Heimlich maneuver, mouth-to-mouth breathing, and childbirth instruction.
Third Party Payor	Insurance; an entity which is responsible to pay for services even though it is not directly involved in the transaction.

LIST OF ABBREVIATIONS

ACLS	Advanced Cardiac Life Support
ACS	American College of Surgeons
AL1	Automatic Location Identity
AN1	Automatic Number Identity
AVL	Automatic Vehicle Location
CB	Citizens Band
CPR	Cardiopulmonary resuscitation
DOT	Department of Transportation
DTEMS	Division of Trauma and EMS
ECG	Electrocardiogram
EMD	Emergency Medical Dispatcher
EMS	Emergency Medical Services
EMS-C	Emergency Medical Services for Children
EMSS Act	Emergency Medical Services Systems Act
EMT	Emergency Medical Technician
FCC	Federal Communications Commission
GPS	Geopositioning satellite
HCFA	Health Care Finance Administration
HRSA	Health Resources & Services Administration
HSA	Highway Safety Act
ISS	Injury Severity Score
MCHB	Maternal & Child Health Bureau
MCO	Managed Care Organization
MICN	Mobile Intensive Care Nurse
NAEMSP	National Association of EMS Physicians
NAS	National Academy of Sciences
NHAAP	National Heart Attack Alert Program
NHTSA	National Highway Traffic Safety Administration
NRC	National Research Council
NREMT	National Registry of Emergency Medical Technicians
PSAP	Public Safety Answering Point
UHF	Ultra High Frequency
USFA	U.S. Fire Administration
VHF	Very High Frequency
YPLL	Years of Potential Life Lost

REFERENCES

1. Adams EL, Trumble P: Nurses. In Kuehl AE (ed): *Prehospital Systems and Medical Oversight*. 2d ed., St. Louis: Mosby-Year Book, Inc., 1994, 307-315.
2. American College of Emergency Physicians: Guidelines for trauma care systems. *Ann Emerg Med* 1993; 22: 1079-1100.
3. American College of Emergency Physicians: Minimum pediatric prehospital equipment guidelines. *ACEP Policy Statement,* approved October 1991.
4. American College of Emergency Physicians: Prehospital advanced life support skills, medications, and equipment. *Ann Emerg Med* 1988; 17:1109-1111.
5. American College of Surgeons Committee on Trauma: Quality assessment and assurance in trauma care. *Bull Am Coll Surgeons* **1986;71:4-23.**
6. Anderson TE, Arthur K, Kleinman M, et al: Intraosseous infusion: Success of a standardized regional training program for prehospital advanced life support providers. *Ann Emerg Med 1994;23:52-55.*
7. ASTM Committee F-30 on Emergency Medical Services: *ASTM Standards on Emergency Medical Services.* Philadelphia: ASTM, 1994.
8. Baker SF', O'Neill B, Ginsburg MJ, Guohua L: *The Injury Fact* Book, 2d ed. New York: Oxford University Press, 1992.
9. Baxt WG, Moody P: The impact of the physician as part of the aeromedical prehospital team in patients with blunt trauma. *JAMA* 1987;257:3246-3250.
10. Bazzoli GJ, Madura KJ, Cooper GF, MacKenzie EJ, Maier RV: Progress in the development of trauma systems in the United States: Results of a national survey. *JAMA* **1995; 273:395-401.**
11. Beaton RD, Murphy SA: Sources of occupational stress among firefighters/EMTs and firefighters/paramedics and correlations with job related outcomes. *Prehosp* Disaster *Med* 1993; 8:140-149.
12. *The Bible,* Luke 10:34.
13. Brewer LA: Baron Larrey 1766-1862. *J Thorac Cardio Vast Surg* 1986; 92:1096-1098.
14. Cady G, Scott T EMS in the United States 1995 Survey of providers in the 200 most populous cities. *JEMS* **1995; 20(1):78.**
15. Cayten CG: Evaluation. In Kuehl AE (ed): *Prehospital Systems and Medical Oversight*. 2d ed., St. Louis: Mosby-Year Book, Inc., 1994, 158-167.'
16. Cayten CG, Staroccik R, Walker K, et al: Impact of prehospital cardiac algorithms on ventricular fibrillation survival rates. *Ann Emerg Med* 1981; 10:432-436.
17. Clark JJ, Culley L, Eisenberg M, Henwood DK: Accuracy of determining cardiac arrest by emergency medical dispatchers. *Ann* Emerg *Med* 1994;23:1022-1026
18. Clawson JJ: Emergency medical dispatch. In Kuehl AE (ed): *PrehospitaI Systems and Medical Oversight*. 2d ed., St. Louis: Mosby-Year Book, Inc., 1994, 125-152.
19. Clawson JJ: Emergency medical dispatch. In Roush WR (ed): *Principles of EMS* Sysfems. Dallas: ACEP, 1994, 263-**289.**
20. Cooper A, Foltin G: Transport protocols. In McCloskey KAL, Orr RA feds): *Pediatric Transport Medicine.* St. Louis: Mosby-Year Book, 1995, 463-473.
21. Cummins RO, Chamberlain DA, Abramson NS, et al: Recommended guidelines for uniform reporting of data from out-of-hospital cardiac arrest, the Utstein style. *Ann Emerg Med* 1991; 20:861-874.
22. Cummins RO, Ornato JP, Thies WH, Pepe PE: Improving survival from sudden cardiac arrest: The chain of survival concept. A statement for health professionals from the Advanced Cardiac Life Support Subcommittee and the Emergency Cardiac Care Committee, American Heart Association. *CircuIation* 1991; 83:1832-1847.
23. Cydulka RK, Emerman CL, Shade B, et al: Stress levels in EMS personnel: A longitudinal study with work schedule modification. *AEM* 1994; 1:240-246.

24. Delbridge TR, Paris PM: EMS Communications. In Roush WR (ed): Principles of *EMS Systems.* Dallas: ACEP, 1994, 245-261.

25. Delbridge TR, Verdile VP, Platt TE: Variability of state-approved emergency medical services drug formularies. Prehosp Disaster *Med* 1994; 9:S55.

26. Dieckmann RA, Schafermeyer RW: EMS for Children. In Roush WR (ed): *Principles* of *EMS* Systems. Dallas: ACEP, 1994, 51-82.

27. Durch JS, Lohr KN (eds): *Emergency Medical Services for Children.* Washington, D.C.: National Academy Press, 1993.

28. Eisenberg M, Hallstrom A, Becker L: Community awareness of emergency phone numbers. *Am] Publ Health* 1981; 71:1058-1060.

29. Eisenberg MS, Horwood BT, Cummins RO: Cardiac arrest and resuscitation: A tale of 29 cities. *Ann Emerg Med* 1990; 19:179-186.

30. Emergency Cardiac Care Committee and Subcommittees, American Heart Association: Guidelines for Cardiopulmonary Resuscitation in Emergency Cardiac Care, III: Adult Advanced Cardiac Life Support. *JAMA* 1992; 268:2199-2241.

31. Emergency Cardiac Care Committee and Subcommittees, American Heart Association: Guidelines for Cardiopulmonary Resuscitation in Emergency Cardiac Care, IX: Insuring effectiveness of community-wide emergency cardiac care. *JAMA* 1992; 268:2289-2295.

32. Emergency *Medical Dispatch National Standard Curriculum, Instructor's Guide. Washington, D.C.: National Highway* Traffic Safety Administration, 1996.

33. Emergency *Medical Services Systems Act of 1973: Public Law 93-154, Title XII of the Public Health Service Act.* Washington, D.C.: 1973.

34. Emergency *Medical Technician: Basic, National Standard Curriculum.* Washington, D.C., U.S. Department of Transportation, National Highway Traffic Safety Administration, 1994.

35. EMS *Outcomes Evaluation: Key Issues and Future Directions, Proceedings from fhe NHTSA Workshop on Methodologies for Measuring Morbidity Outcomes in EMS.* Washington, D.C.: National Highway Traffic Safety Administration, April 11-12, 1994.

36. Erder MH, Davidson SJ, Chaney RA: Online medical command in theory and practice. *Ann Emerg Med* 1989; 18:261-288.

37. Essential equipment for ambulances. *Am Coll Surg Bull 1983; 68:36-38.*

38. *Federal Specifications* for *Ambulances:* KKK-A-1822D. Washington, D.C.: Department of Transportation and General Services Administration, 1994.

39. Feely HB, Athey JL: *Emergency Medical Services for Children: Ten Year Report.* Arlington, VA: National Center for Education in Maternal and Child Health, 1995.

40. Fitch JJ: Volunteers. In Kuehl AE (ed): *Prehospital Systems and Medical Oversight.* 2d ed., St. Louis: Mosby-Year Book, Inc., 1994, 316-320.

41. Fletcher RH, Fletcher SW, Wagner EH: *Clinical Epidemiology — The Essentials.* Baltimore: Williams & Wilkins, 1988.

42. Fontanarosa PB: Occupational issues for EMS personnel. In Roush WR (ed): *Principles* of *EMS* Sysfems. Dallas: ACEP, 1994, 411-431.

43. Fuchs S, LaCovey D, Paris P: A prehospital model of intraosseous infusion. *Ann Emerg Med* 1991; 20:371-374.

44. Garrison HG, Benson NH, Whitley TW, Bailey BW: Paramedic skills and medications: Practice options utilized by local advanced life support medical directors. *Prehosp Disaster Med 1991; 6:29-33.*

45. Garrison HG, Brice JH, Evans AT: Prehospital interventions: An analysis of research design and patient outcomes. *Prehosp Disaster Med* 1992; 7:165.

46. Garrison HG, Downs SM, McNutt RA, Griggs TR: A cost effectiveness analysis of pediatric intraosseous infusion as a prehospital skill. *Prehosp Disasfer Med* 1992; 7:221-226.

47 Garrison HG, Foltin G, Becker L, et al: Consensus *statement: The Role* of Ouf-of-Hospifal *Emergency Medical Services in Primary Injury Prevention.* Consensus Workshop on the Role of EMS in Injury Prevention, Arlington, VA, August 25-26, 1995, Final Report.

48. Garza M (ed): Paramedics report many on-duty assaults. *EMS Insider* 1993; 20(9):7.

49. Gershon RRM, Vlahov D, Kelen G, Conrad B, Murphy C: Review of accidents/injuries among emergency medical services workers in Baltimore, Maryland. Prehosp *Disaster Med* 1995; 10:14-18.

50. Gerson LW, Hoover R, McCoy S, Palmisano B: Linking the elderly to community services. *JEMS* 1991; 16(6):45-48.

51. Gerson LW, Schelble DT, Wilson JE: Using paramedics to identify at-risk elderly. *Ann Emerg Med* 1992; 21:688-691.

52. Gratton MC, Bethkey RA, Watson WA, et al: Effect of standing orders on paramedic scene time for trauma patients. *Ann Emerg Med* 1991; 20:52-55.

53. Green LW, Kreuter M: *Health* Promotion *Planning: An Educational and Environmental Approach.* 2d ed. Mountainview, CA: Mayfield Publishing Co., 1991.

54. Hamman BL, Qcue JI, Miller FD, et al: Helicopter transport of trauma victims: Does a physician make a difference? J *Trauma* 1991; 31:490-494.

55. Harrawood D, Gunderson MR, Fravel S, Cartwright K, Ryan JL: Drowning prevention, a case study in EMS epidemiology. *JEMS* 1994; 19(6):34-41.

56. Hedges JR: Beyond Utstein: Implementation of a multi-source uniform database for prehospital cardiac arrest research. *Ann* Emerg *Med* 1993; 22:41-46.

57. Ho MT, Eisenberg MS, Litwin PE, et al: Delay between onset of chest pain and seeking medical care: The effect of public education. *Ann Emerg Med* 1989; 18:727-731.

58. Hockreiter MC, Barton LL: Epidemiology of needlestick injury in emergency medical service personnel. J *Emerg Med* 1988; 6:9-12.

59. Hoffman JR, Luo J, Schriger DL, et al: Does paramedic base hospital contact result in beneficial deviations from standard prehospital protocols? Western *J Med* 1989; 153:283-287.

60. Hogya PT, Ellis L: Evaluation of the injury profile of personnel in a busy urban EMS system. *Am J Emerg Med* 1990; 8:308-311.

61. Hsiao AK, Hedges JR: Role of the emergency medical services system in region wide health monitoring and referral. *Ann Emerg Med* 1993; 22:1696-1702.

62. Hunt RC, Bass RR, Graham RG, et al: Standing orders vs. voice control. *JEMS* 1982; 7:26-31.

63. *Injury* Control *in the 1990s: A National Plan for Action-Trauma Care Systems.* Atlanta: Centers for Disease Control and Prevention, 1993, 377-432.

64. Jolley S, Delbridge T: A description of the system wide application of transcutaneous cardiac pacing in an urban EMS system. *Prehosp Disaster Med* 1995; 10:S71.

65. Jones SE, Brenneis AT: Study design in prehospital trauma advanced life support — basic life support research: A critical review. *Ann Emerg Med* 1991; 20:857-860.

66. Keller RA: 1992 EMS Salary Survey. JEMS 1992; 17(11):62-73.

67. Kessner DM, Kalk CE, James S: Assessing health quality — the case for tracers. New *Eng J Med* 1973; 288:189-194.

68. Kouwenhoven WB, Jude JR, Nickerbocker GG: Closed-chest cardiac message. *JAMA* 1960; 173:1064-1067.

69. Krumperman KM: Filling the gap: EMS social service referrals. JEMS 1993; 18(2):25-29.

70. Landis SS, Benson NH, Whitley TW: A comparison of four methods of testing emergency medical technician triage skills. *Am J Emerg Med* 1989; 7:1-4.

71. Losek JD, Szewczuga D, Glaeser PW: Improved prehospital pediatric ALS care after an EMT-Paramedic clinical training course. *Am J Emerg Med* 1994; 12:429-432.

72. Lumpe D: Calling 911: Who will answer? *Emerg Med* News, April 1993.

73. MacLean CB: The future role of emergency medical services systems in prevention. **Ann** Emerg *Med 1993;22:1743-*1746.

74. Macnab AJ: Air medical transport: "Hot Air" and a French lesson. J *Air Med* Transport 1992;11(8):15-18.

75. Maio RF: Using cardiac arrest data to evaluate the EMS system. In Swor RA, Rottman SJ, Pirrallo RG, Davis E (eds): *Qualify Management in Prehospifal Care.* St. Louis: Mosby-Year- Book, Inc., 1993, 233-239.

76. Maiava D: Personal *Communication,* February 1996.

77. Martinez R: Injury Prevention: A new perspective. JAMA 1994;19:1541-1542.

78. Mayron R, Long RS, Ruiz E: The 911 emergency telephone number: Impact on emergency medical systems access in a metropolitan area. *Am J Emerg Med 1984;2:491-493.*

79. McNally VP: A history of the volunteers. Fire *House* 1986;11:49.

80. Menegazzi JJ: A meta-analysis of hepatitis B serologic marking prevalence in EMS personnel. Prehosp Disaster Med 1991;6:299-302.

81. Mitchell JT: Critical incident stress management. In Kuehl AE (ed): *Prehospital Systems and Medical* Oversight. 2d ed., St. Louis: Mosby-Year Book, Inc., 1994, 239-344.

82. Mitchell J, Bray *G: Emergency Services* Stress: *Guidelines for Preserving the Health* and *Careers of Emergency Personnel* Englewood Cliffs, NJ: Brady Publishing-Prentice Hall, 1990.

83. *Model Trauma Care System Plan.* Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Health Resources and Services Administration, 1992.

84. Moses HW, Engelking N, Taylor GJ, et al: Effect of a two year public education campaign on reducing response time of patients with symptoms of acute myocardial infarction. *Am J Cardiol* 1991;68:249-251.

85. Munn B: Cellular phones and 911. *Emerg Med* Svcs 1987; 16(8):12-14.

86. Mustalish AC, Post C: History. In Kuehl AE fed): *Prehospifal Systems and Medical Oversight.* 2d ed., St. Louis: Mosby-Year Book, Inc., 1994, l-27.

87. National Academy of Sciences, National Research Council: *Accidental Death and Disability: The Neglected Disease of Modern Society.* Washington D.C.: National Academy Press, 1966.

88. National Association of EMS Physicians: Emergency medical dispatching. *Prehosp Disaster Med* 1989;4:163-166.

89. *National Emergency Medical* Services *Education and Practice Blueprint.* Columbus, OH: National Registry of Emergency Medical Technicians, 1993.

90. National Heart Attack Alert Program Coordinating Committee Access to Care Subcommittee: 9-l-l: Rapid identification and treatment of acute myocardial infarction. *Am J Emerg Med* 1995; 13:188-195.

91. *National Highway* Safety *Act of 2966: Public Law* 89-564. Washington, D.C.: 1966.

92. National Highway Traffic Safety Administration: *EMS* System Development: *Results of fhe Statewide* EMS *Assessment Program.* Washington, D.C.: U.S. Department of Transportation (DOT HS 808084), 1994.

93. National Research Council, Committee on Trauma Research: *injury in America: A Continuing Public Health Problem.* Washington, D.C.: National Academy Press, 1985.

94. Newman MM: Chain of survival takes hold. JEMS 1989; 14(8):11-13.

95. Norton RL, Bartkus EA, Schmidt TA, et al: Survey of emergency medical technicians' ability to cope with the deaths of patients during prehospital care. Prehosp *Disaster Med* 1992; 7:235-241.

96. Ogden JR, Criss EA, Spaite DW, Valenzuela TD: The impact of an EMS-initiated, community-based drowning prevention coalition on submersion deaths in a southwestern metropolitan area. *Acad Emerg Med 1994; 1(2):304.*

97. Pantridge JF, Geddes JS: Cardiac arrest after myocardial infarctions. *Lancet 1966; 1:807-808.*

98. Paris PM, Benson NH: Education about prehospital care during emergency education residency training: The *results* of a survey. *Prehosp Disaster Med* 1990; 5:209-215.

99. Perry S, Wilkinson SL: The technology assessment practice guidelines forum: A modified group judgement method. Intl J Tech *Assess in* Health *Care* 1992; 8:289-300.

100. Pointer JE, Osur MA: Effective standing orders on field times. *Ann Emerg Med* 1989; 18:1119-1121.

101. Polk DA, Langford SJ: EMS degree programs. *JEMS 1992;17(8):69-75.*

102. Powell JP: Training for EMT/Paramedics in perinatal care and transport. J *Tennessee Med Assoc* 1982;75:133-134.

103. Reed E, Daya MR, Jui J, et al: Occupational infectious disease exposures in EMS personnel. J *Emerg Med* 1993;11:916.

104. *Report to Congress on the Benefits of Safety Belts and Motorcycle Helmets.* Washington, D.C.: National Highway Traffic Safety Administration, 1996.

105. Revicki DA, Whitley TW, Landis SS, Allison EJ: Organizational characteristics, occupational stress, and depression in rural emergency medical technicians. *J Rural Health* 1988;4:73-83.

106. Robinson K: Development of ENA national standard guidelines for prehospital nursing curriculum. J Emerg Nursing 1992;18:48-53.

107. Rosenberg M: *Program Briefing* to Dr. David Satcher, Director, Centers for Disease Control and Prevention. Atlanta, GA: CDC, March 13, 1996.

108. Sacra JC, Martinez R: Trauma Systems. In Roush WR (ed): *Principles of EMS Systems.* Dallas: ACEP, 1994, 25-50.

109. Safar P, Escarraga LA, Elam JO: A comparison of mouth-to-mouth and mouth-to-airway methods of artificial respiration with the chest-pressure arm-lift methods. N *Engl J Med* 1958;258;671-677.

110. *Safe Communities: An approach to reduce traffic injuries, discussion paper.* Washington, D.C.: National Highway Traffic Safety Administration, September 24, 1995.

111. Schwartz RJ, Benson L, Jacobs LM: The prevalence of occupational injuries in EMTs in New England. *Prehosp Disaster Med* 1993;8:45-50.

112. Schwartz RJ, Jacobs LM, Lee M: The role of the physician in a helicopter EMS system. *Prehosp Disaster Med* 1990;5:31-37.

113. Seidel JS: Emergency medical services and the pediatric patient: Are the needs being met? Training and Equipping Emergency Medical Services Providers for Pediatric Emergencies. *Pediatrics 1986;78:808-812.*

114. Seidel JS, Hornbein M, Youshiyama K, et al: Emergency medical services and the pediatric patient: Are the needs being met? *Pediatrics* 1984;73:769-772.

115. *Senate Joint Memorial #44: Expanded-EMS Sfudy.* Albuquerque NM Department of Health, Emergency Medical Services Bureau, 1995.

116. Shackford SR, Mackersie RC, Hoyt DB, et al: Impact of a trauma system on outcome of severely injured patients. *Arch Surg* 1987;122:523-527.

117. Sklar D, Sapien R, Olson L, Monahan *C: EMTs and Injury Prevention, Advocates for Children.* Albuquerque NM: New Mexico EMS-C Project, 1995.

118. Snyder JA, Baren JM, Ryan SD, Chew JL, et al: Emergency medical service system development: Results of the state-wide emergency medical service technical assessment program. *Ann Emerg Med* 1995;25:768-775.

119. Spaite DW, Criss EA, Valenzuela TD, Guisto J: Emergency medical service systems research: problems of the past, challenges of the future. *Ann Emerg Med* 1995;26:146-152.

120. Spaite DW, Valenzuela TD, Meislin HW: Barriers to EMS system evaluation — problems associated with field data collection. *Prehosp Disaster Med 1993;8:535-540.*

121. Spaite DW, Valenzuela TD, Meislin HW, et al: Prospective validation of a new model for evaluating emergency medical services systems by in-field observation of specific time intervals in prehospital care. Ann *Emerg Med* 1993;22:638-645.

122. Stewart RD: The history of emergency medical services. In Roush WR (ed): *Principles of EMS Systems.* Dallas: ACEP, 1989.

123. Stewart RD: The history of emergency medical services. In Kuehl AE (ed): *National Association of EMS Physicians EMS Medical Directors' Handbook.* St. Louis: CV Mosby, 1989, 3-6.

124. Stone KC, Benson NH: Specialty transport. In Roush WR (ed): *Principles of EMS Systems Dallas*: ACEP, 1994, 183-201.

125. Stout JL: System financing. In Roush WR (ed): *Principles of EMS* Systems. Dallas: ACEP, 1994, 451-473.

126. Stratton SJ: Triage by emergency medical dispatchers. *Prehosp Disaster Med 1992;7:263-268.*

127. Suter RE: Who calls the shots? EMS operations control and the role of the communication center. *Prehosp* Disasfer *Med 1992;7:396-399.*

128. Swor R: Funding strategies. In Kuehl AE (ed): *Prehospital Systems and Medical Oversight.* 2d ed., St. Louis: Mosby-Year Book, Inc., 1994, 76-80.

129. Swor RA, Chisolm C, Krohmer J: Model curriculum in emergency medical services for emergency medicine residencies. *Ann Emerg Med* 1989;18:418-421.

130. *The Future of EMS Education: A National Perspective* Washington, D.C.: Joint Review- Committee on Educational Programs for the EMT Paramedic, 1994.

131. Thompson SJ, Schriber JA: A survey of prehospital care paramedic/physician communication from Multnomah County (Portland), OR. J *Emerg Med* 1984; 1:421-428.

132. *Trauma Care* Systems *Training and* Development Act *of 2990: Public Law* 101-590. Washington, DC.: 1990.

133. Trooskin SZ, Rubinowicz S, Eldridge C, et al: Teaching endotracheal intubation with animals and cadavers. Prehosp Disaster *Med* 1992;7:179-184.

134. U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau: *Five Year Plan: Emergency Medical Services for* Children, 1995-2000 . Washington, D.C.: Emergency Medical Services for Children National Resource Center, 1995.

135. *Uniform* Pre-hospital Emergency *Medical* Services (EMS) Data *Conference: Final* Reporf . Washington, D.C.: National Highway Traffic Safety Administration, 1994.

136. Urban N, Bergner L, Eisenberg MS: The costs of the suburban paramedic program in reducing deaths due to cardiac arrest. *Med* Care 1981;19:279-392.

137. Valenzuela TD, Criss EA, Spaite D, et al: Cost effectiveness analysis of paramedic emergency medical services in the treatment of prehospital cardiopulmonary arrest. *Ann Emerg Med* 1990;19:1407-1411.

138. Valenzuela T, Spaite D, Clark D, et al: Estimated cost-effectiveness of dispatcher CPR instruction via telephone to bystanders during out-of-hospital ventricular fibrillation. *Prehosp Disaster Med* 1992;7:229-234.

139. Valenzuela TD, Spaite DW, Meislin HW, et al: Emergency vehicle intervals vs. collapse to CPR and collapse to defibrillation intervals: Monitoring emergency medical services system performance in sudden cardiac arrest, *Ann Emerg Med* 1993;22:1678-1683.

140. Walters G, D'Auria D, Glucksman E: Automatic external defibrillators: Implications for training qualified ambulance staff. *Ann Emerg Med* 1992;21:692-697.

141. Werman HA, Keseg DR, Glimcher M: Retention of basic life support skills. Prehosp Disaster *Med 1990;5:137-144.*

142. Wuerz RC, Swope GE, Holliman CJ, Vazquez-de Miguel1 G: Online medical direction: Aprospective study. *Prehosp Disaster Med* 1995;10:174-177.

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