

Emergency Medical Services at Midpassage



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Summary

Much of the current attention to the improvement of emergency medical care in the United States can be traced to the report, *Accidental Death and Disability: The Neglected Disease of Modern Society*, prepared by the Committees on Trauma and Shock of the Division of Medical Sciences of the National Academy of Sciences—National Research Council (NAS-NRC) in 1966. That report identified trauma as the leading cause of prolonged disability and as the fourth major cause of death in the United States, (it was shown subsequently that, for persons under 45, trauma was the leading cause of death) and called for sweeping changes in public awareness, in training of ambulance personnel, in staffing of hospital emergency departments and intensive care units, in the identification of hospitals by their emergency care capability, and in funding for research in trauma. The report and later efforts by other agencies* increased awareness, not only among the public but within the federal government as well.

Some of the recommendations of the 1966 report and of a 1973 NAS-NRC report *Roles and Resources of Federal Agencies in Support of Comprehensive Emergency Medical Services* have been implemented as recommended, some have been modified and implemented, and others have evolved into programs not clearly contemplated at the time of the reports. Some of the issues raised are still the subject of debate. Noting this, the Committee on Emergency Medical Services has attempted to examine the present status of emergency medical services (EMS) in the United States. This examination took into account the substantial efforts at implementation of advanced EMS systems through programs of the Department of Transportation (DOT), the Department of Health, Education, and Welfare (DHEW), and the Robert Wood Johnson Foundation, as well as of various regions acting independently.

* American Heart Association, Committee on Trauma of the American College of Surgeons, National Safety Council, American National Red Cross, American College of Emergency Physicians, University Association for Emergency Medicine, Emergency Department Nurses Association, the American Academy of Orthopedic Surgeons, the American Association for the Surgery of Trauma, the AMA Commission on Emergency Medical Services, and American Trauma Society.

It also noted the promulgation of a variety of standards for emergency care by concerned federal agencies as well as by the American Hospital Association, the American National Red Cross, the American Medical Association, and the American Heart Association.

Progress

The past decade has seen substantial progress in the development of EMS. By the end of 1977, some 116,000 emergency medical technicians (EMTs), about 65% of the total number of persons trained as EMTs, had been certified by the National Registry of Emergency Medical Technicians, and the number of registrants is increasing by about 2,000 per month. EMS systems continue to proliferate: federal plans envision a network of 300 contiguous EMS systems spanning the United States; the 300 areas have been designated, and developmental funding has been provided for 278 of them. Nearly all the states have enacted legislation setting standards for EMS vehicles and personnel, and most states have established EMS offices. Well-designed ambulances have largely replaced hearses and station wagons as emergency vehicles. There is also a growing body of books, articles, and research reports relating to EMS systems.

The diversity of forms that EMS systems have taken has been as striking as their growth. They range in size from citywide to statewide; some include portions of two or more states. Management of an EMS system may rest with a state, county, or city health department, with a fire department or other local agency, with a private ambulance company, with a hospital or hospital association, with an EMS committee, with a civil defense office, with a council of governments, or with any other body that has the will, drive, and resources to carry the work forward. Some systems are supported by local taxes, others by voluntary contributions, by cost-sharing arrangements among providers and users, by fees, by subsidies, by subscriptions, or by some combination of these; many still rely heavily on federal grants.

There has been a clear demonstration that EMTs can be trained to deliver effective prehospital care and to provide safe transportation to the hospital. The design of ambulances has been modified to permit basic (non-invasive) and in some cases advanced (invasive) emergency care to be carried out. The development of radio communication and in some cases, of remote reading of electrocardiograms, etc. (telemetry), permits medical guidance to be given to EMTs in the field. Improvements in the training of physicians, nurses and paramedical personnel in emergency medicine have resulted in beneficial changes in the com-

petence and staffing patterns of many hospital emergency departments. Trauma research centers have been founded, the American Trauma Society has been formed, and many communities have EMS councils. Finally, with the Emergency Medical Services Systems (EMSS) Act of 1973, a set of standards for EMS systems has been established.

The existence of such standards could lead to the assumption that merely meeting them would ensure that a region has an adequate EMS system. Thus, it might appear that the problem in 1978 is only to distribute sufficient funds to ensure that every region within the country can be served by an EMS system that includes the 15 components* specified in the EMSS Act of 1973. That would be an oversimplification. In spite of the gratifying progress in some elements of this previously neglected health field, there remain geographical areas and system components in which progress has been very uneven. In many regions patient access to emergency care remains limited; few systems have realized the full potential of system evaluation or of central emergency medical dispatch (CMED).

Unresolved Problems

Standards EMS standards vary widely in source, object, and legal force. Those promulgated by federal agencies, such as DOT's standards for ambulances and for EMT training or HEW's for system design are, of course, requirements only for those seeking federal funding, except as they have been incorporated into the EMS laws of various states. Some states have no EMS standards; others stipulate in detail the advanced life support (ALS) measures that paramedics may or may not use. Standards for first aid and cardiopulmonary resuscitation (CPR) have been promulgated by the American National Red Cross and the American Heart Association, and for ambulance equipment by the American Academy of Orthopedic Surgeons.

As will be pointed out, reliance solely on currently established standards is not likely to provide an optimal system for every community. The required components specified in the EMSS Act of 1973 appropriately embodied the wisdom of the time. However, the availability of

*The EMSS Act of 1973 required applicants for grants to demonstrate adequacy in the following areas: health personnel, training, communications, vehicles, medical facilities, specialized critical care units, use of other public safety personnel and equipment, public participation in policy making, service without prior determination of ability to pay, transfer agreements, standardized record keeping, public education, evaluation, disaster planning, and links to adjacent EMS systems.

funds authorized under this Act exclusively to communities that could conform to the requirements specified, established an orthodoxy based on the 15 components. It is not widely recognized that these are interim standards to be modified and replaced as a result of experience and research in emergency medical care. Some of the standards, by their nature, are not adaptable to the wide variety of demographic, geographic, economic, and other characteristics of many communities, and their application has in some instances actually reduced the accessibility of emergency care to the public. Under these circumstances, it should be recognized that current standards must be applied with sufficient flexibility to permit variation in consideration of unique local factors. This flexibility is particularly important while we are seeking to validate standards or revise them on the basis of credible evidence. The pluralism of EMS systems offers an opportunity to assess standards and, perhaps more importantly, an opportunity to investigate new approaches that may have broad application.

Regionalization Early EMS systems usually served single counties or metropolitan areas. These systems rarely included all the resources necessary for optimal emergency care, nor did they make efficient use of the resources they had. It seemed obvious that regional arrangements for the pooling and centralization of resources and for patient transfer and referral, outside of the region when necessary, would improve patient care and system efficiency.

Thus, it has been assumed that managerial coordination of the emergency medical resources of a region is necessary if these resources are to be used to improve the quality of care at reasonable cost. But it is not clear what should constitute a region or who should determine its dimensions and configuration. We do not yet know whether a region should be delineated on the basis of population, of availability of various medical care resources, or of political boundaries. Certainly, the size of an EMS region will depend on these and other factors, such as the kind of service to be provided and the sources of financial support. A region of optimal size for prompt delivery of emergency care may not include within its boundaries all the specialized medical services that may sometimes be needed, but system design should include referral protocols and agreements for such services outside the region. Valid criteria by which the success of "regionalization" can be gauged need to be established. Should they include the size of the area served, the degree of centralization of resource management, the utilization of hospital categorization, the frequency with which patients are delivered to appropriate hospitals, system response times, and the extent of local financial support? It must be kept in mind that of all health services, EMS systems

are the most intensely local, by virtue of their requirement for prompt action.

Planning The overall design of EMS systems has generally been modular. Thus, systems have been specified in terms of components, rather than in terms of functions aimed at meeting overall goals. A rational design for an EMS system requires that form follow function in a planned allocation of resources, related to both the development and the operation of the system. Management considerations need to be built into such planning. It is insufficient to hope that mutual aid agreements among independent components will provide an adequate substitute for management. Rather, it must be recognized early that there inevitably will be political and economic obstacles to the development of any well-designed EMS system. The identification and resolution of these obstacles can be facilitated by the early involvement of all providers and of representatives of the potential consumer public in system planning.

The geographic boundaries of an EMS system must be clearly defined, and arrangements made for use of specialized medical services not available within those boundaries. One system must be designed to interact with others. To provide for service in major disasters, the emergency operations centers of the civil defense program must be properly tied in to the EMS communications system.

The responsibility for medical, as opposed to administrative, management needs to be defined and fixed clearly. It is necessary to determine the level of competence desired in the emergency department staffs and to clarify their accountability. The qualifications of physicians involved in providing advice on prehospital care and in reviewing prehospital treatment must also be determined. The extent to which physician-prepared treatment outlines (protocols) in the hands of an EMT can substitute for direct physician supervision or management over the telephone or radio needs to be investigated.

The 1966 report, *Accidental Death and Disability* . . . , stated that "the patient must be transported to the emergency department best prepared for his particular problem. . . . A categorization of emergency departments would serve to indicate the level of care that a patient might reasonably expect." There appear to be continuing political and economic obstacles to the categorization of emergency departments, despite the demonstrated inadequacy of the care often given trauma patients. Hospitals with limited capabilities often fear loss of patients, and thus of income, as well as inability to attract competent house staff. To deal with the political and economic obstacles to categorization, it is necessary to explore its implications for the quality of emer-

gency care, for the costs involved, and for the adequacy of access to that care. Although the capabilities of hospitals are so important that they have a bearing on plans for the prehospital management of patients, the determination of those capabilities is often limited to whether specific equipment and supporting services are available and a skilled physician is on hand 24 hours a day.

Finally, planners must recognize that EMS systems inevitably deal with large numbers of non-emergency patients, and the systems must be designed to do so without diminishing their capacity to deal effectively with emergency patients.

Evaluation Management of an EMS system ideally entails a flow of verifiable data on input, process, and outcome and a means of analyzing those data. At present, most systems still measure performance only in terms of compliance with standards. This approach should be replaced by a data feedback mechanism that would permit midcourse correction through redesign aimed at improving medical outcome and cost-effectiveness. Such a change will require research to establish valid criteria of quality in nearly every aspect of system performance, including cost and accessibility to the public. As a minimum, limited studies should be undertaken to correlate present input and process standards with outcome and to demonstrate the relative merits of alternative approaches to the provision of quality care.

Funding Some economic aspects of system design and operation deserve attention. The question of the relative responsibilities of the federal or state government and of private citizens for emergency care needs to be addressed. Federal and foundation EMS-funding programs tend to assume that the continuing operational costs, such as those associated with central dispatching, maintenance of radio equipment, and training must and should be borne locally. Is there, perhaps, a per capita income level at which this assumption is not valid and at which the provision of prehospital emergency medical care must be supported by outside funds? Given the diversity of economic and social priorities in this country, equality of access to high quality emergency care may be unattainable.

The mechanisms by which EMS systems are funded may affect their structure. Responsibilities and interactions of funding sources should be made explicit, particularly today when federal funding of health services in general is under consideration. For example, plans for the development of an EMS system often neglect to specify how the system will be funded once it becomes operational, and this omission often leads to unfulfilled promises. A solution might be worked out with third party

payers that will provide for the system to be reimbursed for some of the specific costs of prehospital care and ambulance service and for a portion of the overall costs of system operation.

Training In the training of EMTs and paramedics it is generally assumed that "more is better"—from the standpoint of numbers trained, as well as extent of training. This assumption needs to be examined for at least two reasons: the hazard of leading large numbers of people into a career in which employment and advancement opportunities are limited, and the difficulty and cost, in rural areas, of assembling and training sufficient candidates. Each area should try to determine how many EMTs and paramedics it needs. There may well be a point in the development of an EMS system at which expenditures for additional training and recruitment may be less cost-effective than expenditures, for instances, for public education in first aid and accident prevention.

Training courses for EMTs and paramedics require constant validation in the field, to ensure that course content is appropriate to the systems that will use the graduates. Furthermore, the extent of training of EMS personnel should be evaluated not in terms of hours of instruction completed but in terms of knowledge and skills acquired and retained.

Given the great variety of EMS systems, the identification of an appropriate level of training for central medical dispatchers is a problem.

Early reports indicate that widespread training of the public in first aid—as "first responders"—can achieve significant results in reducing mortality. This approach requires an extensive public education effort.

Legal Considerations With the widespread growth of paramedic programs throughout the country, numerous questions have arisen about the potential liability of the physicians, nurses, paramedics, and hospitals involved in such programs. However, there has not been a rash of litigation involving emergency personnel, nor does it appear likely that there will be. Judges and juries will probably continue to appreciate the enormous pressures placed on emergency personnel working under crisis conditions. As long as paramedics are well trained, are acting within the scope of their training, and are supervised by physicians and nurses under previously developed protocols, and as long as patient care is subject to physician review there is not likely to be a significant expansion of legal risk. In the light of experience to date, the possibility of legal liability should not be a significant barrier to the development of paramedic programs.

The increasing use of nonphysicians in emergency care has raised

additional questions about the appropriate credentialing approach to assure a minimum level of quality of such personnel. A national certifying examination should be developed for paramedics similar to that developed by the National Board of Medical Examiners for the "assistant to the primary care physician." Once validated, this examination could be used by states and localities in lieu of separate licensure requirements.

Access The progress detailed earlier has been aimed at increasing the availability of appropriate emergency care. The extent to which those in need have access to that care and avail themselves of it still leaves something to be desired. Even in some areas with good EMS systems, there are still segments of the population that do not have ready access to the services. This may have a variety of causes. Excessive distance from a hospital or from ambulance service is an obvious factor. Inadequate communication is another. In rural areas and on highways the lack of telephones or adequately distributed call-boxes might be overcome by the establishment of a citizen's band (CB) radio network. Within inner cities the only alternative appears to be the toll-free public telephone access. Certainly, public attention should be directed to the establishment, where feasible, of 911 as the single emergency access number. Another aspect of communications is the frequently overlooked inability of the non-English speaking members of the community to express their circumstances or comprehend instructions. The deaf and the disabled require special access facilities. Unfortunately, there are also areas in which constraints on the providers limit public access to emergency care. Ambulance personnel are often reluctant to enter high-crime areas of a city, and, in some systems, ambulance services and hospitals are reluctant to undertake the care of those known to be unable to pay for services rendered. Special provisions for addressing these problems should be included in the design of any EMS system.

Conclusions

It seems clear that the simple addition of dollars for implementation of EMS systems around the country will not necessarily result in satisfactory quality of care, and access to that care, at reasonable cost. The attitude toward EMS has changed since 1967 from a lack of awareness, which our predecessors appropriately called "neglect," to a lack of knowledge with which to deal with the complexities and pitfalls that have arisen. Thus, the Committee finds EMS in the United States in midpassage, urgently in need of midcourse corrections, but uncertain as to the best direction and degree. Accordingly, the Committee strongly

recommends increased expenditure on research and evaluation directed both to questions of immediate importance to EMS system development and to long-range questions. Without such investment, there can be no reasonable assurance that implementation dollars will be well spent or even that overall goals will be properly identified and met. However, the progress already made suggests that with the answers to these questions, we may well achieve appropriate levels of emergency care for the population at large. The question of withholding further federal support for EMS development pending evaluation of the effects of past investments, was raised in an investigative report to the Committee on Appropriations of the U.S. House of Representatives.* The report also questioned the responsiveness of EMS research to the needs of EMS systems. These are critical concerns, but the actions they imply must be very carefully considered.

It is of utmost importance to continue the orderly development of emergency medical care in the United States, while information is being sought to optimize the investments aimed at the specific needs of a great variety of local and regional EMS systems. This will require continuation of federal assistance. However, the requisite information cannot be obtained without carefully designed systems research and evaluation.

It is misleading to say that federally-sponsored research to date has been "unresponsive" to EMS needs.† Actually, the findings of such research have only recently begun to appear and there has been little opportunity to explore their applicability to EMS system needs. Many of the EMS systems are so new and so seized by the pangs of growth and conformity to federal requirements that they have had little time to examine the potential value of the research findings on EMS. It would be unfortunate to proceed in EMS development without adequate investment in both short-term research, to address specific questions raised by system managers and emergency personnel, and long-term research to address basic problems of medical and social decision-making. The short-term research is that targeted at first-order effects, i.e., the immediate impacts of alternative methods of operation on the efficiency and effectiveness of the emergency system. The long-term research explores such problems as opportunity costs and the overall evaluation of the effects of changes in EMS on the health of the community.

*Hearings before a Subcommittee of the Committee on Appropriations, House of Representatives, Ninety-Fifth Congress Second Session, Part 2. *Report to the Committee on Appropriations, U.S. House of Representatives, on Emergency Medical Services in the United States*. Surveys and Investigation Staff. February, 1978, p. 277.

†*Ibid.*, p. 250.

Without adequate investment in both types of research, EMS in the United States will be in the same position of uncertainty a generation hence as it is today.

Recommendations

System Design

The design process should begin with a definition of system goals, given the political and geographical limitations within which the system must operate and the resources available for system development. The second step is to determine how the system should interrelate providers, physicians, political entities, and the public. System components can then be selected with a view to facilitating these relationships and achieving the specified goals. No recommendation to adopt a system component should be made without reference to its interconnections with other components of the system.

The design process should envision a continuing cycle of reassessment and adjustment, based on a flow of information from system components to management.

The EMS community should accept as legitimate the participation of the political processes in the system design cycle; it should be aware that it is, in fact, providing another social service, albeit a dramatic and highly technical one.

Quality Assurance and Assessment

Individual EMS facilities and providers, as well as the lay community, should be involved in the setting of quality assessment standards that are specific to local conditions.

Design for EMS evaluation should permit detection of the effects of individual components and activities on the quality of service.

Quality-control data should be collected on a continuing basis and should reflect an integrated sampling of information from all elements of the system.

Highest priority should be given to the establishment of a feedback mechanism that will identify the best ways to improve system performance.

Quality control responsibility should be placed with a regional body that is able to effect system improvements.

System Management

Whatever its structure, the management organization must have a secure financial base, if it is to provide those system elements—such as administration, dispatching, communications, and training—that are not usually covered by user charges; it must have the authority to control the use of emergency ambulances in its service area; and it must have the ability to effect improvements in system components.

Economics

Initial planning for EMS systems must recognize and deal with the need for funding beyond the developmental state.

An effort should be made, locally and nationally, to update third party insurance coverage to include all the costs of EMS.

Legal Aspects

To protect the public, all states should enact comprehensive legislation assuring the basic quality of ambulance services, and this should apply equally to all ambulance providers, no matter how organized, managed, or financed. Such legislation should include the designation of a lead agency (such as the state health department) as having authority to set standards and adopt regulations, the provision for statewide and regional EMS advisory councils, and the appropriation of adequate funds to enforce such standards.

The development of advanced life support programs should be facilitated through the enactment of flexible legislation that permits paramedics to function under remote supervision by physicians (or specially trained nurses) as part of carefully monitored and evaluated programs.

Regionalization and Categorization

Regional EMS planning should include the establishment of acute care registries, of uniform ambulance and hospital records for patient tracking to allow for assessing the impact of regionalization on health outcomes, and of arrangements with hospitals outside the EMS service area for specialized services not available in the area.

Studies are urgently needed on the impact of hospital categorization both on health-care delivery and outcomes and on hospital economics.

State and regional health authorities should seek to develop service tradeoffs among hospitals to offset the perceived economic threat of categorization. Authoritative criteria and methods of categorization need to be established.

Communications

The universal emergency telephone number, 911, should be installed wherever possible—lacking that, a single EMS number should be established, identified on public telephones, and widely publicized.

Central medical emergency dispatching (CMED) should be seriously considered, but the dispatching facility should be designed to meet the specific requirements of its region.

Greater effort should be expended on the coordination of EMS communications on an areawide basis; this would be enhanced by technical assistance from state or federal sources.

The communication system should provide for the collection of data that will allow linkage of patient records that are essential to continuing evaluation of the effectiveness of the service.

A handbook, setting forth telecommunication requirements and guidelines for the staffing and operation of emergency communication centers, is needed.

Transportation

The operational effectiveness of design criteria for EMS vehicles should be reexamined every 3–5 years.

Until vehicle design criteria and standards have been validated, they should be applied with a measure of flexibility.

Manpower and Training

Efficient distribution of EMTs and paramedics in a given system should be determined on the basis of the expected frequency of life-threatening emergencies that require advanced care, the assumed capabilities of EMTs with various levels of training, and relative costs of teaching and maintaining the skills and knowledge involved.

Well-designed coordinated studies, using adequate samples of patients in comparable settings, should be undertaken to determine the relative effectiveness of advanced emergency care provided under a set of es-

established procedures (protocols) vs. that provided under direct physician guidance by voice communication and telemetry.

The competence of individual EMS personnel should be evaluated on the basis of observed performance in actual or simulated circumstances, rather than in terms of hours of formal training completed.

Greater effort should be devoted to public information and education programs aimed at increasing the number of lay persons in the community who are competent in first aid and emergency care.

Public Education and Information

Public information and education programs should be considered essential parts of the planning and operation of an EMS system. These programs should be keyed initially to the development of understanding of the service, and of support for it; once an EMS system is established, to assessment of public understanding of and participation in the activity; and, in older systems, to the maintenance of interest and enthusiasm.

EMS System Design

EMS, like other services, is concerned with questions of who gets what, how, at what cost and under what auspice. This section attempts to impose some order on these questions by assuming a system design hierarchy that includes the design of system components, their interrelations, and the goals of the system. It stresses the interdependence of the three levels of system design, and the importance of proceeding in a "closed loop" or self-correcting fashion. The system design process should be one of successive approximations to an ideal, one which does not end with initial planning but is continuous and evolutionary.

A number of system design questions confront EMS planners today. Should advanced or basic life support be the major element of pre-hospital care? Which hospitals should be designated to receive the most critically ill patients? Under what circumstances should air ambulances be purchased? How can information on system performance be fed back effectively to those providing services? Can telephone screening be made to substitute safely for expansion of ambulance fleets in the face of rising demand? Should EMS be provided at public expense, or should user charges be levied?

In a real sense, these questions and others form an agenda created by the progress in EMS made since the 1966 report was issued. The major public and private initiatives in EMS in the last decade have exposed uncertainties about the best way to provide emergency medical care at the same time that they have stimulated and channeled our energies and resources. Responding to the urgency of the problem of reform of EMS, the nation moved to establish and upgrade EMS systems on the basis of the best clinical, technical and organizational judgments. Having established this momentum, it is proper now to review these judgments in the light of recent experience. We should capitalize on the movement in the EMS field, being careful to avoid uncritical allegiance to our first cuts at EMS system design. Our initiatives have left us more certain of some aspects of system design and less certain of others; this report attempts to consolidate both our new knowledge and our new uncertainties.

The word "system" has been used and misused so often that it stands in danger of losing a precise meaning. We present below both a definition of "system" and a way of organizing the major issues in EMS system design. This perspective on EMS system design is by no means the only one possible, but it may help us to avoid thinking of systems in terms of component checklists and show us how our questions of system design are related to each other.

A system consists of a set of *elements*, and the *relationships* among them by which they are assembled to achieve certain *goals*. The critical elements of an EMS system are its people, its technology, and its knowledge base. "People" includes patients, clinical providers, and support personnel (in administration, planning and research). "Technology" includes facilities, communication and transportation equipment, and clinical apparatus. "Knowledge base" consists of diagnostic and therapeutic protocols, their scientific underpinnings, and management expertise. The critical relationships in an EMS system concern flow of patients, coordination with other emergency services, information and funds. The goal of an EMS system is to reduce death, disability and discomfort in time-critical emergency illnesses and injuries.

In recent years, these three aspects of EMS systems have been the subject of critical scrutiny. The concern has had a natural progression over time. First, the elements of EMS were criticized. Inadequate training and inadequate equipment were highlighted as targets for reform. Standards for training and vehicles followed. Then it was recognized that the anticipated improvements attendant on the use of higher quality elements would be minimal if their relationships were not carefully coordinated and controlled. Communication and categorization strategies followed. Finally, as national activities under the EMSS Act were assessed and renewal was at issue, there was concern that the goals of EMS systems be assessed with reference to relative costs and relative priorities among social programs. We are left today with a backlog of unanswered questions about the design of EMS systems.

How these questions are to be answered depends on the most basic concepts of "system." Some involve choices among possible elements of a system. For instance, system planners should not seek to resolve the question of whether to use very high frequency (VHF), ultra high frequency (UHF), or a combination of the two solely on the technical merits of each, but should deal with them in terms of expediting patient care and delivery, facilitating communication with other emergency resources, coordinating with neighboring systems, and maintaining compatibility with state planning. In an ongoing system, it should eventually become possible, through analysis of data from component evaluations, to reach rational decisions on, for instance, the relative merits

of additional funding for public education or for a more sophisticated address locator. This assumes the existence of a body which can analyze data from system components and implement appropriate system modifications.

Such analysis focuses on the relationships among elements. These relationships distinguish system design from component design and may usefully be approached by the tools of systems analysis, provided that the design problem is properly framed, with agreement on the boundaries of the problem and on the goals by which alternative system designs can be evaluated.

Optimization of component relationships presumes a set of goals that give form to the problem of system design. The goal-setting activity carries the problem of EMS system design farthest from the EMS community itself; with each level of design activity, the participation of "outsiders" becomes more useful and more legitimate. It is at the level of problem framing and goal setting that fundamental decisions are made to determine "how much is enough" in EMS care, where the boundary lies between public and individual responsibility for the prevention of and response to emergencies, and whether rural populations are entitled to equal access or only to equal funding—and in general to confront the nontechnical issues of judgment that form the basis for later design activity. Just as components of systems cannot be properly evaluated without reference to their intended interconnection, neither can the dynamics of system operation be assessed without reference to the boundaries and goals that fundamentally govern design.

We have described three levels of a hierarchy of system design activities: evaluation of components, analysis of relationships among components, and problem-framing and goal-setting. We have noted that the recent history of EMS in the United States has been marked by critical inquiry that has progressed upward in this hierarchy, until today the EMS community is confronted with a number of major questions, which range from evaluation of specific emergency care techniques to the relative value of investments in EMS or in other social services.

There is some value in addressing these questions within a general framework of the design of any service delivery system. For any such system, the designer must determine *who gets what, how, at what cost, and under what auspices*. The major issue in the question of who receives service concerns the treatment of nonemergency patients, who constitute the majority of those treated in an EMS system. Questions of what is provided to the clients of the system concern the timing, intensity and standardization of service, and such questions as whether to provide basic or advanced life support. How the service should be provided concerns such issues as the use of nonphysicians in emergency

departments and the establishment of hospital categorization schemes. Issues of cost include not only the absolute amount of resources to be committed to EMS, but also their distribution: What is a fair contribution from local, state and federal sources? Does equity require equal expenditures per capita for various subpopulations, such as rural and urban, or does equity require equal access, which implies unequal expenditures per capita to overcome inherent disadvantages (such as travel time in rural areas)? Questions of auspice include those of the proper role of voluntary activity in EMS, of the role of superspecialized centers of definitive care, of dedicated *versus* general purpose (police, fire) services, of separate departments of emergency medicine *versus* the inclusion of emergency rooms within general departments of outpatient care, of locally-controlled block grants *versus* categorical federal funding, and of loose municipal confederations *versus* strong regional authorities.

Asking "who gets what, how, at what cost and under what auspices" helps to organize the major concerns of EMS system design, as it does for many other social-service delivery systems. Most of the questions about what treatments to provide and some of the questions about how to provide them tend to be questions of the first level of the hierarchy of design activities: i.e., they involve comparisons of system components. The question of *how* to provide service tends to be a question of the second level of the hierarchy—i.e., how to relate components. And questions of who gets care at what cost and under what auspice tend to be questions of the third level of the hierarchy—problem-framing and goal-setting.

The relation of these questions to the hierarchy of system design activities is intended to clarify the process by which they might be answered. An answer to a question of component comparison must be interpreted in the light of system relationships; an answer to a question of component relationships must be interpreted in light of systems boundaries and goals, identified by the political processes that define societal concerns and commitments. This implies that, in the initial design of an EMS system, political participation is essential; basic decisions regarding the geographic, financial, qualitative, and administrative dimensions of the system are essentially political decisions. Only with political participation and defined commitment can EMS planners guard against starting something that they may be unable to finish.

Any strategy for responding to one of the questions confronting the EMS community should locate that question in the hierarchy of design decisions, and then range across the hierarchy of design decisions in assembling an answer. A good process of system design should have the following properties, which are often lacking in current practice:

- The design process should demand high standards of evaluation of system components.
- The available tools of systems analysis should become commonplace in the system design process. No recommendation to adopt a system component should be made without reference to its connection with other components in a system. However, no systems analysis should be regarded as a unique, definitive solution to the design problem.
- The EMS community should accept as legitimate the participation of political processes in the system design cycle. The EMS community would do well to remember the similarities of its problems to those of other social service delivery systems. Indeed, those providing EMS should be aware that they are, in fact, providing a social service, albeit a dramatic and highly technical one.
- The design process should begin with definition of the goals of the system, given the resources available. Once these are established, it is possible to address the relationships among providers, physicians, political entities, and the public that are necessary if the system is to succeed. With this groundwork laid, planners can determine which kinds of system components will best facilitate the chosen relationship and achieve the chosen goals.

One final argument should be presented about the nature of the design process in EMS. The process should recognize the critical role of organizational intention in good design and should be alert to the signs of organizational commitment to improving the delivery of services. Just as we know that EMS cannot eliminate mortality from accident and illness, so we know that EMS system design cannot eliminate imperfection in the structure and functioning of the system itself. We should recognize the inevitability of error in prediction of performance and adopt "closed-loop" strategies that accept—even insist upon—a continuing cycle of assessment and adjustment. To design better EMS systems, we must be willing to change systems, rejecting rigid notions of orthodoxy in system design and cultivating an openness to reform. Institutions which resist continual inquiry into their effectiveness will inevitably resist experiment and analysis. Conversely, institutions that intend reform for themselves will inevitably provide fertile ground for experimental and analytic activities: they will spontaneously develop information systems, however crude, to track their own performance; they will spontaneously alter, however haphazardly, the manner in which they provide services to improve their own performance; they will be self-aware and self-confident; they will benefit from systematic attempts at design; they will even develop a systemic consciousness,

which permits them to empathize with institutions elsewhere in the EMS system. A good deal of work remains to perfect the techniques of experimental design, evaluation, and system analysis, but it should be recognized that efforts should be made to learn how to help EMS institutions reach this level of commitment to continual reform.

Conclusions and Recommendations

We are left today with a backlog of unanswered questions about the design of EMS systems. If these questions are to be answered correctly they must be answered within the context of the system concept—and the answers must be based on valid data.

The design process should begin with definition of system goals, of the limitations within which the system must operate, and of the resources available for system development. One should then determine the appropriate relationships among providers, physicians, political entities, and the public. System components should then be selected with a view to facilitating these relationships and achieving the specified goals.

The EMS community should accept as legitimate the participation of political processes in the system design cycle; it should be aware that it is, in fact, providing another social service, albeit a dramatic and highly technical one.

No recommendation to adopt a system component should be made without reference to its interconnection with other components of the system—this can be facilitated by the use of systems analysis techniques.

The design process should demand high standards for evaluation of system components—not relying on anecdotal and non-experimental evidence.

The inevitability of error in prediction of performance should be recognized, and system designers must contemplate a continuing cycle of assessment and adjustment.

Quality Assessment and Assurance In EMS Systems

The mechanism for self-correcting evolution is one of quality assessment and assurance. This section reviews the status of quality assessment and assurance in EMS and notes serious deficiencies in both concept and execution. The deficiencies lead to recommendations of four kinds. First, "standards for standards" are offered, to improve the quality of guidelines. Second, particular research designs are advocated to improve the quality of evaluation studies. Third, routine but selective data collection is urged to sustain quality assessment and assurance as a continuing activity. Fourth, because it is recognized that the choice of institutional auspice for quality assessment and assurance programs is crucial but that the best choice is not obvious, it is recommended that attention be devoted to this issue.

Quality assessment asks whether a given system component, medical technique, or system modification is beneficial in terms of medical outcomes, and can lead to the setting or the reevaluation of standards. Quality assurance asks whether these things are being used properly, comparing their use with some predetermined standard. Quality assurance may include the management function of ensuring that performance meets standards. An NAS report, *Assessing Quality in Health Care: An Evaluation* (November 1976), delineated the following characteristics of an ideal quality assurance system.

... the existence of an organizational entity created for assessing quality, the establishment of standards or criteria against which quality is assessed, a routine system for gathering information, assurance that such information is based on the total population or representative sample of patients or potential patients, a process for providing the results of review to patients, the public, providers, and sponsoring organization, and for instituting corrective actions.

Taken together, quality assessment and quality assurance constitute powerful tools for planning and managing EMS systems and individual

facilities, not merely retrospective mechanisms for assessing effectiveness. Thus, quality assessment can be regarded as a continuing survey to identify the kinds of service needed in a community. It can also serve as a consensus-producing process whereby localities determine their program expectations and whether they are being met. Quality assurance provides routine and significant feedback for the system and facility so that needed corrective actions can be taken.

Because quality assessment and assurance are normative activities, it is well to review the categories of performance norms before addressing the key issues in quality assessment and assurance.

The evaluative norms, like all program standards, may refer to input, process, or outcome criteria. Input standards deal with the presence in the EMS system of resources specified by expert groups as necessary, such as ambulances with 54 in. headroom, a burn center, and the use of 911 or a single EMS access telephone number. Input standards are readily available, precisely defined, and easily and inexpensively measurable. Many input standards are incorporated in and therefore mandated by state laws and local ordinances. Compliance with input standards is not, in itself, a valid indication of effectiveness in an EMS system. Input standards relate only to the availability of a resource item, not to its affect on a patient's clinical course.

Process standards deal with the use of resources and the appropriateness of that use. Thus, emergency departments may be characterized by patient waiting time, ambulance systems by response time, and entire EMS systems by the proportion of patients in need of a service who actually receive it. Process standards are expensive and time consuming to use, because they require data not only on the existence of a resource but on its use. Although process standards focus specifically on particular aspects of the EMS system (in contrast with some outcome measures that are aggregate indicators of the entire system), compliance with them does not necessarily correlate with improved clinical course. Process standards are based on degrees of utilization established as appropriate for given circumstances; but they are exceedingly hard to establish with any degree of consensus. For example, is 10 minutes an appropriate ambulance response time in urban areas? Should trauma patients go only to trauma centers? Does a centrally dispatched ambulance system produce better outcomes than a multiple-dispatch system? Process standards, however, are more useful than either input or outcome standards for identifying what is wrong and what needs to be changed.

Outcome standards deal with changes in the health status of a patient or population that are attributable to a change in the provision of emergency care. It is important to note that outcome evaluation is more

than merely measuring health status at some point after the patient's encounter with the EMS system. It is the attribution of a known and measurable change in outcome to a change in the quality of EMS by controlling for and excluding all other influences on outcome. This, of course, calls for an ability (not now available in all diagnostic groups) to measure one factor independently and to control for other factors that affect outcome. These factors include such environmental variables as speed limits and automotive and highway safety design and such patient characteristics as age, comorbidity, general health status, and, most importantly, the severity of the illness or injury in question. Although outcome measures are ultimately the most important test of effectiveness, grave difficulties are associated with their use. The data are expensive to collect and hazardous to interpret. Baseline data may be unobtainable. Nonfatal outcomes are not easily conceptualized and are even less easily defined and measured, and fatal outcomes are often insensitive to program changes. In most EMS systems, injury classification by type and severity will result in numbers too small to be statistically significant. Also, because the EMS system is less a single input-process-outcome sequence than a sequential set of such patterns in which the outcome of one EMS subsystem (ambulance) is the input to another (hospital emergency department), it is difficult to think of a single outcome attributable to the entire system. Therefore outcome evaluation runs the danger of being unable to specify causality with any precision in the sense of identifying the subsystem interaction responsible for the outcome. This is not to say that outcome assessment should not be undertaken, but rather that outcome measures, if not carefully dealt with, might lead to a conclusion of "no change" only because the subsystem effects are canceling each other out. There are situations, nevertheless, in which a net effect can be reasonably interpreted on the basis of detailed knowledge of the subsystems and the use of well-structured hypotheses.

One approach to data analysis might be as follows:

- Study the outcome effect of a process in a controlled sample. For instance, in King County, Washington, it has been found that bystander-initiated CPR has significantly increased the survival rate in heart attacks.
- The results of such a study can be used as a standard: e.g., it can be determined that training of X% of the population in CPR results in Y% reduction in mortality from heart attacks.
- It is then possible to study and define the input—training, equipment, and strategies—that made the output possible.
- Thereafter, a process measure (the proportion of the population trained in CPR), weighed against a determined optimum, can serve as a

rough index of program success, rather than the more difficult and costly outcome measure.

Other approaches are possible, but this one has the advantages of economy, applicability, control, and exportability.

Key Issues

1 Standards for Quality Assessment and Assurance

Given the importance of evaluative standards to the evaluation process, it is clear that the standards to be used should themselves meet some criteria. The following eight criteria are offered for this purpose.

- Standards should be precisely defined and measurable. It is insufficient to say that a hospital emergency department or a critical care unit should have "an adequate number of appropriate personnel" without defining the terms "adequate" and "appropriate." However, the specification that an adequate response time for an ambulance system is one in which "95% of cases are responded to within 10 minutes in urban areas and 30 minutes in rural areas" is precise and measurable.

- Standards should represent an expert consensus, systematically arrived at, on a preferred, reasonably attainable state of affairs. Thus, a program evaluator should avoid imposing his or her own standard or a standard arbitrarily arrived at or plucked out of the literature on an evaluative design. Similarly, *ex cathedra* pronouncements by single individuals, however eminent, should not be regarded as acceptable standards until there has been consensual validation.

- Evaluative standards should refer to variables that have a strong presumptive relationship to health-status outcomes.

- Standards should pertain to relevant and controllable system variables so that the information that an EMS system does not comply with a particular standard can be used to effect program changes.

- Standards should be sufficient in number and diversity to constitute a comprehensive and representative evaluation of the EMS system under review. Many evaluative standards suffer from the assumption that what is true for one standard or tracer is true of all, by extension rather than by actual measurement.

- Standards should be usable to assess needs, to tell an EMS system what improvements should be made, and to provide a baseline set of measures, in addition to their evaluative use in determining what changes have resulted from which program interventions.

- Evaluative standards for EMS should be locally credible and acceptable. They should represent criteria that local providers, administrators, planners, consumers, and elected officials are willing to accept as a test of their system's effectiveness; and they must be developed in conjunction with local providers, not imposed by an evaluator in isolation. It is very important that the evaluator assume the role of facilitator to enable a community to see whether its expectations are being met, and not the role of an expert applying his or her own standards.

- EMS criteria should be concerned with instances in which the system is not used, as well as with instances in which it is used. Thus, although there has been concern with characterizing emergency department and ambulance utilization as clinically justified or not, there has been scant attention to unmet needs and their life-threatening consequences.

2 Research Designs for Evaluation

Research designs for EMS evaluation should be carefully constructed. The use of control groups is especially recommended. The designs should allow statements about the relative effectiveness of single interventions as well as of the system as a whole. Inasmuch as changes in an EMS system often cannot be treated in isolation but only as part of a complex set of interactions, multivariate analysis, perhaps entailing use of logistic models for testing hypotheses, may be needed. Population-based statements about changes resulting from EMS intervention should be provided. Research designs should control for exogenous influences on the impact measures, so that rigorous statements can be made about the association between EMS changes and improved health outcomes.

3 Routine Data Collection Systems

Any adequate quality assessment and assurance system requires routine data collection procedures that provide data that are analytically and evaluatively important, can be accurately and comprehensively collected, and impose the least necessary burden on emergency medical personnel. In contrast, the present arrangements for quality assessment and assurance in EMS are often based on "one-shot" surveys, rather than routine data systems, and are thus vulnerable to sampling error and seasonal fluctuations. Data collected by means of reporting forms completed by dispatchers, ambulance attendants, and hospital emergency departments and critical care units are not well integrated with each other and often contain an excessive number of items.

Data collection systems rarely require a 100% sample. What is im-

portant is that the data collection should be systematic and uniform, and that the sample be representative and of appropriate size for a given study. Studies of "tracer" conditions present one approach, but care must be taken, lest the tracer conditions chosen turn out to be unrepresentative.

4 Organizational Entity for EMS Quality Assessment and Assurance

A key issue is identification of the organizational entity most appropriate for undertaking quality assessment and assurance studies and for initiating corrective actions. Although there is little evidence that EMS quality assessment and assurance systems have measurably improved the process and outcome of health care, this probably reflects an inability to identify an appropriate regional authority with the capacity to perform studies and implement change based on them rather than any inherent deficiency in quality assessment as an approach. Indeed, it is not entirely accepted that quality assessment and assurance in EMS is a function both of individual facilities and of the overall regional system. This committee takes the view that quality assessment and assurance should be performed at both levels.

Similarly, it is not reasonable to assume that merely performing a quality-assessment study and disseminating the results will lead to needed changes or that system recommendations for changes in individual facilities and jurisdictions will be rapidly or willingly implemented. In both the individual facility and the system, mechanisms must be created whereby corrective changes can be instituted. This is, of course, part of the more general problem caused by the lack of an effective regional EMS authority to which component jurisdictions and facilities have ceded important resource allocation and quality-control functions. Because quality assessment and assurance are integral aspects of regionalization, the early delineation of *suitable regional bodies able to perform these functions* is a high priority.

Conclusions and Recommendations

Taken together, quality assessment and quality assurance constitute powerful prospective planning and management tools for EMS systems and individual facilities—yet it is apparent that over the past decade they have received insufficient emphasis. Many standards have, perforce, been established without valid evidence that compliance with them results in the greatest benefit to the patient. Standards have often

been imposed without regard for specific requirements and characteristics of a given region. Research designs for the assessment of quality standards have been weak, in that they have tended to monitor such broad activities that it has not been possible to isolate the factors responsible for changes in EMS outcomes. The collection of data for quality control is often done on a "one-shot" instead of a continuing basis, and where the latter is used, data from the various elements of the system are often not properly integrated. Efforts to correct identified deficiencies are often futile because of the absence of a properly constituted authority in the system. In many systems, there is no feedback of quality control data to the operating elements.

Individual EMS facilities and providers, as well as the lay community, should be involved in the setting of quality assessment standards, and those standards should be specific to local conditions.

Designs for EMS evaluation should permit detection of the effect of individual components and activities on the quality of service.

Quality-control data should be collected on a continuing basis and should reflect an integrated sampling of information from all elements of the system.

Quality control responsibility must be placed in the hands of a regional body that is able to improve the system.

Highest priority should be given to the establishment of a feedback mechanism that will identify the best ways to improve performance.

System Management

The openness of an EMS system to quality assessment and assurance will depend very much on the extent to which all participants feel themselves to be members of a team, on the attitudes of the system managers, and on the form of the organization.

Insofar as management implies authority, responsibility, and accountability, many organizations operating EMS systems find themselves in the role of coordinator rather than manager, in that the system is composed of a variety of organizations, each with its own authority and responsibility. This presents obvious problems in maintenance of quality control and efficiency of resource management. Perhaps no system, except one in which a region's only hospital operates the ambulance service, can control all the major emergency care resources of an area. But many systems have developed effective management of the pre-hospital phase.

There appear to be three principal routes by which this has been achieved: through voluntary but binding delegation of authority in specific sectors, chiefly dispatching and quality control, by the providers to the management organization; through operation or managerial control of the system by a government agency; and by assuring a virtual monopoly to a single ambulance service under firm government regulation. The first route implies provider participation in EMS planning, a strong public education campaign, and strong organizational and medical leadership. The latter two imply commitment and willingness to exercise authority by the concerned government agency.

Key factors in successful EMS management are funding, dispatching, and quality control. The management organization must have a secure financial base if it is to provide those system elements—such as administration, dispatching, communications, and training—not usually covered by charges to users; it must have the authority to control the use of ambulances in its service area; and it must be able to effect improvements in system components. The economics of EMS systems is discussed later. Central dispatch has been achieved by a variety of

means, ranging from persuasion, through contracts with providers, to government directive. Quality control, requiring the ability to make changes where needed, on the basis of analysis of information from system components, has been formally instituted by few systems. Informal quality control is practiced at many projects through conferences between emergency medical technicians or paramedics and emergency department personnel, through feedback of ambulance form analyses to squads, or through user surveys.

EMS management organizations range from citizens groups, such as EMS committees, to city, county, intercounty, or state governments. It seems clear that no particular organizational form enjoys a monopoly of managerial virtues. Tax supported systems have a good potential for survival, but need to guard against undue subordination to police and fire departments and are vulnerable to changes in political administrations and priorities. At the other end of the scale, EMS committees functioning as system managers are likely to be sensitive to public needs and to have a strong medical component, but are often short of funding and authority. Most systems represent a mix of the public and private sectors. In many rural systems, EMS committees gain strength through appointment of their members as representatives of local government units; and many tax-supported systems have incorporated EMS or medical advisory committees into their management structure. Some systems, in which county governments have specified in detail the kind of EMS system they wished and have then contracted with private ambulance companies to provide the services, have been pleased with the results.

Medical Management

“Medical management” in EMS means the direction of patient care by a physician located either at a base hospital or elsewhere remote from the ambulance attendant and his patient. Whether this direction is given by voice communication, with or without such adjunctive devices as telemetry, or indirectly by protocol, the final authority and responsibility for patient care rests with the supervising physician. The ambulance attendant uses the skills in which he was trained, and the physician aids in interpretation of the findings and gives verbal orders for procedures and medications.

Some degree of indirect medical control, through use of treatment protocols that are, in effect, standing orders, is commonly practiced. The protocols indicate the circumstances and conditions or findings which permit use of specified procedures and medications without voice

communication, and they may specify others that require direct orders of a physician.

It is not certain at this time what degree of authority or responsibility it is appropriate to delegate. More studies are needed on the continued performance of learned skills, on whether life saving skills are misapplied, on whether early intervention is worth the risk, and on whether time and distance from definitive care should be the factors that determine which skills and medications should be used by field personnel with and without voice control by a physician.

As a safeguard against failure of communication or unavailability of an appropriate medical advisor, dispatchers and EMTs should be trained to a degree that allows them to act independently with the aid of sound protocols (subject to case review by physicians). In areas where the workload is insufficient to ensure the maintenance of skills in-service training sessions should be planned. Dispatchers should be prepared to offer advice to callers and make appropriate decisions on the disposition of calls; and EMTs should be prepared to take command at the scene of an emergency without mandatory reliance on remote physician control.

Conclusions and Recommendations

The receptivity of an EMS system to evaluation and reform depends on the extent to which all participants feel themselves to be members of a team, on the attitudes of the system managers, and the form of the organization. EMS organizations which find themselves in the role of coordinator rather than manager face obvious problems in efficiency of resource management and in maintenance of quality control. Effective management has been achieved in many cases through voluntary delegation of authority by providers to a management organization, operation or control of the system by a government agency, or provision of a virtual monopoly to a single ambulance service under firm government regulation.

Whatever the structure, the management organization must have a secure financial base, if it is to provide those system elements—such as administration, dispatching, communications, and training—that are not usually covered by user charges; it must have the authority to control the use of ambulances in its service area; and it must have the ability to effect improvements in system components.

Economics and EMS System Design

This section discusses the economics of EMS systems with particular reference to the interplay between the financing of the system and the system's goals. It reviews the types and magnitudes of EMS expenses and typical methods of funding, and points out that the programmatically appealing concepts of improved prehospital care and systematic organization of services are seriously threatened by traditional financing arrangements.

One of the major findings of the recent study by the General Accounting Office* was that permanent financing for EMS administrative and operating costs that were initially supported with EMS grant funds constitutes a serious problem. Typically, initial interest in most communities focuses on planning and implementing service improvements, particularly those for which federal or other grant programs can be tapped. Active interest in longer-term financing for continued operation tends to surface only as the end of developmental funding draws near. Thus, the process of EMS system design is unbalanced, with serious consequences when external funds are withdrawn.

System Costs

For the purposes of this discussion, EMS costs can be related to four major system functions: pre-hospital care, hospital care, communications, and management. The costs of EMS are influenced by many factors and can vary substantially from community to community. System structure, size, and sophistication and community characteristics are important costs determinants in most cases.

The operation of ambulance services typically accounts for 20% to 30% of total EMS system costs. Personnel costs account for the largest portion of ambulance service costs—often as high as 75%—but they

**Progress, But Problems in Developing Emergency Medical Services System*. Report to the Congress of the Comptroller General of the United States, July 13, 1976.

may vary widely with staffing arrangements (e.g., fulltime vs. volunteer personnel) and qualifications. Administration of ambulance services averages about 10% of their costs, but varies with the nature of the organization and the management activities undertaken (e.g., data processing and evaluation). The costs of equipment, training, and space depend largely on the type and sophistication of the services provided.

The burden of fixed costs (those incurred regardless of the number of runs made) and the resulting impact of underutilization are most apparent in prehospital EMS services, especially in rural regions. Substantial fixed costs contribute to the greater expense of maintaining an adequate capacity for ambulance response in sparsely populated areas. Per capita costs generally reflect a strong inverse relationship to population density: they increase greatly as distance increases and the number of runs decreases.

The communication associated with EMS may account for as little as 2% of total EMS costs where costs are shared with other public services or as much as 35% in rural areas, where extensive communications networks are maintained solely for EMS purposes. Significant economies can be achieved where police, fire, and ambulance communications are combined. Factors influencing communications costs include the sophistication of the equipment in use and the degree to which dispatching is centralized, to permit most efficient use of personnel and equipment.

The costs associated with system management vary with the range of management functions performed. Public-information programs, system planning and evaluation, legislative liaison, and fund-raising are a few of the activities that might be included in system management. In the carrying out of these functions costs may be incurred for a regional coordinator or EMS council staff, for consultation, and for office, travel, and data processing services. Management generally accounts for only 1%-2% of total EMS costs, with a tendency toward higher costs in early stages of EMS system development.

Funding Sources and Approaches

It is often useful to distinguish between two types of funding for EMS systems. *Developmental*, or grant, funds have been made available by the federal government (principally DHEW and DOT), by state governments, and by private foundations (especially the Robert Wood Johnson Foundation) for such "startup" activities as system planning and organization, equipment purchases, and personnel training. *Operational* funding, on the other hand, is directed toward the expenses of system

operation, which continue long after developmental funds have been expended to get an EMS program started.

There can be little doubt that developmental funding programs over the last 5 years have led directly to the creation of regional EMS systems across the country. In many cases, however, there have been serious problems in obtaining permanent financing for continuing system operations that were supported initially by grant funds. This is due at least in part to the fragmented nature of EMS financing and to the complexity of the revenue sources through which EMS operating costs must be supported. These sources include patient service revenues (user fees and insurance reimbursements), family subscriptions, general taxes, special purpose taxes, and contributions.

Service charges and subscriptions are major sources of operating funds for emergency transportation. Ambulance services typically charge a base fee with additional mileage charges and supplementary charges for special services. Ambulance charges vary widely, but tend to be higher in urban areas than in rural areas. In urban areas, a fixed fee is quite common; rural ambulance services more commonly add a mileage charge. Collection rates are poor for many ambulance services, ranging between 30% and 50% of charges. However, several groups have achieved collection rates above 80% through the persistent pursuit of delinquent accounts and threats of legal action. In many areas, local governments subsidize at least a portion of ambulance operating costs. The methods for determining subsidies vary, with some set in proportion to the population served, some in relation to the number of ambulance runs actually made, and others set at what appear to be arbitrary fixed levels. Voluntary contributions are the primary source of support for volunteer squads.

As a rule, the costs of EMS communications and system management are borne by local taxpayers or by developmental funds where grant support is available. Patients can be charged in most systems only by the units that contact the patient directly (i.e., the ambulance and the hospital emergency room). It will therefore often be necessary to develop new organizational mechanisms in most communities before such revenues can be utilized to support "overhead" activities like communications and system management.

Several innovative approaches to the financing of the overall costs of EMS systems have been developed in recent years. Some states have enacted laws permitting single-county or multicounty EMS districts to levy property taxes for funds to support EMS. In Atlanta, for example, counties participating in the regional EMS system contribute on a per capita basis to support the management and operation of a central communication system. The recently enacted Pennsylvania nofault

automobile insurance law specifically includes EMS communications cost as a reimbursable expense, along with ambulance charges. A multiparish private ambulance service in southwestern Louisiana operates much like a regulated monopoly, with costs totally covered by family subscriptions and user charges set at levels approved by parish governments.

Despite the expanding set of approaches to EMS financing, it is apparent that reimbursement practices are generally disorganized and fragmented. From a financing perspective, EMS is still operated not as a system, but rather as a collection of unrelated elements. This is especially evident when current third-party financing provisions are considered.

On the average, 80% of EMS patients are covered by one or more health insurance plans through such third-party carriers as Blue Cross-Blue Shield, Medicare-Medicaid, commercial insurance companies, and private programs. Those in rural areas are twice as likely to be covered as those in urban areas. Many insurance policies do not provide coverage for prehospital EMS; policies that do include such benefits are typically limited in the nature and extent of coverage. Common insurance restrictions limit coverage to selected patient conditions, set maximum allowable costs for defined services, or restrict benefits to hospital-based services. For example, 20% of the total population insured through Blue Cross plans across the nation are not covered for emergency transportation; and one-third of those covered by Blue Cross are limited to reimbursement for accident-related injuries only (i.e., sudden illness is excluded from emergency coverage.) Some commercial policies provide benefits for transportation services only if a patient is hospitalized after transportation. Few health insurance plans specify any coverage for either communication or system management costs that are not included in transportation charges. In some instances, treatment services rendered by emergency medical technicians are also not covered.

As reflected in current third-party benefit structures, therefore, insurance benefits have not generally kept pace with changing concepts and developments in EMS delivery. Until third-party coverage is up-dated to reflect all necessary and actual EMS costs, its effect on prehospital services will continue to be far less than on hospital services.

Issues for the Future

While developing EMS systems have provided important insights into the costs and financing of emergency services, they have also raised

important economic questions. These are difficult to answer but may have significant implications for the future development of EMS systems.

Who should pay the bill? Whatever the cost of an EMS system in a particular community, someone must pay for it. The underlying issue can be phrased in the language of the economist as follows: Is EMS a private or a public good? That is, should it be treated as a private service like most other medical care services or as a public service like fire and police protection? If the answer is "private," it follows that the users should pay for EMS through service charges, subscriptions, or other direct means. If the answer is "public," it follows that the cost should be borne by all for whom services are available—in practice, by the taxpayers. In most communities, because hospital-based services are generally relatively well supported through health insurance, it is convenient to consider these services as private. However, to the extent that out-of-hospital services are inadequately supported through private sources, there are significant pressures to consider them as public services and, hence, as eligible for support through governmental sources.

Whatever philosophical position is taken, it is clear that citizens will end up paying one way or another for EMS system development and operation.

What are the effects of financing methods on EMS system structure? How EMS systems are financed may significantly influence their development and evolution. This is perhaps most evident in the case of developmental financing programs, both federal and foundation-supported, which have substantially influenced the nature of EMS systems through extensive specifications of system structure and resource requirements. For example, the federal EMS program explicitly requires grantees to focus attention on selected aspects of emergency system structure and operation as a condition for receipt of developmental funding.

There is additional evidence from both EMS and other health care delivery experience that system structure will tend to be influenced by the sources and nature of funding. It is no coincidence, for example, that the best financed component of the EMS system—the hospital emergency room—is generally also the most well developed. Because there are few traditional funding sources for management and communication activities beyond the developmental stage, there is a danger that a shortage of operating funds will selectively retard development

of these essential components of EMS systems in the future. In general, one can expect prehospital activities to suffer most as developmental funding dwindles.

It is not only the amount of money available for selected activities that determines the pattern of system development, but the role or position of those to whom the money is given, as well. The recipient generally controls the funds. If the funds go to the system *per se* one can hope for distribution among the elements according to design. If they go to the elements, it is unlikely that there will be any sharing, and the structure of the system cannot be controlled.

Are there economies of scale in regional EMS system? An underlying rationale for the design and development of regional EMS systems is the improvement in efficiency that is expected to result from more appropriate use of resources across a broader area and population. The regional organization of health resources and services is one of the dominant themes of this decade in health care delivery. This is reflected most clearly in the recent National Health Planning and Resources Development Act (Public Law 93-641). However, despite substantial federal and private foundation investments in the regionalization, of health services, including EMS, little evidence has been assembled to date to show that regionalization actually result in increased efficiency.

Such important issues as the appropriateness of designated regional boundaries for different emergency services (e.g., for burns, trauma, and poisoning), and the implications of alternative regional system structures must still be examined as EMS systems mature. These issues are discussed in more detail elsewhere in this report.

What trade-offs exist between EMS system costs and service levels? In a time of limited resources, serious questions must be raised about the costs associated with the various levels of service which can be provided in an EMS system. The availability of advanced emergency care throughout the nation is a worthy objective, but the cost of such services will often prohibit communities from obtaining them, at least for the foreseeable future. Such communities will need to set priorities that will permit the greatest improvement in service for the funds available—inevitably, some objectives will have to be sacrificed in favor of others. If these design and development decisions are to be made in the most responsible manner it is essential to know how costs vary with different kinds and qualities of service.

These data can be provided by careful component evaluation and systems analyses, but the tension between cost and service level requires a political resolution.

Summary

It seems clear that the availability of developmental funds has significantly increased public expectations and aspirations for improved EMS and has resulted in significant improvements in many communities. These improvements can involve substantial increases in EMS costs that must be financed on a continuing basis, if the momentum toward expanded EMS service levels is to be maintained. However, it appears likely that uncertainties with respect to support for continuing operation will continue as long as fragmented funding sources must be depended on.

Both the federal and the Robert Wood Johnson EMS programs have permitted the payment of administrative costs, including salaries, from grant funds. On the one hand, it seems clear that many of the projects could not otherwise have become operational. On the other hand, it also seems clear that, in general, this policy encouraged projects to postpone coming to grips with the problem of continued financing. Perhaps future programs should consider some compromise, such as a percentage limit on the amount of grant funds that could be so used, with sharply decreasing percentages in successive years, which might force grantees to develop local funding sources.

Conclusions and Recommendations

Developmental funding programs have led directly to the creation of regional EMS systems across the country. However, in many cases there have been serious problems in obtaining funds for the continuing operation of systems so developed. In most systems the patient can be charged only for services that involve him or her directly (ambulance and hospital care); this leaves the costs of such elements as communications and system management to be met from some other source. Third party benefit structures have not kept pace with the growth of EMS—many insurance policies do not provide coverage for prehospital services, and those which do are generally limited in the nature and extent of coverage.

Initial planning for EMS systems must recognize and deal with the need for funding beyond the developmental stage.

If it is determined that patients should contribute to the payment of overhead costs, arrangements will generally have to be made with the ambulance service and hospital for the sharing of collected fees.

An effort should be made to up-date third party insurance coverage to include all the costs of EMS.

Legal and Regulatory Issues

This section will review some of the most important recent legal developments related to emergency medical care since the publication of *Accidental Death and Disability: The Neglected Disease of Modern Society*. It does not attempt to cover every possible legal issue related to emergency care—many are widely discussed in the medical and legal literature. Moreover, many questions are not unique to emergency medicine, but relate to basic legal principles involving the interface between medicine and law.

The focus will be on four general issues that are particularly important to planners or policy makers as they design or refine emergency care systems. The analysis will reveal a marked but understandable diversity in approach, since legal frameworks must necessarily be tailored to local characteristics and local factual differences. The four areas to be discussed are: the legislation enacted recently in most states that provides basic standards for regulating prehospital emergency care; the amendment of state medical and nursing practice acts and new physician's assistant and paramedic legislation, which begin to delineate the authority and responsibility for physicians and non-physicians to provide prehospital emergency care; liability and insurance protection with respect to acts performed by physicians and others in treating emergency patients, particularly before they enter the hospital; and the evolving institutional responsibility of hospitals in emergency care.

Basic Standards—Regulation at the State Level

The regulation of EMS, like organization and delivery, was fragmented, inadequate, and in some cases nonexistent as recently as 1970. Although state health departments have typically had standard-setting authority over hospital emergency departments, ambulance services were largely unregulated. Frequently, states had developed rigorous standards for barbers and hairdressers, but usually none for the training, vehicles, equipment, or availability of ambulance services.

However, the situation has changed substantially since 1970. Nearly every state has made some legislative changes related to emergency medical care during the past decade, and over half have developed reasonably comprehensive statutes. Typically, the more comprehensive laws include the creation or expansion of a state division or office of EMS (usually under its department of health) with licensing and standard setting authority and authorization for state or regional EMS councils to develop EMS plans and provide continuing advice. Many statutes also include development of a state EMS communications plan; authorization for incorporated cities, counties or districts to contract for or operate ambulance services; and, in a few cases, authority to categorize hospital emergency departments. Some laws provide for the setting or review of rates for ambulance services.*

Other states have limited their legislation to ambulance services. These laws usually include minimum standards related to the training of ambulance personnel, types of equipment and vehicles, and some requirements for licensing of ambulance providers. However, in some states—such as Idaho, Kentucky, and New Jersey—volunteer ambulance services have been exempt from most licensing requirements. It seems highly desirable that all providers of prehospital emergency care, however organized or reimbursed, should be subject to the same criteria.

Most state EMS agencies (usually health departments) function under general enabling legislation and have developed detailed rules and regulations to implement it. Generally, this is a desirable approach, because rules and regulations are usually easier to modify than legislation as new technology and new knowledge develop. Unfortunately, some states have not appropriated enough funds to provide the staff to enforce such standards adequately.

Many local ordinances further define the level of care required of ambulance providers. As counties become increasingly involved in the delivery of emergency care, countywide agreements and standards are becoming more common. Anyone involved in developing or refining emergency care systems will need to consult carefully the legislation, ordinances, and regulations now emerging.

In summary, a wide variety of state legislation has been enacted to provide sorely needed control over the delivery of prehospital emergency medical care. Despite their diversity, the essential ingredients of these statutes are: designation of a lead agency (usually the state health department) as having authority to set standards and regulations, provision for statewide and regional councils to ensure involvement of

*Sadler, A. M., Sadler, B. L., and Webb, S. W. *Emergency Medical Care: The Neglected Public Service*. Ballanger Publishing Co. (Cambridge, Mass.), 1977.

numerous groups, appropriation of adequate funds to enforce standards, and applicability to all ambulance services, no matter how managed or financed.

Licensing and the Authority to Practice Emergency Medical Care

One of the most important developments in EMS during the past 10 years has been the use of nonphysicians—particularly nurses, physician assistants, emergency medical technicians and paramedics—to extend the scope of physician capability at the emergency scene and in hospital emergency rooms. This trend has been widely regarded as desirable and indeed necessary to improve citizen access to prompt emergency care, but concerns have been raised about the legal authority of such persons to expand their roles.

In all states, medical-practice acts typically provide that no one can “diagnose, operate, treat or prescribe,” unless he or she is a physician licensed in the state. However, during the last 8 years, nearly all states have recognized the restrictive nature of such provisions and have begun to amend medical-practice acts or adopt new legislation. Many of the changes have occurred in response to the development of physician assistants and nurse practitioners; others have been designed specifically for emergency-care personnel.

In the early 1970s, the American Medical Association, the American Hospital Association and DHEW recommended that states enact amendments to their medical practice acts to codify the right of physicians to delegate tasks to personnel working under their supervision and control. Although the doctrine of “custom and usage” has always established the authority of physicians to delegate tasks, it does not readily apply to innovations in the use of existing health workers or to new types of personnel. Most states have now adopted some form of legislation to facilitate such delegation.

Most laws make no attempt to define actual tasks or situations in which they may be delegated, but provide that “any act, task or function” may be delegated by the physician. Delegation amendments require that the act be performed under the “supervision, control and responsibility” of a licensed physician. “Supervision” and “control” are rarely defined in the statute, leaving the legal resolution of this question, if it arises, to the courts on a case-by-case basis. This is probably wise in view of the enormous variety of situations in which such personnel can perform.

Supervision can take at least three forms: over the shoulder, on the

premises, or remote with regular monitoring and review. It is quite possible that quality of care with remote supervision can equal that with over-the-shoulder supervision if the person supervised is well qualified and there is adequate task definition and review. This is particularly important in emergency care, in which EMTs and paramedics often work at substantial distances from the physician, but still can legally be said to be supervised because their actions are subject to continuing medical review and direction.

In addition to delegation amendments to medical-practice acts, there has been considerable pressure for separate licensing of new types of health personnel. The licensing issue arose in the early 1970s, when licensing of all health professions was under heavy attack. Enacted in the nineteenth century to protect the public from quacks and incompetent practitioners, licensing laws are now viewed as unnecessary barriers to educational advancement, effective delegation of tasks, and innovative use of manpower. Furthermore, they have not eliminated incompetent and unethical practitioners.

In lieu of licensing, many have favored the development of national certification examinations of competence that could be used by state review boards. Once a test is developed and validated, one might be certified by passing the test without having to take a formal preset education program, if previous work experience could be shown. The National Board of Medical Examiners has developed a certifying examination for "assistants to the primary care physician" that is now widely accepted. A national registry of emergency medical technicians has been formed with government support and has been increasingly recognized. Another potential advantage is that national testing and certification would ease the problem of reciprocity between states.

The acceptance of emergency medical technicians (EMTs) as the appropriate ambulance personnel to provide *basic* life support has been nearly universal and has raised few legal issues about the authority to practice. In contrast, there is considerable diversity of opinion concerning the scope of function and the type of training required of personnel providing *advanced* life support—usually known as paramedics or EMT IIs. Such advanced life support functions as cardiac defibrillation, intravenous therapy, the administration of drugs, and ventilation techniques contain considerable risk to the patient if performed improperly. It is understandable that medical opinion is not unanimous about the appropriateness of these procedures and the circumstances under which they should be performed.

Because of these additional uncertainties and risks, several states have enacted laws specially designed for paramedics, in addition to delegation amendments. One of the first and most important was the

California Wentworth-Townsend Paramedic Act enacted in 1970. This legislation specified in detail the functions, including the use of specific drugs and procedures, that can be performed by paramedics under physician supervision. Authority has been delegated to individual counties for the actual conduct and regulation of paramedic programs. The statute defines minimal training hours although most of these minimums have been exceeded in the several counties that have established programs.

Several states have since enacted their own form of paramedic legislation, some of it based on the California law. The great majority of these have been enacted within the last 4 years, and many others are pending before state legislatures. They vary considerably in their specificity and in the degree to which they delegate rule-making authority to state or local agencies.

In most states, initial defibrillation is permitted in the case of a pulseless nonbreathing patient without the requirement of voice contact or telemetered electrocardiogram. However, in those states, such contact must be established between the paramedic personnel and a licensed physician or registered nurse authorized by a physician, and it must be maintained before any of the other functions permitted by law are carried out. Several other states require that voice contact or telemetered electrocardiography be established before defibrillation is carried out. These variations reflect differing medical opinions as to the value of physician contact or advice to paramedics before any emergency procedure is performed. Undoubtedly, the state of the art will continue to advance in the next few years as experience with such programs grows. This experience is likely to be gained quite rapidly, because DHEW is now vigorously encouraging advanced life support as a primary goal of emergency care systems. In the interim, legislation should be flexible and should permit paramedics to function with appropriate delegation and remote supervision by physicians as part of carefully evaluated programs.

Malpractice, Liability and Insurance

Generally, a person is held legally responsible for the delivery of health care on the basis of his or her experience and training. However, considerable controversy has arisen over personal liability when a person, whether a physician or not, renders care at the scene of an accident.

Because of the increasing number of malpractice verdicts and the size of the monetary awards, it is understandable that many health

professionals are concerned that stopping to help in such a case might lead to a malpractice suit. But this is not a well-founded fear in that the law permits a flexible standard of care according to the circumstances. Consequently, a physician is not held to the same standard of care in a roadside emergency as in a hospital operating room or his or her own office. An American Medical Association study undertaken in 1965 indicated that only eight physicians had ever been sued for malpractice in "good Samaritan" situations and that all these suits were settled in favor of the physician. There is still no reported successful lawsuit concerning the rendering of emergency care in "good Samaritan" settings.

Nevertheless, most states enacted "good Samaritan" statutes to provide immunity from liability for emergency medical assistance of first aid. Most of the early legislation covered only physicians, or in some cases nurses, who were acting gratuitously and voluntarily. With the development of paramedic programs throughout the country, these laws are now being expanded in some states to include all types of emergency personnel functioning in an employment situation, as well as voluntarily.

The main theme in such legislation is that persons are granted immunity from liability for any act or omission carried out at the emergency scene or in transit to the hospital unless they cause harm as a result of willful, wanton or gross negligence. Thus, despite the widespread concern about malpractice suits, there has not been a rash of litigation involving emergency personnel, nor does it appear likely that there will be. Judges and juries are most likely to continue to appreciate the enormous pressures and demands placed on emergency personnel working under crisis conditions. In short, as long as paramedics are well trained, are acting within the scope of their training, and are supervised by well trained physicians and nurses under previously developed protocols, there does not appear to be a major expansion of legal risk.

Even in states where comprehensive paramedic legislation has not yet been enacted, it seems safe to proceed with paramedic programs if the previous conditions are met. This is particularly so if EMS councils, local medical societies or such local agencies as the legal counsels for cities or counties have approved and reviewed protocols and program guidelines. Although such review does not have the effect of law, it provides informal sanctions for pilot programs. Program planners confronted with the lack of comprehensive legislation might consider some of these short-run alternatives concurrently with the development of adequate state statutes.

The availability of adequate malpractice insurance for paramedics

and for the physicians and nurses who supervise them has been a concern in some areas. In many parts of the country, existing municipal coverage (if the paramedics are municipal employees) or hospital institutional liability has been adequate, or only a rider to existing policies has been needed. Some large cities have self-insured paramedic programs by setting aside a reserve fund to pay for the legal defense of emergency personnel and to pay damages if necessary. Because of the virtual absence of lawsuits of this kind, it is expected that such insurance will be increasingly available to paramedics as well as to the physicians who supervise them and the institutions that employ them.

Hospital Emergency Departments

At one time, it was possible for a private hospital to refuse to admit patients for emergency treatment. Its right of refusal was predicated on the absence of any affirmative commonlaw duty requiring a physician or a hospital to render medical treatment. However, abuses have prompted legal decisions that have virtually eliminated the freedom of a hospital to refuse emergency treatment and which require that if an institution holds itself out as being able to treat emergencies, it must accept all patients who present themselves with emergency conditions.

Indeed, the Joint Commission on Accreditation of Hospitals and nearly all state health departments have developed detailed requirements concerning hospital emergency rooms. As stated in other sections, categorization plans have now been developed in many states and in a few cases have actually been given legal authority. This is desirable, because not every hospital in a given region should be required to provide a particular level of emergency care if other hospitals in the region are more adequately equipped to do so. In spite of the increasing number of malpractice verdicts against physicians and the size of monetary awards, there have been few lawsuits involving physicians, nurses, paramedics, or EMTs as providers or supervisors of emergency treatment. Thus, the fear of such legal action should not deter the development of advanced life-support systems.

There has been a concurrent concern regarding hospital liability for prehospital emergency care provided by hospital-based emergency medical technicians or by paramedics who rely on hospital-based physicians for supervision and medical advice. Again, there has been no rash of litigation and it would seem adequate physician supervision and control, good training programs, and well-developed protocols would provide solid protection.

Conclusions and Recommendations

Nearly every state has made some legislative changes in the interest of regulating EMS, and more than half have developed reasonably comprehensive statutes.

Nearly all states have recognized the restrictive nature of older medical-practice acts and have begun to amend them or adopt new legislation related to the role of emergency care personnel and to the delegation of responsibility to EMTs and paramedics by the physician, and affording a measure of immunity from liability for emergency care personnel properly performing assigned tasks.

To protect the public, all states should enact comprehensive legislation assuring the basic quality of ambulance services, and this should apply equally to all ambulance providers, no matter how organized, managed, or financed. Such legislation should include the designation of a lead agency (such as the state health department) as having authority to set standards and adopt regulations; the provision for statewide and regional advisory councils, and the appropriation of adequate funds to enforce such standards.

The development of advanced life support programs should be facilitated through the enactment of flexible legislation that permits paramedics to function under remote supervision by physicians (or specially trained nurses) as part of carefully monitored and evaluated programs.

Regionalization and Categorization

Regionalization of EMS is the process of identifying and developing resources on an area-wide basis to meet the needs of all the acutely ill and injured for prompt, efficient, and effective medical care. Prerequisite to regionalization are the establishment of geographic boundaries of the EMS delivery area and the development and definition of organizational, operational, and advisory authorities for planning, implementing and evaluating the EMS system and its components.

Regionalization is achieved by areawide organization, coordination, and integration of the components of an EMS system, including communication, training, and personnel. The regional concept incorporates such arrangements as transfer and mutual aid agreements which make resources and services that are outside an EMS region available to the population in it.

A major medical goal of regionalization is the delivery of the acutely ill and injured to the specialized medical facilities best able to care for them. Acute illnesses and injuries for which regionalization of care, through transfer agreements and modifications of patient flow patterns, is alleged to improve survival or reduce morbidity include cardiac arrest, burns, neonatal disease, trauma, spinal-cord injury, drug overdose, and acute psychiatric illness. The assumption that regionalization of emergency care will result in decreased morbidity and mortality is strongest in the case of neonates and spinal cord injury and is probable but not as well substantiated in the case of the others listed.

A major economic goal of regionalization is to prevent or reduce duplication of costly services, equipment, and facilities. Such savings have been demonstrated in the formation of consolidated dispatch centers, in centralized ordering of ambulance and communication equipment, and, in a few systems, in a rational placement of ambulance squads. On the other hand, the prospect of categorization may increase hospital costs, as competing hospitals increase their outlays for additional emergency equipment and staff, through fear of being downgraded, bypassed, or eliminated in the emergency care system. Whether such jockeying among

hospitals would cease after implementation of a regional plan for EMS emergency medical services, including categorization of hospital facilities, is conjectural. Most EMS systems, which owe their existence to the voluntary cooperation of independent providers, are unable to do much toward elimination of redundant services. Often, savings that are achieved through regionalization are difficult to demonstrate, because they are offset by the costs of upgrading the quality of the service.

Operational control of regional EMS programs has most frequently been assigned at the state level to the health department or to a body reporting independently to the Governor and locally to a fire service or to some newly developed consortium. The major disadvantage of assigning operational control of a regional EMS system to an existing agency such as a health department, fire department, or police agency, has been the difficulty in obtaining recognition of the importance of this mission in the agency when EMS must compete with the agency's other programs for authority, funding and qualified personnel. Multicounty and multi-community EMS regions often have no satisfactory existing governmental structure or political constituency that can provide operational authority or guarantee continuity for an EMS system. Differences over funding of a multigovernment EMS region can be divisive, if one community perceives its tax money as being used to subsidize services in another community.

Whatever its form, the organization responsible for management and operation of an EMS system must have the ability and commitment to integrate and coordinate all components of the system with each other and with disaster plans and total health care systems; to ensure compliance with the regional plan and maintain quality control of the system and its components; to maintain a data base of system activities and evaluate their efficacy; and to furnish the providers, the government agencies, and the public with the information they need for system supervision and improvement.

Categorization of hospitals' ability to provide services necessary for the care of the 5% who are acutely ill and injured is one tool available to planners to assist them in matching regional resources and needs.

Better prehospital organization and care, including improvements in access to the EMS system, training of EMTs, central dispatch, and radio communications between EMT and hospital physician, are now bringing more injured patients alive to the hospital than was the case 10-15 years ago. However, during the same 10-15 years, the hospital phase of the care of the acutely injured has not improved commensurately. Recent reports indicate many potentially salvageable patients who arrive alive at the hospital are still dying unnecessarily. Recent studies have shown that errors in evaluation and management are common. The

planning, mobilization, and organization of hospital staff and facilities necessary for the care of the injured were often inadequate.

A major cause of inadequate hospital care, particularly in suburban and urban areas, is the delivery of patients to the nearest hospital rather than to a more qualified pre-designated hospital capable of caring for the patients' injuries. There is little question but that hospitals with extensive experience with critically injured patients (trauma centers) provide better care for such patients than hospitals receiving them only occasionally. The skills and teamwork employed in this complex task are improved by practice and repetition, which come with a large volume of injured patients.

In some regions, categorization of hospitals and the process of categorization have created anxiety on the part of physicians and hospital directors. An often expressed fear is that their hospitals will be bypassed, with subsequent loss of patients, income, and prestige, leading to the disruption of physician practice patterns, and compromise of existing residency training programs. Conversely, a trauma or burn center may see categorization as increasing its burden of indigent but expensive patients. These perceived threats focus on EMS planning, implementing and regulatory agencies, such as State and local health departments, Health Services Agencies and EMS councils. The anxiety of these physicians and hospitals is heightened by their feeling of helplessness in dealing with governmental EMS agencies and councils in which they do not feel adequately represented; for example, many EMS advisory councils which have 51% consumer and 49% producer membership, may have only 1-2 physicians and one hospital administrator out of 10-14 members. Many physicians feel these agencies and councils lack the technical expertise essential to address issues of categorization, training, communication, and legislation that affect EMS.

Making categorization more palatable to hospitals in a regional EMS plan requires development of tradeoffs among hospitals. The success of categorization may well depend on the skill with which these service tradeoffs are balanced and perceived to be economically fair by the hospitals and physicians affected.

The types of illness and injury requiring hospital transfer or consultation could be better delineated and gain greater local acceptability if data were available to document the reduction in mortality and morbidity associated with care in the region's specialized units. Therefore, trauma, burn, and cardiac arrest registries should be a requirement of regionalized emergency medical care.

Whether hospitals are graded horizontally, according to their ability to care for the acutely ill and injured, or vertically, according to the special

services provided, the public should know which services are available at each hospital.

Another obstacle to categorization has been conceptual disagreement among professionals as to the most appropriate criteria for classifying hospital facilities. Criteria for classifying hospital facilities recommended by state, county, city, and HSA EMS agencies often differ markedly, not only from state to state, but within any given state.

Development of EMS systems and organizations at the state, HSA, county and city level has also led to jurisdictional uncertainties with regard to which agencies should be responsible for EMS planning and implementation. Many of these uncertainties could be resolved by appropriate legislation or guidelines from state EMS planners.

Regionalization of EMS should entail planned coordination with emergency preparedness agencies. Lack of such coordination leaves populations in areas of high risk from tornadoes, earthquakes, or nuclear terrorist actions with no assurance that provision has been made for rescue and emergency medical care.

In summary, regionalization and categorization of hospital care of the critically ill and injured have sometimes been resisted because of economic and political concern. Nowhere in EMS is there a greater need for study than in the effects of regionalization and categorization on access to care, on the quality and the cost-effectiveness of care, and on existing hospital residency programs, hospitals, physicians, and patient outcomes.

Conclusions and Recommendations

Regionalization of emergency medical services, extensively encouraged and developed through federal and foundation programs, is intended to improve prehospital emergency care through centralized management and quality control of emergency medical resources. The degree of regionalization achievable in a given region will depend on the willingness of providers and political entities to cooperate, on the adequacy and permanence of the funding base, and on the authority inherent in the EMS management organization. Regionalization includes arrangements with hospitals outside an EMS service area for specialized medical services not available within the area.

Categorization of hospitals can be an important aspect of EMS regionalization, making possible the delivery of critically ill and injured patients to the facilities best able to care for them. But categorization has been effectively implemented in few areas, owing to lack of agreement on criteria and to fear adverse economic consequences.

Regional EMS planning should include the establishment of acute care registries, of uniform ambulance and hospital records for patient tracking to allow for assessing the impact of regionalization on health outcomes, and of arrangements with hospitals outside the EMS service area for specialized services not available in the area.

Studies are urgently needed on the impact of hospital categorization both on health care delivery and outcomes and on hospital economics. State and regional health authorities should seek to develop service tradeoffs among hospitals to offset the perceived economic threat of categorization. Authoritative criteria and methods of categorization need to be established.

EMS Communication

The EMS communication network can be considered in terms of functions and of components. Thus, EMS communications must serve the following functions:

- Citizen access—the system must include the means, usually telephone (or in remote areas by CB radio Channel 9) whereby the public can gain immediate entry into the EMS system.
- Linkages among components—to function efficiently, the system must provide radio and/or telephone linkages among all EMS system components—dispatchers, ambulances, and hospitals—as well as with police and fire departments and other providers of emergency services.
- Medical supervision—the system must provide the means—by radio, directly, or through telephone interconnections at the central medical emergency dispatch (CMED),—by which EMTs and paramedics can receive instructions and advice from an emergency physician, usually at the hospital emergency department.

The components of the EMS communication system include:

- Equipment—transmitters, receivers, CMED consoles, relay stations, telemetry equipment, etc.—whatever is needed to serve the functions of a particular system.
- The personnel responsible for responding to calls, establishing linkages, dispatching emergency vehicles, maintaining current information on system status, and maintaining the equipment.

The receipt of a call, usually by telephone, from a person perceiving an urgent need for medical attention, is one of the two major pathways for access to emergency care, the other being direct access to a hospital emergency department. To call for help expeditiously, the caller must either know or have rapid access to the emergency number. Thus, there is need for standardization of the display of information in telephone books, prominent display of emergency numbers on private and public telephones, and training of telephone operators to transfer calls promptly to appropriate sources of help.

For an EMS system, as opposed to a single ambulance service, communication links (in addition to those required for public access and ambulance dispatch) include links with police, fire, and other public safety services for mutual assistance; with civil defense and adjacent EMS systems for disaster coordination; with poison control, drug control or other special centers for referral of certain calls; between ambulances and hospitals for notification and advice; and among hospitals and rural clinics for consultation and referral.

EMS access is commonly by telephone. Arrangements vary in sophistication from those in which the public is instructed to dial "Operator" to those in which 911 is used for all emergencies, with the caller's number and location automatically displayed before the dispatcher. The "best" system is that which is most suitable to the needs and resources of a particular region.

911, the universal emergency telephone number, now used in cities and counties scattered throughout the United States, is considered to represent the best solution to the access problem for a highly mobile population. Use of 911 presupposes an agreement among police, fire, and EMS organizations to cooperate; the ability of the local telephone companies to supply the service; and the ability of local agencies to pay for it.

Ideally, cooperation among a region's emergency response agencies will take the form of a consolidated dispatch center, serving police, fire, and EMS thus obviating the need for electronic communication links among these agencies. Where this is not possible, calls to 911 may be answered at a public safety answering point (PSAP), which immediately relays the call to the appropriate dispatcher.

Problems associated with 911, to which system planners should be alert, include the following:

- The difficulty often encountered of getting police, fire, and EMS agencies to accept 911 or to agree later on where the consolidated dispatch center or PSAP should be located; emergency response services and agencies often feel that their identities are inextricably tied to their individual telephone numbers.
- The possibility that, for instance, a single county may promote adoption of 911 county-by-county to undermine the concept of a regional EMS response (one proposed method of managing 911 calls is to install a countywide 911 system in which calls would automatically be routed to an answering point nearest the caller, thus effectively blocking even countywide coordinated response).
- The fact that many small telephone companies, common in rural areas, lack the resources for conversion to 911.

- The inability of many regions to meet the price stipulated by the local telephone company for conversion to 911.

The objection sometimes raised that 911 would delay EMS system response by interposing an additional intermediary between the caller and the dispatcher is, we feel, invalid inasmuch as the time saved by the caller (particularly in the case of the very young and very old) in not having to search for the correct local number would more than offset the few seconds required, if a PSAP is used, in identifying and relaying the call.

Apart from the potential for better service that a consolidated dispatch center using 911 implies, a persuasive argument for its adoption may be that it is one area of emergency communications that can be shown to be cost-effective: one dispatch center for police, fire, and EMS is ordinarily less costly to operate than three. If the three agencies all contribute to the establishment of a consolidated communications center, the initial cost will be less for each.

In regions where 911 is not now possible, a single EMS access number, widely publicized and identified on all public telephones, should be established.

In the United States today, the most widely used nontelephonic means of EMS access is the CB radio Channel 9. The principal problems with this have been the lack of designated answering points and lack of radio discipline in the use of Channel 9. However, a growing number of EMS systems now monitor Channel 9, and in several states, such as Missouri and New Mexico, police patrol cars systematically monitor Channel 9 and relay information on medical emergencies to the nearest EMS communications center.

A variety of special access devices—such as electronic monitors for persons with cardiac problems, teletype systems for the deaf, vehicular emergency signal transmitters activated by sudden impact, and television monitors located in high hazard areas—have been tried experimentally but have yet to be evaluated.

For the network of an EMS system, it is generally acknowledged that central medical emergency dispatching (CMED) is a desirable goal. This entails the receipt of all calls for assistance and the dispatching of an appropriate vehicle or team or referral to a non-EMS agency. The coordination of public services needed to respond adequately to a given emergency is here visualized and acted on. Decisions at the CMED are made on the basis of assessment of need and timely knowledge of the location and status of EMS resources. Continuous knowledge of the status of resources allows the dispatcher to identify the closest available emergency vehicles and the closest hospital emergency department

that is suitable for the patient's needs. The communication center may also link EMTs with hospitals or consultants, by radio or radiotelephone, to permit receipt of advice and guidance with respect to treatment at the scene and in transit. Through that link, hospitals may be informed of expected emergency-vehicle arrivals or decisions may be made as to the most appropriate hospital for special cases.

Complete CMED has been achieved in very few systems, and its impact and cost-effectiveness have yet to be evaluated. In general, each system must explore its own needs and design a CMED to meet the specific requirements of the region. "Standard" designs are not likely to be appropriate to many specific systems, and there is little information indicating the merit of a given design.

It is important that the communication system provide for the collection of data that will allow the linkage of records of patients entering the system—starting with the request for assistance, proceeding through prehospital care to care in the hospital emergency department, and including followup. Such records are essential to the process of evaluating the effectiveness of the EMS system, and thus to improving it.

The introduction of a 911 system requires specially trained personnel who can connect or direct callers to appropriate sources of advice on emergency assistance. With the development of more extensive and sophisticated EMS communications there is increasing need for refinement in the selection and training of dispatchers and for the development of protocols or procedures for decision-making at the dispatch center. These procedures, again, should be undertaken in considerations of policies of the specific system and the internal and external networks required.

The importance of dedicated radio frequencies for emergency medical communication is recognized in Federal Communications Commission Docket 19880, which established 10 UHF channels (20 frequencies) exclusively for EMS. Although VHF systems are still useful and may be more affordable in some areas, EMS planners should allow for eventual phasing in of the UHF system.

The EMS communication network often suffers from interference from the radio systems of other agencies in the same community or of EMS systems in adjacent communities. There is a clear need for coordination of EMS communications on an areawide basis, both to preclude interference among EMS systems and to facilitate the transfer of patients from one region to another. A consolidated dispatch center, shared by police and fire departments and EMS, can provide one means of coordinating the use of frequencies among emergency services of a particular region. Multipurpose communication systems as found in

systems with consolidated dispatch centers, also provide the advantages of economies of scale, joint funding, cost-sharing, and the specialized management that is more likely to be available to larger and more comprehensive systems. In general, development and operation of such local enterprises would be further enhanced by coordination among relevant federal and state agencies.

Conclusions and Recommendations

The EMS system is activated by a call for assistance. The universal emergency telephone number, 911, provides the best access for a mobile population—saving time and realizing the economy of a consolidated communications center. Problems to be anticipated in establishing 911 are reluctance of involved agencies to relinquish their own numbers, a desire to center 911 on a local rather than regional base, and lack of resources or funds to make the conversion. Central medical emergency dispatching (CMED), entailing the receipt of all calls for assistance and dispatch of EMS resources or referral to appropriate non-EMS agencies, is a desirable goal for EMS systems. Radio communication within the network is often subject to interference from the transmission of other community agencies or of adjacent EMS systems.

The universal emergency telephone number, 911, should be installed wherever possible—lacking that, a single EMS number should be established, identified on public telephones, and widely publicized.

Central medical emergency dispatching (CMED) should be seriously considered, but the facility should be designed to meet the specific requirements of its region.

Greater effort should be expended on the coordination of EMS communications on an areawide basis, and this would be enhanced by technical assistance from state or federal sources.

The communication system should provide for the collection of data that will allow linkage of patient records that are essential to continuing evaluation of the effectiveness of the service.

A program of technical assistance, under federal or state auspices, could bring available experience and knowledge to the aid of regions that are planning new or improved EMS communications. Interaction among manufacturers, users, and communication specialists is desirable as a stimulus to the development of useful equipment at reasonable costs. Organizations

such as the Association of Public Safety Communications Officers and the Association of State Telecommunications Directors should be brought into technical assistance programs.

A handbook, setting forth telecommunication requirements and guidelines for the staffing and operation of emergency communication centers, is needed.

Transportation

In the early part of this century, a military writer stated that the ultimate objective of the Army Medical Department was "to bring the patient, the facilities for his treatment, and the surgeon in conjunction under the most favorable possible circumstances." In a general sense, this is true of a civilian emergency medical system. In those days, the objective could be furthered by placing mobile hospitals close to the troops, an option not readily available to EMS. The other option is to have the means to move the patient to the hospital. This is the classic function of the ambulance, and there are still many vehicles that serve only that purpose. However, the introduction of modern emergency medical vehicles has permitted, in a sense, the movement of a part of the hospital to the emergency site.

The basic criteria for an EMS vehicle are speed, safety, and comfort. Beyond that, the vehicles differ in the rescue and medical equipment on board and in the sophistication of their communications. It is obvious that these characteristics are related to the degree of training of the personnel who man the vehicles, and this in turn is a function of the design of the specific EMS system.

Generally, the vehicles involved may be those which simply transport patients with a minimum of care en route, those which provide a working environment within which trained personnel can provide a good measure of care both at the scene and en route, and those designed solely to provide a fairly sophisticated workplace for highly trained technicians, and not to transport patients. The use of the latter type of vehicle requires that it be accompanied by an ambulance or that its personnel be able to summon one.

The 1968 report of the NRC Committee on Emergency Medical Services *Medical Requirements for Ambulance Design and Equipment*, has served as a guide for emergency vehicle design, and the basis for the paper, *Ambulance Design Criteria*, prepared by the DOT National Highway Traffic and Safety Administration. Although present standards for emergency vehicles are generally appropriate, they may not suit all circumstances and locations. The design criteria must be related to

specific tasks, and their adequacy is best determined locally. There is a need to validate some of the present design criteria in terms of operational effectiveness, and until this is done the criteria should be applied with a measure of flexibility. In view of rapid technologic advances, it would seem appropriate to reexamine vehicle standards every three to five years.

Transportation services by part-time providers (e.g., funeral homes) is no longer a major concern, owing to a general upgrading of emergency vehicles to conform to specified standards. However, in many areas, the number of such vehicles is inordinately high. Criteria are needed to permit a rational deployment of vehicles, taking into account response time, services offered, and quality control.

There has been increasing interest in the air ambulance, both rotary and fixed-wing craft. The Federal Aviation Administration, concerned with standards for medical air transport, has been developing criteria for size, interior design, and equipment for such aircraft. What remains to be established are the circumstances under which emergency air transport should be called for and who should be responsible for the decision to do so. The safety of the crew and the passengers must be the paramount consideration. Because such vehicles and their operation and maintenance are very expensive, it is usually necessary to finance them through a multipurpose system. The considerable experience that has been acquired in the Military Assistance to Safety and Traffic (MAST) program and in a number of police, fire, and private systems may be useful as a guide to further development.

Conclusions and Recommendations

Present standards for emergency vehicles are generally appropriate, but they may not suit all circumstances and locations. The feasibility of putting military surplus aircraft to use in civilian EMS systems should be studied.

There is a need to validate the operational effectiveness of some of the design criteria for EMS vehicles.

Until design criteria have been validated, they should be applied with a measure of flexibility.

Vehicle standards should be reexamined every 3-5 years.

Manpower and Training

Human resources are the major element in any EMS system. Among the factors that have a bearing on the recruitment and training of personnel to optimize local or regional systems are the geographic and demographic setting, the numbers and types of personnel needed, the availability of training facilities and personnel, the form of system administration and quality assurance, the available funding, and the agreed on targets in terms of acceptable morbidity and mortality from specific diseases and injuries. It must be assumed that there are personnel qualifications and staffing patterns that are most effective for a given system, once it is characterized in terms of these factors.

The personnel who may be involved in the provision of emergency medical care can, for our purposes, be roughly divided into those who are formally parts of the EMS system and those who are not. Those within the system can be roughly grouped into prehospital-care and hospital-care categories.

Although a variety of designations are in use for prehospital-care personnel, this report uses the terms "Emergency Medical Technical" (EMT), "Emergency Medical Technician-Intermediate" (EMT-Intermediate), and "Paramedic." In the hospital-care category are physicians and nurses whose titles include the descriptive words "emergency" or "critical care." Outside the care structure of the EMS system are fire, police, utility, and other such personnel, and lay persons.

A number of questions can be raised with regard to the current planning and implementation of programs for EMS manpower development. Among these is the question of the extent of need for advanced-level emergency care, as exemplified by the paramedic. In recent years, this category of personnel has become well established, and its members are increasingly subject to certification programs required by law. Yet we lack grounds for determining how many such workers are needed to serve specified geographic regions and populations. Nor is there agreement on how they should be trained, supervised, deployed, and evaluated.

The cost of paramedic programs should be considered in both urban and rural areas. In a given system, it should be possible to determine

the relative impact of alternative investments in the training of more basic-level EMTs and their deployment at sites that permit more rapid response. Another alternative that has been suggested is the greater utilization of EMT-Intermediates. Decisions on this matter should be made, in a given system, on the basis of the expected frequency of life-threatening emergencies that require advanced care; the assumed competence of EMTs of various levels of training to assess and treat patients in those emergencies; and the relative costs of teaching and maintaining the EMT skills and knowledge involved.

The training of ambulance attendants, particularly to the paramedic level, poses severe problems in rural and wilderness areas served by volunteer squads. These people are likely to have neither the time nor the funds to travel to a college or central hospital and to enroll in an intensive 200-500 hour course. Yet they serve regions in which, because of the often long ambulance runs, advanced care at the scene and in transit is most needed. A partial answer to this problem may be found in the modular form of the recently-issued DOT-HEW-DOL paramedic course, which may permit a regional system to select those segments of advanced training that it most needs, such as IV therapy or endotracheal intubation, and to have them taught at a local hospital or community college. Another approach sometimes used is to provide advanced training for only two or three members of a given volunteer squad. Equally difficult is the problem of maintaining advanced life saving skills in a rural or wilderness volunteer squad, where each member may serve for only a few hours each week, and thus have little opportunity to practice and preserve skills. A partial answer to this has been to provide squad members with rotational tours of duty in a hospital emergency department or with an active urban squad. Underlying this is the general training problem, which deserves intensive investigation, of determining what the optimal number of EMTs and paramedics is for a given area and population density.

The relative effectiveness of providing advanced emergency care on the basis of standing procedures (protocol) without direct medical supervision, as opposed to physician control by means of voice communication and telemetry, remains to be determined. This is yet to be evaluated with respect to medical outcome in well-designed, coordinated studies with adequate samples of patients in comparable settings. One approach that is being tested is the combination of standing orders or treatment protocols with guidelines for communication with physician consultants. Regardless of the results of the evaluation, it will undoubtedly be found that different settings and EMS systems require their own arrangements, and it would be counterproductive to fix or mandate one approach for all systems and settings.

With respect to evaluation of personnel, the number of hours of training completed is likely to be less valid as a measure of competence than an appraisal of the performance in actual or simulated cases. The adoption of more or less standard sets of tests of skill and knowledge would enhance reciprocity in certification, geographic mobility of personnel, coordination of standards for required continuing education, and recertification or decertification procedures. However, if standardization of testing, insofar as it dictates training content, is carried too far personnel may find themselves trained in techniques rarely or never used in the EMS system in which they work, yet uninformed and unskilled in procedures that are often used.

For example, endotracheal intubation is part of the present DOT paramedic training program, but some systems use only the esophageal obturator airway. Training guidelines should be sufficiently flexible to allow local modification and adaptation of training programs when necessary. This acquires further importance when one notes that there is often a relationship between the local methods of recruitment and selection of personnel and the training programs that are suited to the given region.

The role of the physician in prehospital emergency care is generally accepted as, at most, indirect. It is not usually feasible or economical in this country for physicians to ride in emergency vehicles. However, they are increasingly involved as EMS system consultants, as hospital emergency-department directors and clinical staff members, and as supervisors of EMT training programs. In some systems, nurses trained in intensive and coronary-care units accompany the paramedics on the emergency vehicles. Nurses are also assuming increasingly important roles emergency departments and in the training and supervision of EMTs.

One generally thinks of the EMS system in terms of ambulance personnel, medical dispatchers, and hospital emergency-department staffs. But, for the individual patient, an important figure is the layperson who, being near at hand, is often referred to as the "first responder." A beginning has been made in adult education programs and in the revision and upgrading of elementary and secondary school curricula in first aid and emergency care. However, the great potential of informed laypeople will not be realized until more effort is devoted public education and training. Certainly, high-risk industries and occupations should have personnel with emergency medical training, and all public safety personnel should have at least the basic skills with which to institute first aid.

With the burgeoning of professional personnel engaged in emergency medical care, it may be timely to examine the role of medical schools,

nursing schools, and education programs for allied health professionals. Do their curricula reflect the growing demand for EMS training? Might they contribute to the training of the lay public by offering aid and guidance in curriculum development and revision?

In developing EMS manpower, particularly at the EMT level, it is important to take into account the need to attract persons to careers in EMS, to offer them the possibility of advancement, and to ensure job satisfaction in order to retain experienced personnel. An example of the problems is reflected in the fact that EMS divisions of fire departments often find that they are busier than the firefighters, yet receive little or no additional compensation or recognition. Some communities are establishing EMS as a separate force, apart from police or fire departments, but this often requires additional investment and may lead to unnecessary duplication.

Conclusions and Recommendations

In recent years the occupational category of paramedic—the most highly trained emergency medical technician—has become formally established, and large numbers have been recruited, but we lack criteria by which to determine the optimal distribution of such personnel in specific geographic and demographic regions. There are no valid data by which to determine the extent to which paramedics may be left to function without direct guidance by physicians. The assessment of individual competence is better done by appraisal of performance in actual or simulated cases than by review of the number of hours of training completed. The lay “first responder” is an important figure in the provision of EMS, but the teaching of first aid through adult education programs and school curricula has only begun.

Efficient distribution of EMTs and paramedics in a given system should be determined on the basis of the expected frequency of life-threatening emergencies that require advanced care, the assumed capabilities of EMTs with various levels of training, and the relative costs of teaching and maintaining the skills and knowledge involved.

Well-designed coordinated studies, using adequate samples of patients in comparable settings, should be undertaken to determine the relative effectiveness of advanced emergency care provided under a set of established procedures (protocol) and that provided under direct physician guidance by voice communication and telemetry.

The competence of individual EMS personnel should be evaluated on the basis of observed performance in actual or simulated circumstances, rather than in terms of hours of formal training completed.

Greater effort should be devoted to public information and education programs aimed at increasing the number of laypersons in the community who are competent in first aid and emergency care.

Other Operational Problems

Hospitals

Many hospitals, especially teaching hospitals, rotate medical personnel assigned to emergency department (ED) duty. Because the tour of duty in this setting is limited, physicians do not develop an understanding of the ambulance personnel, their individual capabilities and skills. They are therefore often reluctant to advise or give orders for prehospital care, and thus they often delay care until the patient arrives at the hospital.

In some hospitals equipped with radio for communication with ambulance attendants, the radio has been moved out of the ED and placed with the hospital telephone operator or is kept in the ED but turned down "to cut down noise" and is inaudible. In these circumstances the benefit of installing the radio is diminished or voided.

Emergency departments have become the entry points for primary care for a large segment of the population who have no private physician. An additional large percentage of visits are by people who have private physicians but use the ED because they do not wish to bother their physicians, cannot contact them, wish to take advantage of the 24 hour availability of the ED or have insurance policies that cover emergency visits, but not visits to a private physician. The ever-increasing volume of ED visits has reached about 60 million per year and causes severe crowding and long waiting periods. Although triage systems usually afford rapid care for the most critical patients, many with painful or urgent conditions must wait many hours to be seen.

Ambulance companies, often with good reason, may be reluctant to go into areas with high crime rates. Some commercial groups are reluctant to respond to calls when the chance of collection is slim. In many areas the only agency or office that is available 24 hours a day is the police or sheriff's office. It is, therefore, most effective for this office to be the recipient of medical calls as well. However, the disadvantaged often have a deep mistrust of law-enforcement groups, and their fear of

being conspicuous makes them reluctant to call. In this circumstance, the entry point interferes with access. Another problem of the poor is the shifting of such patients, if they have no identifiable payment mechanism, from one hospital to another. Areas of low socioeconomic status are likely to lack both the necessary funding and the available manpower to support a volunteer ambulance service.

Triage

“Triage,” originally a term used to describe the sorting of mass casualty victims, now generally means simply the sorting of patients for care. This sorting can occur at various points in the daily operation of an EMS system. There is no unanimity of opinion as to where or by whom it should be done.

Triage by Dispatchers EMS systems vary widely in their allocation of triage responsibility and authority to dispatch. This diversity is reflected in the level of training that the various EMS systems require of their dispatchers.

At one end of the spectrum are systems that have no triage activity by the dispatcher. In this group, there are both simple and sophisticated systems. In many rural areas, the dispatcher function is allocated to the sheriff's office because it is the only official organization that operates 24 hours a day. It is considered most cost-effective for the dispatcher to handle all calls, both police and medical. In this case, the dispatcher is usually not prepared for triage. In contrast there are sophisticated systems in which the dispatchers do not handle triage. An example is a region with a computerized locator system based on grids and landmarks that can identify and display on monitors the names of the closest units and indicate vehicular and crew capability. In this system accuracy of spelling and speed of typing are considered of prime importance. Therefore, they hire expert typists who have no medical training and do not handle triage.

At the other end of the spectrum, there are systems that use EMT or even paramedic-trained dispatchers with field experience. In such systems, a dispatcher may handle triage and decide whether a responding unit is to be sent, what kind of unit it should be, and often the hospital to which the patient is to be taken. In some systems a dispatcher can intervene with emergency instructions and advice on measures to be taken before the arrival of the ambulance. There are both advantages and dangers in this practice. There are the limitations of not being on the scene, of acting on the basis of incomplete information,

and of overconfidence in diagnostic ability based on limited medical knowledge. Some systems have developed algorithms for guiding the dispatcher in triage. Advice should be limited to what to do until the ambulance arrives. More documentation is needed to ascertain whether harmful, as well as beneficial, outcomes result.

Dispatchers should have linkages to poison control centers, suicide prevention agencies, battered spouse organizations, and other organizations related to urgent needs. The need to tie in with police and fire departments is now recognized almost universally.

Triage by EMTs at the Scene There is little disagreement that the EMT has a triage role at the scene. However, he should be able to refer to or discuss questions with a higher level of authority, such as a physician at a base hospital.

Triage in the Emergency Department Emergency departments of hospitals are often crowded and the people waiting to be seen have conditions of various degrees of urgency. Therefore, persons arriving in an ED should not be seen solely in chronologic sequence of arrival. A health professional should be assigned the duty of triage. Who that person should be is not uniformly agreed on. In some places, triage is performed in a perfunctory informal fashion; in others it is an organized formal function of the ED. Most commonly it is performed by a nurse. There are some who believe this triage is a most critical function and should therefore be performed by an experienced physician. They also feel that, although the triage nurse or physician assistant can consult with a physician when in doubt, the index of suspicion is too often limited by inadequate knowledge or tempered by an unwillingness to disturb a busy physician. Further studies should establish preferred patterns.

Triage for Transfer to Another Hospital Guidelines should be established for conditions that, because of type or severity, should be treated at other facilities. There should be voice communication between the physician treating the patient and the one to receive the patient and agreement on the degree of stabilization necessary before transfer, the tests to be performed before transfer, how the patient is to be transported, who is to accompany the patient, and what care should be provided en route. Most of these agreements should be prearranged, so that only the special features of a given case need be discussed by the physicians involved.

Public Education and Information

Emergency medical services are a community resource. If they are to be nurtured, they must have the understanding, the confidence, and the support of the community. As noted elsewhere in this report, ready accessibility to EMS cannot be taken for granted. People must be taught how to enter the system to get an effective response.

The lay public must be considered an element of an emergency medical system. During the period between the emergency event and the arrival of the first emergency unit, the intervention of laypersons trained in first aid and CPR can make the difference between life and death.

Improvement in the above circumstances can only be brought about by educating the public. There is evidence that the effectiveness of many EMS systems is limited by inadequate efforts to inform and educate the community.

During the planning stage and the initial period of operation of a new system, the main effort should be devoted to developing community understanding of the service and support for it. Where a broad-based EMS committee exists, a public education subcommittee (including mass-media representatives) could use the following approaches:

- Provide statistics on the incidence of emergency events in the community or region and the potential effectiveness of the EMS system in reducing mortality and morbidity.
- Describe the new EMS system, its resources, how it works, and how it is financed.
- Present the concept of self-help in public media and at community meetings.
- Recruit leaders for EMS training programs for the public.
- Undertake special information campaigns to increase public competence in gaining access to the EMS system.

Once the EMS system has acquired some experience, public education and information activities might be aimed at the following:

- Assessment and enhancement of public knowledge of the system,

attitudes toward it, and practices in using it, including use of the emergency telephone number.

- Assessment and development of the firstaid skills of the public, including the ability to determine when those skills should be applied, such as recognition of early warning signs of catastrophic illness.
- Development of public education programs designed to remedy specific deficiencies brought to light in the preceding assessments.
- Presentation of preventive programs based on the local incidence of the type of accidents experienced by the EMS system—accident prevention, seatbelt use, safe storage of poisons and toxic substances, etc.; presentation of data regarding overuse and underuse of the system as a point of departure for a continuing campaign to enhance public effectiveness in using the service.

In a well-established system that has already carried out many of the activities mentioned above, the chief problem is the maintenance of interest and enthusiasm. Some approaches that may be helpful are the following:

- Encouragement of continuing education and advanced instruction designed to reach a larger segment of the community—competitive incentives may be offered for achievement, such as certificates indicating advanced skills.
- Encouragement of persons who attain specified levels of training and who demonstrate interest and enthusiasm in the program to become speakers for civic organizations and community forums.
- Creation within the community of an organization of volunteers devoted to emergency care, along the lines of the numerous disease-specific voluntary health organizations now found in the community.

Public education and information programs may most effectively be implemented through existing community organizations, such as schools, churches, clubs, parent groups, and scout troupes. Employers may also be encouraged to participate in developing training programs for their employees.

Beyond formal programs, the public may be kept aware of EMS by appropriate display of the EMS telephone number, in the presence of emergency telephones on highways, and in other critical public areas; by dissemination of EMS information in commercial mailings, product labels, billboards, and special EMS newsletters; and through public service programs and notices in public media.

Leaders for public education and information programs may be drawn from the following resources:

- Medical societies and other organizations of health professionals.

- Health organizations such as the American National Red Cross.
- Industrial and commercial organizations that are prepared to launch inplant and communitywide programs.
 - Officials in various public health and safety agencies.
 - Service clubs and special organizations, such as CB clubs.
 - Well-known speakers and community figures, who may be encouraged to participate in meetings aimed at generating interest in EMS education.

Despite federal and state aid, the financing of an EMS system is likely to remain largely the responsibility of a community or region, and it is necessary to gain citizen support for appropriate legislation and for the provision of public funds to maintain the system. To generate public support, public officials must be made aware of the following:

- The potential effectiveness of EMS in saving lives and reducing morbidity.
- The potential benefits of regionalization of EMS and centralization of management.
- The importance of trained citizens as "first responders."
- The impact of federal and state EMS legislation on the development and operation of local and regional EMS systems.

Conclusions and Recommendations

There is evidence that the effectiveness of many EMS systems is limited by inadequate efforts to inform and educate the community.

Public information and education programs should be considered essential parts of the planning and operation of an EMS system. These programs should be keyed initially to the development of understanding of the service, and of support for it; once an EMS system is established, to assessment of public understanding of and participation in the activity; and, in older systems, to the maintenance of interest and enthusiasm.



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