IMPROVING THE DELIVERY OF EMERGENCY MEDICAL SERVICES: THE CASE OF CENTRAL MASSACHUSETTS

by

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Submitted to the Department of Urban Studies and Planning on May 12, 1972, in partial fulfillment of the requirements for the degree of Master of City Planning.

ABSTRACT

The thesis is a case study of the delivery of emergency medical services in the central region of Massachusetts. It examines the organization of services within that region and the planning and policy-making activities that guide and influence the patterns of organization. The particular focus of consideration are the spatial and institutional arrangements associated with emergency outreach of medical care from hospitals by means of ambulance services. A theme throughout is that improving outreach is only achieved by improving those arrangements of delivery and, as well, the planning and control (or guidance) processes. The criteria used to gauge the effectiveness of the guidance and outreach systems relate to quality of care, geographic accessibility of services, and economic efficiency.

The study examines the present and proposed state powers for planning and regulation and concludes that they are limited in scope, essentially negative in style, and with a weak policy basis. Proposed alterations have some promise of partially remedying those defects. The thesis concludes that the actions and decisions of the individual providers are much more significant in the overall guidance of emergency services organization and delivery than the state programs.

A detailed examination of the resources and modes of delivery in Central Massachusetts reveals a fragmented and uncoordinated pattern. Resources are used inefficiently because the base population is inadequate to effectively support a system organized on a town-by-town basis. Gaps in the accessibility and the quality of services are also apparent because of the lack of regional organization and coordination. The processes that enhance and ensure the management of medical care by a physician are especially deficient, since contact between ambulance crews and hospital emergency facility staffs is unsystematic and often infrequent and since many of the hospitals in the region offer emergency service without having full-t e, hospital physician coverage.

In addition to evaluating the performance of the delivery system by the use of standards embodied into state laws and regulations, other means of evaluation associated with the basic criteria mentioned above are presented, including a methodology for analyzing ambulance utilization rates.

The thesis proposes, on the basis of the case study, improvements as to the processes of planning and regulation and as to the organization of the delivery system in the central region. It recommends the formalization of a regional emergency medical services planning council and encourages the state to delegate sufficient authority and responsibility and to provide sufficient support to the regional planning program to make its efforts meaningful. It is argued that much more collaboration among providers and users--and planners--of emergency services is needed. Furthermore, it notes the need for a regulatory process that takes into account the wide range of capabilities and characteristics of the various communities and provider organizations across the state.

Finally, the thesis proposes a model of delivery of emergency medical outreach services in Central Massachusetts, that is hospital-centered and organized on an area-wide basis. The thesis concludes by arguing the necessity of improved information methods, effective means of public financing, and careful planning of the transition process, if real improvement in the direction of the model is to occur.

Thesis Supervisor: Robert H. Hollister, Ph.D.
Title: Assistant Professor of Urban Studies

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Writing a thesis requires a commitment of personal and family energies and resources that is perhaps seldom appreciated. It requires the support of many people in numerous and varied ways. Unfortunately, a brief statement here cannot begin to adequately acknowledge nor express appreciation for the contributions made.

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The Comprehensive Health Planning Council of Central Massachusetts provided the economic support and the basic impetus for this study and made available needed office and staff resources. Rich Tompkins, the Research Coordinator, deserves special credit for the interest and thoroughness with which he helped me structure the research program and carry out the fieldwork. In addition, he spent a great deal of time reviewing the drafts and giving me articulate criticism and suggestions.

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Thanks, too, go to Mrs. Karen C. Holmes of the Bureau of Resource Development and to a number of others in the state Department of Public Health who are concerned with emergency medical services, for opening doors, providing background, making files and data available, and otherwise being interested in the study's progress.

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Finally, I should thank Joe Conley of the Joint Center for Urban Studies for providing me desk space during the final period of putting the thesis on paper. I don't thing I could have finished without a quiet corner where I could work day and night.

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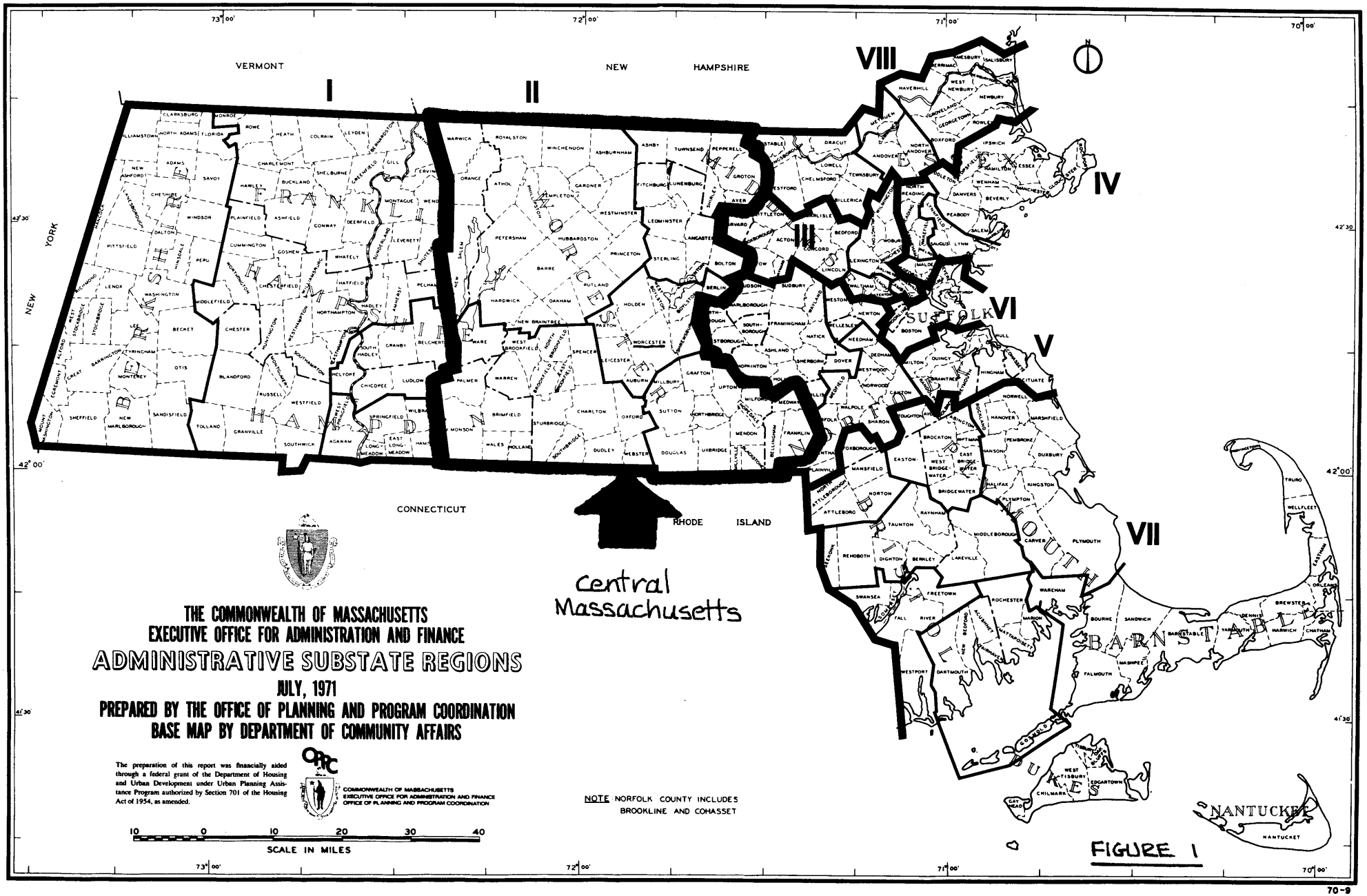
Chapter I: Introduction: The Context of the Study

This study is concerned with the effects - intended and unintended - of planning and decision-making on the organization and delivery of emergency medical services and ways in which the system for rendering emergency medical assistance can be improved. The document reports the findings and recommendations resulting from a case study of emergency care in the central part of Massachusetts and of the planning, regulatory, and strategic decision-making activities which affect the system, taking place both within Central Massachusetts and at the state level. Of particular interest is the interplay between the fragmented and traditionally autonomous decision-making of individual emergency service provider organizations and institutions and the state's regulatory efforts. How and where regional planning should fit in between is an important theme.

This study was catalyzed by a request of the Comprehensive Health Planning Council of Central Massachusetts (CHPC) - an area-wide health planning agency authorized under Section 314b of Public Law 89-749 - which has planning and advisory responsibility over a wide range of health concerns within its planning region.[1]

The CHPC had for some time been interested in the subject of emergency medical services,[2] and additional impetus came in the form of an inquiry from a committee of Worcester hospital administrators about whether any "official policy" existed or might appropriately be formulated to guide ambulance crews in their choice of hospitals. Beyond that, the Council felt a need to document emergency care resources available within the region in order to better respond to requests for advice about the subject which state agencies were beginning to make and to be in a better position for obtaining emergency medical services-related grants.

The CHPC should not be held responsible for the final study design, the observations, or the recommendations expressed within. The staff participated extensively in the assembling of information


VERMONT
NEW HAMPSHIRE
NEW YORK
CONNECTICUT
RHODE ISLAND
I
II
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Central Massachusetts
THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE FOR ADMINISTRATION AND FINANCE
ADMINISTRATIVE SUBSTATE REGIONS
JULY, 1971
PREPARED BY THE OFFICE OF PLANNING AND PROGRAM COORDINATION
BASE MAP BY DEPARTMENT OF COMMUNITY AFFAIRS
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COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE FOR ADMINISTRATION AND FINANCE
OFFICE OF PLANNING AND PROGRAM COORDINATION
10 0 10 20 30 40
SCALE IN MILES
NOTE NORFOLK COUNTY INCLUDES BROOKLINE AND COHASSET
NANTUCKET
73° 00'
72° 00'
71° 00'
70° 00'
42° 30'
42° 00'
41° 30'

FIGURE 1

70-9

and in the production of the report and provided invaluable support and criticism along the way, but the study is essentially an independent evaluation, done as a thesis for the Department of Urban Studies and Planning, and presented to the agency with the hope that it will prove useful to them in structuring their policies and programs and in stimulating dialogue and collaboration among the providers and consumers of emergency medical services in Central Massachusetts. In addition, it is hoped that the perspective that this study provides will be helpful to state officials and planners, particularly in the Department of Public Health, who are presently elaborating state-wide emergency care policy and who were also very helpful during the course of this research.

Conceptual Framework and Definitions

The emergency medical services delivery system is the means through which a community - whether through public, institutional, or private entities - provide emergency medical assistance. It consists of "signaling" arrangements (such as emergency phone numbers, special signal boxes, messengers, etc.); medical care outreach, through trained personnel, medical equipment and supplies, and communications capabilities to medical care centers; transportation, by ambulance, public safety vehicles, helicopters, or whatever; and hospital emergency care, with access to the full medical resources of the hospital, especially competent physicians to manage the care of emergency patients. The system exists primarily to respond to emergency conditions occurring unexpectedly outside the realm of influence of medical facilities and providers.[3]

An apparent medical emergency may be perceived without resulting in a demand on the emergency medical services delivery system. If a person has access to other means of getting immediate and convenient diagnosis, advice, and/or treatment of a condition which he feels is urgent (as when he has access to a group practice of private physicians that provide coverage on a twenty-four hour basis), he may make relatively few demands on the emergency medical services system. If a person has access to alternative means of transportation, particularly if he feels

inhibited about calling an ambulance ("too expensive," "it will take too long to get there," "they don't know what they're doing") he may bypass the outreach and emergency transportation components of the system.

A medical emergency is defined as follows:

> "Condition requires immediate medical attention; time delay is harmful to the patient; the disorder is acute and potentially threatening to life or function." [4]

The final determination that an emergency in fact exists can only be made upon an examination of the patient by a physician. Hence, the system must involve means of sorting patients (called triage) according to the apparent urgency and characteristics of their need, to ensure that out of the total demand on the system of apparent or patient-perceived emergencies, the urgent cases are picked up and given necessary priority.

The emergency medical delivery system has a heavy burden of responsibility: Unlike some other aspects of medical care, the consumers of emergency care may be completely dependent (either because of time constraints or physical/emotional limitations imposed by their conditions) on the operations of the system as to the management of their care. The delivery must be prepared for a maximum range of eventualities, since emergencies are only predictable statistically and require rapid-to-instantaneous response. Moreover, human lives are at stake.

Hence, there must be means to account for the system's performance to the public - those who use, who mandate, and who pay for the system, and those who direct and provide the services rendered - to ensure that the purposes of the emergency medical services delivery system are met, that the system operates impartially and consistently, and that mistakes or deficiences are quickly remedied. The means for doing so may be described as a system of guidance. Through the guidance system, the processes of goal-and standard-setting (planning and program development), performance evaluation (regulation), and system improvement (enforcement and program adjustment) occur.

The study presented here will describe essential features of both the emergency medical response system in Central Massachusetts, focusing particularly on the outreach and transportation aspects, and the means of guiding it in order to evaluate the net effectiveness of the guidance processes in ensuring that delivery of services meets public standards with respect to three criteria:

1. The quality of the response, as to triage and initial care and as to the speed with which competent physician supervision of the patient's care is established.
2. Accessibility of services, primarily as to geographic location and distribution.
3. Efficiency in the use of economic and other resources committed to the delivery system.

Based on that evaluation, policy recommendations for improving both the response system and the means of guiding it can be made.

By chapter, then: The conceptual, historical, and methodological frameworks on which the study is based are set forth in Chapter I. Chapter II describes the existing programs and responsibilities and the directions of policy development, primarily in Massachusetts state government, as elements of the guidance system. That description provides a backdrop for the presentation of the case study in Chapter III, where the delivery of emergency medical services in Central Massashusetts is examined for the patterns of coverage, the interrelationships among the elements of the provider network, and the policies and procedures which shape delivery. Chapter IV is an evaluation of the processes of guidance in accounting for the three criteria established above, and Chapter V contains the recommendations for improving policy and the structure of the response system.

Emergency Care in the United States

> "Medicine's lifesaving techniques and the system organized to deliver them are in sharp contrast. Progress in medicine's lifesaving techniques is dramatic. Today there are cardiac monitors and pacemakers, exquisite surgical techniques, drugs of great potency, institutions splendidly equipped and superbly staffed. These are available for many.

> Emergency medical systems in most cities and nearly all rural areas, however, do not often enough bring the patient at the right time to the right place; nor is there assurance the patient will get the proper treatment by the proper professional. Progress in this system is not dramatic." [5]

Manegold and Silver, in the above quote, noted a fundamental problem of emergency care in the United States - the gap between the state of sophistication achieved in medical science and technology and that achieved by the systems for extending those resources to patients in emergency circumstances. The reasons for this disparity can be seen in a historical context.

The development of medicine as a science and as a profession and particularly the role of the hospital as the prime locus of medical care created a need for an emergency medical response system, for, if lives were to be saved, initial stabilizing care and definitive treatment had to be provided quickly. Also, as medical care became more dependent on specialized equipment and facilities and personnel, it became increasingly separated from the average home or workplace. Hence, the need for a way to quickly bridge distance and connect the patient by means of transportation and communication with the centers of care delivery.

Emergency care services were slow in their development, however, for a number of reasons. Emergency care was less scientifically interesting because individual cases had to be handled as crises, offering little time for reflection, research, and formulation of method and because patterns of incidence and causality were less predictable. In the rather paternalistic mode of early hospital care, oriented heavily to charity cases, emergency care was particularly neglected. Emergencies could be viewed as anomalous occurrences, allowing expediencies in procedures that wouldn't be tolerable in normal situations. And, too, medical emergencies often never entered the emergency care system because constraints imposed by communications and transportation technologies made it often impossible to activate the response system quickly.

As a result, hospital emergency care was limited to a neglected and inadequately organized and equipped "accident ward" until well into the twentieth century.[6] In addition, the ambulance function, which had been operationalized in military settings, was not given civilian application for a number of years. Initially, whatever mode of transport happened to be available was used, and only in the late 1800's did hospitals begin to provide specialized ambulance service.[7] However, even though hospital-based ambulance service staffed by interns became a significant mode in some parts of the country for a time, there was really no commitment by medical care providers to the ambulance service as a medical or hospital function. Hence, as demands of economic and staff resources increased, hospital ambulance service languished because it became a burden for them to provide.[8]

The responsibility for ambulance service is divided even today amoung private organizations, of which funeral parlors predominate, who somehow manage to relate it to their other activities or otherwise make it at least marginally profitable;[9] police or fire organizations, who provide about 25 percent of the nation's service and who assumed the burden in many cases only because no one else seemed ready to do it; and volunteer groups in smaller towns, which make up another quarter of United States service. Only 2 percent of the service nationwide is presently provided by hospitals.[10] The trend, incidentally, is away from private services because of rising costs and shrinking profits, though they are still responsible for forty to fifty percent of the service provided in the United States.

A major problem with emergency care, then, is that the response system is fragmented. It is not clearly organized as a system of medical outreach but represents a patchwork of business, public safety, volunteer, and medical care interests each providing some component of the total delivery of emergency medical services and usually as a sideline to other activities.

The twentieth century has seen a radical increase in the demands made on hospital emergency facilities for "non-emergency" care because of the apparent unavailability of primary care MD's, greater urbanization, and increasing expectations as to the level of care and as to the convenience of obtaining it.[11] The pressure on the emergency care system has also increased because, as other causes of death are brought under control, the terrible loss from trauma and heart attacks and other emergency conditions becomes less tolerable.

After lagging far behind the emergence of the problem there has been growing attention to the problems of emergency care delivery in recent years. The mid-1960's saw the publication of what came to be a landmark report, Accidental Death and Disability: The Neglected Disease of Modern Society, which has catalyzed much activity and research, [12] and the enactment of the Highway Safety Act of 1966 with the subsequent issuance of "Highway Safety Program Standard Number 11 - Emergency Medical Services," Standard Eleven, which established, among other things, that each state should have an "up-to-date, comprehensive plan for emergency medical services" with the purpose of providing "the coordination, transportation, and communication necessary to bring the injured and definitive medical care together in the shortest practicable time..."[13]

Yet, despite such standards and numerous conferences, commissions, and studies on emergency care,[14] the impact to date seems small. Five years after the enunciation of such standards, Massachusetts has no state plan and the president of the State Medical Society describes emergency care in the Commonwealth as "lousy."[15]

The reasons for the lack of apparent improvement are complex. One explanation may simply be that in an era when many priorities are being urged upon the public conscience, the response time to an issue is long, particularly one that does not automatically inspire public commitment as seems to be true of emergency medical services delivery.[16]

Another reason is that no established tradition exists for the use of regulatory power to ensure that the health and welfare of the

citizenry is not endangered by ineffective organization of the delivery system. That kind of application has not developed because the concept of medical care delivery occurring through an area-wide system or network of many providers and facilities is relatively recent. Traditionally, the hospital or other medical facility was viewed as complete in itself, and its relationships were not considered particularly significant to the quality of care. With this perspective, regulation could be limited to sanitary conditions and approved procedures and equipment.

Yet the quality of emergency medical assistance, because of the importance of geographic accessibility and speed of response, is especially dependent on the nature of the relationships among providers and the means connecting the network together. It has, as a result, been especially limited by the narrow traditional view.

A third reason, and probably the most important, is that the challenge of emergency care is different in kind than the challenge of say, cancer, or from a different area, getting to the moon. The problems inherent in the delivery of emergency medical services do not demand technological breakthrough. As Manegold and Silver noted at the outset of this section, the essential need is to create (or revamp) an institutional framework which is systematic and efficient in making emergency care resources available to everyone. Doing so requires some sacrifice of traditional prerogatives, some disturbing of established balances of influence, some adjusting of the role definitions of individuals and organizations, because emergency care delivery stands at the nexus of a number of well-established institutions. Obviously, such change does not occur without resistance.

The nations with good emergency medical services have perhaps been working at it harder and longer than we have, but have also faced in almost all cases a simpler, substantially less pluralistic political environment. However, well-organized systems of emergency response are just as worthy a goal and just as necessary here as elsewhere, even though progress toward the goal seems slow and our context is pluralistic.

In the United States, we must face the fact that, given the

fragmented delivery system and diversified political environment, change must occur through collaborative planning and participatory program development as well as governmental regulation - and that quality emergency care must develop out of effective processes of community action, as well as broader policy development.

Relatively few studies have dealt specifically with the effect of guidance processes on the organization of delivery at local levels. This study is presented to enhance such a perspective of the problem and to aid specifically in overcoming the obstacles to creating an effective delivery system in Central Massachusetts.

Methodology

The objective of the study was to come to understand the nature of a system - the means of guiding the delivery of emergency services. An appropriate and effective method of learning about a system is through a case study, an investigation of an example of a system that is chosen not because it is necessarily typical of other instances of the system (since typicality cannot be defined until the system characteristics are understood) but because it is interesting and illuminating and conducive to the generation of additional knowledge about the system.

Hence, though nothing can be said about whether Central Massachusetts is or is not typical of other areas as to the guidance and delivery of emergency medical services, it is useful as a case because it provides material for the subject at hand in four respects. The case study occured during a time of ferment and change in emergency medical services guidance in Massachusetts and thus can be a means to begin to evaluate proposed policies and also to provide additional input into the development of policy. The region, as defined, is a relatively complete and cohesive area, socio-economically and as to medical care delivery - and is a single health planning jurisdiction. Third, it presents the problems involved in organizing the delivery of emergency care in rural as well as in urban areas and in trying to establish standards that are reasonable for both. And, finally, it is a useful case because the planners and providers involved were anxious to help, which improved the process of knowledge generation.

To the extent that the characteristics of the emergency medical response system of Central Massachusetts are a consequence of policies and programs of higher governmental levels, they are likely to have analogues in other regions similarly affected. Inverting the statement, to the extent that similar conditions and characteristics are found in other regions, the subsequent presentation might provide an initial explanatory model.

The methodology was intentionally open and, to some extent, opportunistic. A literature search, using the Index Medicus and similar guides and following up bibliographic citations, provided an overview of the issues of emergency care delivery, a sense for the various methodologies used, and comparisons against which incoming data on the case could be checked and compared as the research proceeded. The literature was also important in revealing the themes of recommended standards and programs and the points of consensus and controversy.[17]

Interviews with key state and Federal officials, as well as representatives of charitable and professional associations, with some interest in or responsibility for emergency medical services programs were conducted. The interviews were usually quite open and occasionally informal in order to improve the interview. Individuals with roles particularly significant to the Central Massachusetts emergency medical services were interviewed in greater detail to gather information about the processes of guidance and about existing and proposed legislation and standards within the state.

Providers of emergency medical services in Region II were also interviewed - in person and by phone. These interviews tended to be more structured, particularly those over the telephone, in order to elicit specific information about programs, operations, and policies but still retained some flexibility in order to pursue and highlight unique situations or problems and particular perspectives. In total, five Worcester-area and three other hospital administrators, representatives of eighteen licensed ambulance services (three private, one hospital-based, eight volunteer, and six police or fire services), and twelve police or fire chiefs of departments providing non-regulated emergency transportation in so-called "dual purpose vehicles" were interviewed.

The planning and regulatory activities of State agencies were another major source of data. The Bureau of Resource Development of the Department of Public Health had on file the returns of two statewide surveys, one of all hospital emergency facilities that was conducted in the Spring of 1971 and the other of seventy-five percent of the regulated ambulance services, conducted early in 1970. Both studies proved useful, although the latter suffers from rather poor design and has never been tabulated. The Division of Medical Care, of which the aforementioned Bureau is a part, also maintains on file Annual Statistical Reports submitted by each hospital. From these certain statistical information could be gathered. Information about the licensed ambulance services of the region was obtained from the files kept by the Bureau of Health Facilities on each service. In addition, statistics on deaths from accidents, heart attacks, and other causes were provided by the Registry of Motor Vehicles and the Office of Health Research of the Department of Public Health. Though these data could only be given brief mention in this report because of the problems involved in interpreting their meaning for emergency services, they were considered in some detail during the course of the research.

Finally, two survey instruments designed specifically for this study were utilized: A short, mailed survey of licensed ambulance services in Region II, conducted in December, 1971 and January, 1972, which had a fifty-six percent response (25 of 45),[18] and a survey of arrival modes at five high-volume emergency rooms in Worcester and Fitchburg over a six-day period in early February, 1972. Record was kept by emergency room staff of means of transportation used by each patient in getting to the hospital. Also recorded were the general time of arrival, the patient's age, and whether the patient's condition was urgent (defined as requiring immediate medical attention).

Unfortunately, getting reliable and comparable information is an inevitable difficulty given the nature of current emergency medical services planning in Massachusetts. The information from these sources did not completely coincide, and the more significant disparities will be noted during the course of the report. In addition, data on services

varies, also unavoidably, from town to town. Very little information was obtained on many of the smallest towns, because the services available within the town are extremely limited. The only larger populations for which information is particularly scarce are in Milford, the Ayer-Shirley-Groton area, and the Monson-Warren-Brimfield area. These deficiencies were due in part to the distance of these areas from the Worcester office of the Comprehensive Health Planning Council (which was a base of operations for the field work of this study), and in part to a simple lack of response of providers within the area to requests for information. To some extent, secondary sources of information, such as interviews with providers in adjacent communities and with state officials familiar with circumstances in those areas, helped compensate for the [illegible] deficiencies.

NOTES

[1]Region II, as defined by the Office of Planning and Program Coordination, Executive Office for Administration and Finance, Commonwealty of Massachusetts.

[2]Planning Program in Central Massachusetts, April 21, 1971 (agency work program).

[3]When a medical emergency occurs within a hospital, some of the equipment, supplies, and personnel of the emergency facility may be called upon, but seldom is the emergency victim actually taken to the emergency facility.

[4]Weinerman, E. Richard, et. al. "Determinants of Use of Hospital Emergency Services," American Journal of Public Health, July 1966, p. 1043.

[5]Manegold, Richard R. and Silver, Michael H., "The Emergency Medical Care System," Journal of the American Medical Association, April 24, 1967, p. 124.

[6]National Academy of Sciences - National Research Council, Accidental Death and Disability: The Neglected Disease of Modern Society, p. 18.

[7]Curry, George J., M. D., "Immediate Care and Transport of the Injured," p. 9.

[8]Mitchell, Howard W., M. D., "Ambulances and Emergency Medical Care," American Journal of Public Health, November 1965, p. 1719.

[9]Even service stations and auto wrecking firms get into the act in certain localities. See Medical World News, "The Crisis in Medical Care," p. 7.

[10]ibid., pp. 6-7

[11]Shortliffe,Hamilton, and Noroian, "The Emergency Room and the Changing Pattern of Medical Care," New England Journal of Medicine, Jan. 2. 1958, p. 24.

[12] Gaston, Sawnie R., M. D., "Accidental Death and Disability...: A Progress Report," Journal of Trauma, March, 1971, pp. 195-206.

[13]U. S. Department of Transportation, Federal Highway Administration, National Highway Safety Bureau, June, 1967.

[14]Such as the American Medical Association Conference on Emergency Medical Services, 1967; the Airlie Conference on Emergency Medical Services, 1969; Emergency Medical Services in the Chicago Area, by the University of Chicago Center for Hospital Administration, 1971, etc.

[15]Ballantine, Thomas, quoted in the Boston Globe, December 27, 1971.

[16]The human tendency seems to discount one's personal risk of requiring emergency medical assistance; also, emergency facilities tend to be "out of sight, out of mind."

[17]The literature on emergency medical services delivery tends to break down into four categories:

1. Descriptions of current problems and recommendations for standards.
2. Inventories of services and utilization studies
3. Theoretical studies, emphasizing mathematical modeling and operations research techniques
4. Description of specific technologies, equipment designs, and techniques for rendering emergency care

The fourth group was the least applicable to this study. No pieces reviewed of this type were used to any great extent. Examples of each of the first three that were particularly helpful are listed here. The reader is referred to the Bibliography for other references.

1. "The Crisis in Emergency Care," special publication of Medical World News, McGraw-Hill, 1971. Also, Recommended Standards for Development of Emergency Medical Services Systems, U. S. Department of Health, Education, and Welfare, Public Health SErvice, Health Services and Mental Health Administration, Division of Emergency Health Services, 1971.

2. Gibson, Geoffrey, Emergency Medical Services in the Chicago Area, Center for Health Administration Studies, 1971.

3. Stevenson, Keith A., Operational Aspects of Emergency Ambulance Services, Technical Report No. 61, Operations Research Center, Mass. Inst. of Tech., 1971.

[18]A copy of the questionaire is attached in Appendix A.

Chapter II: The Means of Guidance, Present and Prospective

The guidance system of emergency medical services consists of three major components. The first is strategic planning, which involves decision-making relating to the development of policy with long-term or widely-felt impacts (such as locational decision of a new hospital, determination of need by the state Public Health Council, passage of legislation increasing training requirements, etc.). This chapter will deal primarily with the planning carried on at the state level. However, as this report will show, the state's role in policy development has been limited. The individual providers have the big impact. An additional input to this process, particularly in the legislature, is the effect of interest and "veto" groups in advocating or opposing changes in policy.

Regulation is a second function and derives out of the state's police power. The Department of Public Health is the agency with primary responsibility for emergency medical services but its regulatory activities at present are quite narrow.

The third component might be called operations control and involves both logistical as well as medical care quality control. This is a function of individual providers. Chapter III will essentially be a description of operations control in Central Massachusetts.

The guidance of emergency medical services delivery in Massachusetts is primarily an ad hoc, fragmented system. Individual providers of hospital and ambulance emergency service play the dominant role and can act relatively autonomously. Traditionally, an individual or group could decide to offer ambulance service pretty much at their own discretion and could as well determine the nature and extent of that service. Recent years have seen the development of some state regulation of ambulance services in Massachusetts, but, even so, once the reguirements are met, the service is in business, and still there is no master determination of need or of appropriate service area. As will be explained shortly, the establishment of emergency hospital service has been a subject of state regulation for a longer time but the nature of that service, once the basic regulatory criteria are met, has been the

prerogative of the individual institution to determine. Again, no overall establishment of objectives for the delivery system has traditionally occurred.

The matter of guiding the delivery of emergency medical services in Massachusetts raises a number of issues which become important themes in this report. A number of these are also generating political heat at the present time.

If emergency care is in fact rendered through a network of providers and facilities (whether or not it is recognized or admitted), and if the outreach and transportation component provided by ambulance service is as much a part of the delivery system as is hospital care, then the respective component providers of the delivery system have to be organized some way. A few would maintain that the "invisible hand" is sufficient - that the respective providers, pursuing basically their self-interest will achieve an effective system, adequate for its mission, while avoiding the stifling effects of control. On the other hand, an argument is also made for rather extensive centralized control. Thus, underlying the debate is the basic question of to what extent the government should be involved and how much regulation should occur.

As mentioned, government use of the police power in relation to emergency medical care has been limited but is increasing. In Massachusetts, both recent history and the immediate future promise substantial change in this direction.

A significant concern that arises especially in relation to the case examined here is the place of local and/or regional determination. Assuming providers agree that planning for the delivery of emergency medical services really must take into account networks and systems rather then individual providers, how much authority for determination of objectives and regulation would be left with them? From the state's perspective on this matter - what represents the state's interest? Can it simply oversee regional planning and guidance activities to ensure that they result in the achievement of desired ends or must the state carry out the great bulk of the guidance function itself? Furthermore, at what level is achieved the appropriate mix of first-hand knowledge of how the emergency medical services system functions

and yet of detachment and impartiality and understanding of the broad persepctive? That is, can regional planning efforts - especially those involving the participation of providers - be sufficiently protected against favoritism, undue influence, and logrolling? Or, conversely, can state planning efforts be sufficiently informed about how "things really are"?

For Central Massachusetts, there are added concerns that the state guidance processes, emanating from Boston, seem to be biased by an urban perspective and make unreasonable demands of the more rural parts of the state. The worry is that state regulation is insensitive and causes "the baby to be thrown out with the bath water" by setting standards which undermine or altogether drive out the emergency care resources of smaller communities. Emergency services are by no means the only focus of this concern.

Another thread is apparent in the foregoing: the appropriate degree of interconnection between elements of guidance. There is debate about how much information is needed for the regulatory process and when it becomes an imposition on privacy. There is some tension between regulatory and planning bodies about whether the latter should give cues to the former. Also unclear is the appropriate role for planners and emergency service providers as to participating in the regulatory function.

Finally, the issue is whether central planning and guidance can do more than ensure a minimum system. How much can state regulation do to create excellence? Can state planners stimulate local processes that would lead toward real improvement? Can collaborative, self-determining planning efforts of providers and consumers within an area find the commitment and result in the sacrifices necessary to succeed in achieving real system effectiveness?

These issues are much too complex, of course, to deal with fully and explicitly in this report. Nevertheless, they have been interwoven in the study, as it has developed, and will run through the discussion to follow.

State Guidance

1. The Regulation of Ambulance Services.

The Division of Medical Care of the Department of Public Health and the Registry of Motor Vehicles are the two bodies which have specific legal mandate for the regulation of ambulance services under two statutes, one dealing with the training of drivers and attendants and the other giving the Department of Public Health (DPH) the authority to regulate ambulance services so as to ensure sanitary conditions.

The first is a 1957 Act, apparently rather progressive in its time,[1] which states:

> "No person shall operate any ambulance transporting a sick or injured person, nor shall the owner or custodian of an ambulance permit the same to be so operated upon any way unless the operator of such ambulance or attendant thereon has been certified as having successfully completed the Senior Red Cross course of first aid training, or has received training which is equivalent thereto."[2]

As far as could be determined, however, the Registry has no enforcement machinery established to deal with this code; rather it has been left to the Bureau of Health Facilities of the Deparment of Public Health to assure compliance with this statute along with their duties pertaining to the second.

The second statute gives the Department power to regulate "sanitary conditions of ambulances" and to make rules regarding the "necessary equipment for the care and treatment of sick or injured persons" and allows the imposition of fines.[3] Pursuant to that authority the Department approved a set of regulations which were to be administered by the Bureau of Health Facilities. Under these regulations, a copy of which is attached in Appendix B, the Bureau assumed responsibility for receiving and reviewing annual "Applications for Certification" and for inspecting ambulance vehicles and base stations and other aspects of service.[4] This inspection is carried out by a cadre of nurse-inspectors who visit the various ambulance services in the course of their work inspecting other health facilities.

The Bureau maintains a file on each service containing the Applications for Certification, the Reports of Training, mentioned in the previous chapter, the inspector's reports, and any complaints or allegations which are received. The files are difficult to use and consequently are infrequently consulted for system-wide information. Because the role of the Bureau of Health Facilities deal with hospitals, nursing homes and other similar health facilities in addition to ambulance services, and becuase the man-power of the office is so constrained, there is almost never any contact between the Bureau and an individual service in between annual inspections and re-certifications. Midyear contact only occurs if the service itself were to seek out the Bureau's assistance or, possibly, if someone brings a complaint against a service (which necessitates knowing about the Bureau's function).[5] The files indicate that requests of these types are very infrequent. As a consequence, the Bureau has almost no notion of the way in which the service actually operates or the level of quality of the care rendered. It gets no information on operations of the ambulances services, such as numbers of runs of various types, numbers of patients served, activity of each of the personnel listed in the file, types of first aid rendered, and so forth.

As mentioned previously, the legislation and regulations do not at present cover emergency public safety vehicles used for other purposes in addition to ambulance work. Illustrative of that escape hatch is the final paragraph in the above-mentioned regulations:

> "These rules and regulations shall not preclude the reasonable omission of any of the foregoing requirements when a law enforcement officer or a representative of a fire department determines an emergency exists."[6]

2. The Regulation of Hospital Emergency Care.

For two decades, the Commonwealth has had a regulation relating to hospital emergency rooms as a rather small piece of the licensure rules for hospitals which the Department of Public Health administers. The provisions include the requirements that the emergency room be a distinct facility with a special ambulance entrance; that it have sufficient space, equipment, personnel, and

diagnostic and therapeutic facilities available at all times; that certain equipment and supplies be available (a minimal list); that a physician be available; and that a record be kept for each patient.[7] Obviously, these provisions do not make major demands in terms of policy explication on the part of the hospital.

3. Planning and Policy Development.

Beyond these regulatory functions, activities relating to emergency medical service guidance has been very limited at the state level until quite recently. The Department of Public Health has never had an office dealing specifically with planning for emergency services, and so the staff of the Bureau of Resource Development have had to add the day-to-day shepherding of any emergency medical services projects to their other duties. With the assistance of a staff person from the United States Public Health Service who has been on loan to various state agencies doing work related to emergency medical care, the Department of Public Health has administered two surveys of emergency care providers in the state mentioned in the previous chapter. However, the use of the result has been minimal.

Presently, the Department of Public Health is moving in three major policy directions to expand its planning and guidance function. They are the creation, within the Department, of an Office of Emergency Medical Services and a state Advisory Council on Emergency Medical Services; the revision of regulations pertaining to hospital emergency services; and a legislative effort to increase its statutory basis for the regulation of ambulance services. Succeeding paragraphs will discuss them in turn.

The Department of Public Health has also applied for a grant from the Department of Transportation under its Highway Safety Act, for the creation of an Office of Emergency Medical Services. The application has been approved and the Department received the go-ahead in the Fall of 1971. However, due to a series of complications, the Office has not yet been established and can therefore only be discussed on the basis of what the grant application outlines.

In addition to the three-member office, is a state Emergency Medical Services Advisory Committee, made up of representatives of various agencies and associations, the general purposes being to provide "leadership in stimulating interested health agencies in planning for emergency response programs," to acting as a "clearing house of information," to assisting in the "evaluation of the delivery of emergency medical services," and to stimulate "appropriate research activities."

The proposed activities of the office would involve preparing an interim State plan, inventorying existing laws and ordinances regulating emergency medical services, creating an emergency medical services data collection system, and surveying local delivery systems.

Later phases, to occur in the second and third years, focus on evaluating and updating the plan and establishing procedures for periodic program evaluation.

All of this, again, waits and remains untested until positions can actually be created and filled. The objectives are grand, but the budget and staff will be small.

Another strategic planning activity of the Department of Public Health has been to review and propose rather significant revisions of its regulations for hospital emergency services. The proposed revision is aimed at encouraging regionalization of policy and role determination as to emergency care.

The proposal would require all hospitals to identify themselves as to emergency service in one of three ways; as providing comprehensive emergency care, routine emergency care, or as having no announced emergency service. A hospital in the third category would at a minimum have to "accurately inform the community of its potential for providing emergency services" and have explicit policies concerning emergency medical assistance and referral for the cases of medical emergencies that do arise. To offer emergency service, a hospital would have to have, among a detailed list of requirements, in-hospital availability of an M.D. at all times with a Registered Nurse on duty in the emergency room

and would have to announce its capabilities and spell out its policies. More specifically, the capabilities of a hospital offering routine emergency service would have to include twenty-four hour physician coverage of the emergency room with the emergency service the physician's principal assignment, readily available radiological and anesthesiological personnel, and, "if possible," two-way radio contact with "ambulances, dispatches, law enforcement personnel and other hospitals."

A comprehensive service would include these capabilities:

1. Twenty-four hour hospital coverage by at least senior residents in general surgery, internal medicine and anesthesiology.

2. Twenty-four hour emergency room physician and Registered Nurse coverage, without concurrent duties elsewhere.

3. Twenty-four hour radiological and anesthesiological coverage in-house, and

4. Such hospitals "are urged" to have two-way radio equipment linking to the emergency care outreach components.

The third thrust is to seek expanded legal definition of the Department's emergency medical services regulatory powers - particularly with respect to ambulance services - an effort which has been unsuccessfully attempted in the past two legislative sessions. Presently, however, the state legislature is considering a bill submitted directly by the Governor which shows greater promise of succeeding.

The bill would substantially increase the Department's role. "Dual purpose" vehicles (vehicles used by the police and fire departments for both ambulance work and regular duties) now exempt, would become subject to regulation. Regulatory authority would cover not only sanitary conditions but also subjects "...including but not limited to requirements governing ambulance personnel, safety, sanitation, equipment, medical supplies, and records." The Department of Public Health would be allowed "to make such reasonable classifications of ambulances, by type of vehicle and purpose, and ambulance services, by nature and scope of service, as it finds necessary or appropriate in the public interest."

Further, it would have "determination of need" powers as to the distribution of services and vehicles, and it would have the power to delegate to subdivisions authority relating to regulations. A date of January 1, 1974 should be set as a deadline for compliance with training requirements to be established by the Department. In addition, the legislation would mandate the creation of an emergency medical services advisory board similar to that proposed in the grant application. The enforcement mechanism is also much strengthened.

Other Influences on the Guidance System.

Recently, the Tri-State Regional Medical Program announced that Federal emergency medical service-related money would be available for the coming fiscal year and a hurried grant proposal for Massachusetts was assembled with the Department of Public Health and regional health planning agencies inputs. If the grant is in fact obtained in roughly the amounts requested, it will allow the establishment of a state-wide data system, creation of regional emergency medical services planning mechanisms where none exist and improvement of communications systems, training programs, community education activities, and other programs, as specified by individual regional health planning agencies.

Also exerting subtle influence over emergency medical services guidance in Massachusetts are voluntary and professional associations, such as the Massachusetts Heart Association, Massachusetts Medical Society, Red Cross, Massachusetts Ambulance Association. The impact of such groups in the guidance process is difficult to assess accurately. They act as interest groups in the process, pressing for reforms or actions they feel would be valid and rather successfully vetoing moves they oppose, yet their advocacy is, in most cases, translated into real action only in areas very central to their identity. Individuals, however, from such organizations serve devotedly in a number of guidance capacities such as advisory committees.

The Joint Commission on Accreditation of Hospitals, also has minimal influence on the policy and practice of hospital emergency service delivery. It has set out five basic standards of evaluative

accreditation pertaining to emergency medical services of which the first is that: "A well-defined plan for emergency dare, based on community need and on the capability of the hospital, shall exish within every hospital." In elaborating on the standard, the Joint Commission elaborates the standard as requiring that even a hospital without an emergency service per se must have a plan for effectively referring emergency patients when the need occurs, and also that a "hospital and its medical staff should promote, and help to develop a community-based emergency plan, and should show evidence of such participation."[8]

Although it is unclear how much overall importance these considerations are given in accreditation, indications are that they are not stringently pursued.

Guidance Within the Region

As noted, the bulk of the guidance of Region II emergency medical service delivery occurs within the region. No emergency medical services advisory commiteee or other region-wide planning body presently exists. Rather, the process is fragmented at the level of providers. Chapter III will discuss their role in the context of a description of the delivery system.

NOTES

[1]Curry, Op. Cit., p. 14.

[2]General Laws, Chapter 90, Paragraph 7f, Registry of Motor Vehicles, Ambulance Drivers, First Aid Training, 1957.

[3]General Laws, Commonwealth of Massachusetts, Chapter III, Paragraph 8B, Department of Public Health, Sanitary Conditions of Ambulances and Equipment.

[4]Although the authority was limited to the regulation of sanitary conditions and equipment, the actual regulations are broader than that and, therefore, cannot be effectively enforced at the margins.

[5]Interestingly, the predominant source of the few complaints that are on file is other ambulance services, and even this is usually limited to the private services which compete for business.

[6]Department of Public Health, Division of Hospital Facilities, Rules and Regulations Relative to Ambulances, April 10, 1968, p. 9.

[7]State Licensure Rules and Regulations for Hospitals and Sanatoria in Massachusetts, 1950, p. 19.

[8]Accreditation Manual for Hospitals, 1970, p. 71.

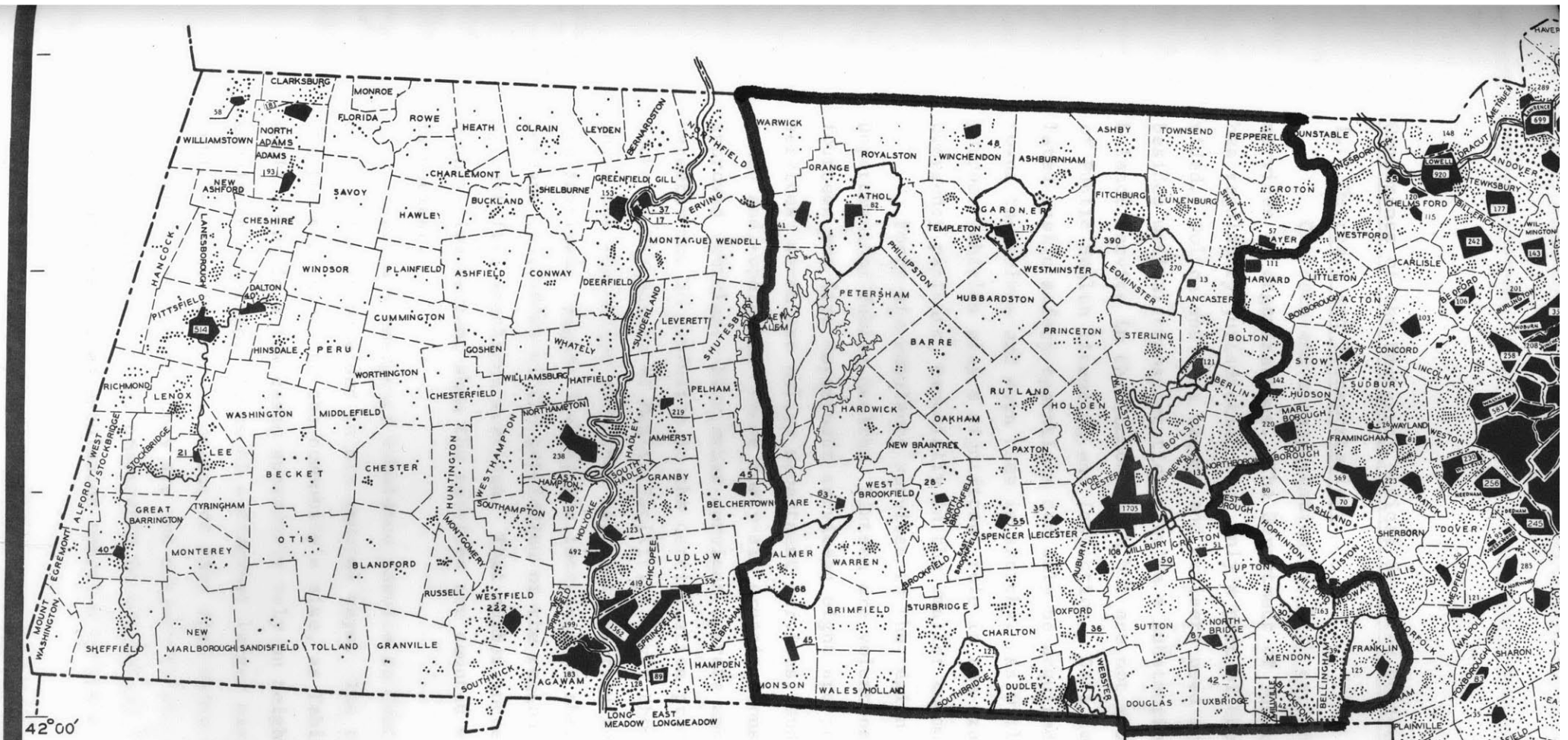
Chapter III: The Case of Emergency Care Delivery in Central Massachusetts

This Chapter will describe the resources available to provide emergency medical assistance in Central Massachusetts. The emphasis will be on the outreach and transportation component of the response system. Hospital emergency care will be considered to the extent that it affects outreach. Call-receiving arrangements will get only minimal attention. The description will be based on the information gathered within the region by interviews, phone calls, and two surveys, and on information about regional emergency medical resources available from the state. Existing Massachusetts laws and requirements will be used as standards in this chapter. Throughout the description of the resources themselves and the patterns of resource origin, the role of the decision-making and operations control activities of the individual providers of service will be noted.

The Setting

The study area lies roughly between Route 495 and the Quabbin Reservoir east of Amherst. In that region there are seventy-one towns and four cities, ranging in population (1970) from New Salem (474 inhabitants) at the west boundary to Worcester with 176,572.[1] Thus, the region contains 21.4 percent of the 351 towns and cities in the Commonwealth of Massachusetts, almost a quarter (1,936 square miles) of the land area, and about one-eighth (713,721) of the state's population.

The distribution of population can be seen on the map in Figure 2. The primary cluster is in the Worcester-Shrewsbury area with a population of 195,768 and a density of 3,380 per square mile; a secondary cluster is in Fitchburg-Leominster with a total population of 76,282 and a density of 1,357 in 1970. These two urban areas together make up thirty-seven percent of the Region's population. Other smaller aggregates occur in Gardner, Milford, Franklin, Southbridge, Webster, Clinton, Athol, and Palmer. Route 9, Route 2, Route 12, and the Blackstone River are the major population axes.



THE COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF COMMUNITY AFFAIRS

POPULATION DISTRIBUTION

1970

FIGURE 2

LEGEND

EACH DOT REPRESENTS 100 PEOPLE
POPULATION DOTS WITHIN SOLID AREAS DESIGNATED BY NUMBER
TOTAL POPULATION

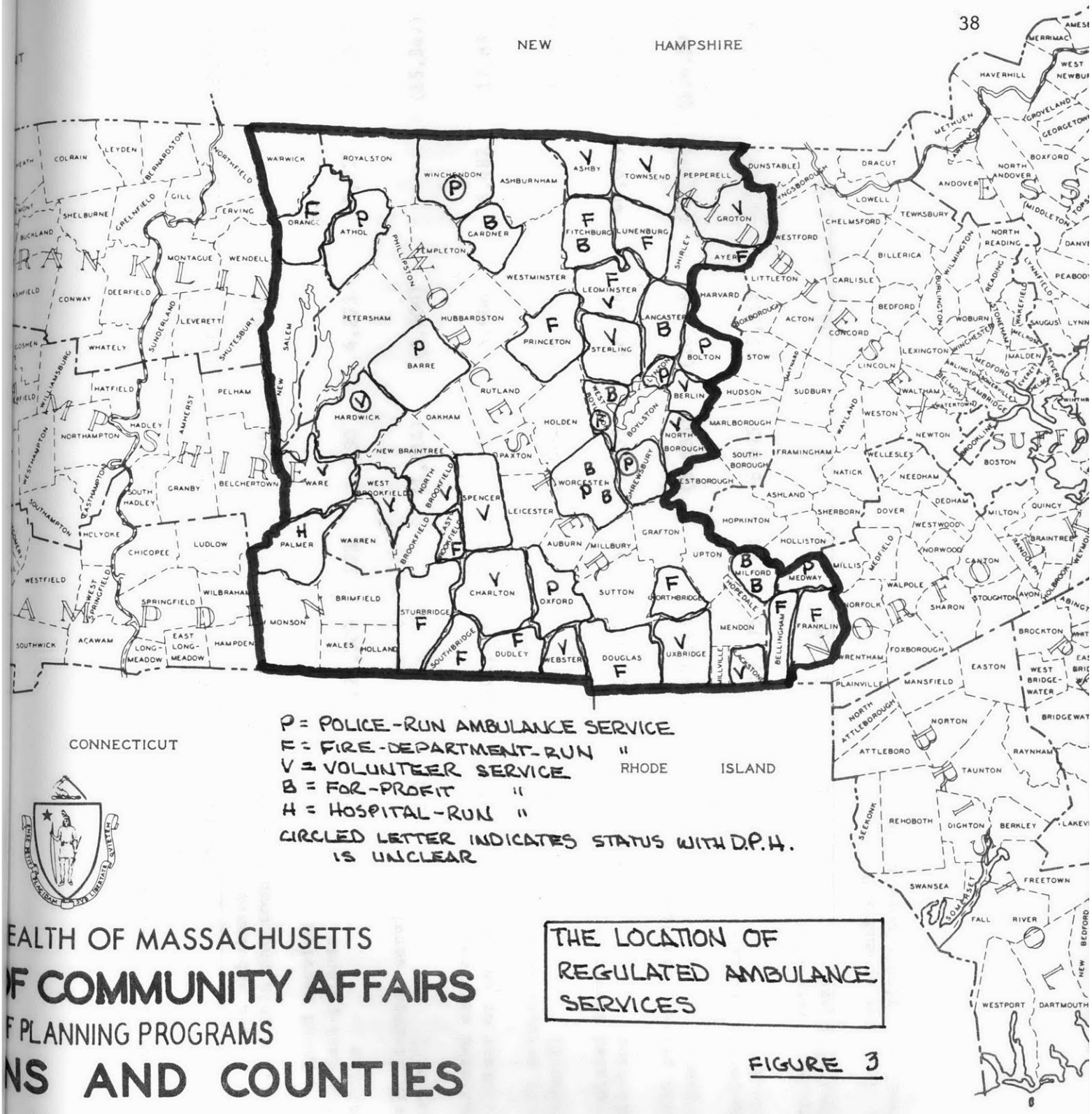
Components of the Emergency Medical Services Delivery System

1. Outreach and Transportation.

Outreach and transportation are both carried out by ambulance services or organizations. The Department of Public Health, as noted, has regulatory jurisdiction over only a part of the total service provided. Police and fire wagons and cruisers used for other purposes besides medical transportation provide a substantial part of the ambulance service in the Commonwealth but are not subject to the Department of Public Health licensing and inspection. Data concerning these unregulated public safety operations can only be acquired directly from the towns themselves and even then is sketchy. As will be seen, dual-purpose vehicles play a significant role in the transportation of emergency patients, especially in the smaller communities.[2]

Forty-six ambulance services in the region are certified by the Department of Public Health. Sixteen are volunteer rescue squads; fourteen are fire department services; eight are private, for-profit services; seven are police department services; and one is hospital-owned and -operated. These forty-six organizations use fifty-eight approved vehicles. Four other services operate ambulances which, apparently due to confusion in the certification process, are not on the books at the Bureau of Health Facilities, even though the operators are under the impression that they have met the requirements. Five vehicles are involved. Figure 3 shows the locations of these services. Eighty percent (571,4000) of the population of the region live in towns served by certified ambulance services. That number increases to 606,100 or eighty-five percent when the services are counted whose licensure status is unclear.

Primary emergency ambulance service to Central Massachusetts communities is provided in six general ways. The type of coverage relates, for the most part, to the community's size, as Table 1 reveals. Very small towns in a few cases apparently rely on neighboring communities for ambulance coverage. Towns of a somewhat larger size are serviced by vehicles used in general police or fire work which double as ambulances (though, as mentioned, they are not subject to state regulation as such). A third group of cities, comparable in population to those in the previous group, have certified ambulances operated by volunteer squads or on-call



EALTH OF MASSACHUSETTS

F COMMUNITY AFFAIRS

F PLANNING PROGRAMS

NS AND COUNTIES

THE LOCATION OF REGULATED AMBULANCE SERVICES

FIGURE 3

NOTE: NORFOLK COUNTY INCLUDES BROOKLINE AND COHASSET

Table 1: Community Characteristics by Type of Ambulance Coverage

TYPE	NO. OF COMMUNITIES [1]	TOTAL POPULATION	% [2]	SMALLEST COMMUNITY	MEDIAN COMMUNITY	MEAN COMMUNITY	LARGEST
(1) No organized ambulance service within the town	11	14,461	2%	474	872	1,315	4,292
(2) Unregulated service using dual-purpose vehicles	21	120,309	17%	730	4,273	5,729	15,347
(2a) (with licensed service support)	(12)			(1,014)	(6,609)		(15,347)
(3) Regulated service-volunteer or on-call	31	201,966	28%	1,681	5,606	6,482	17,830
(3a) (with private service support)	(9)			(1,681)	(4,281)		(8,779)
(4) Regulated service - full-time	8	320,310	45%	6,635	18,126	40,039	176,572
(4a) (with private service support)	(6)	(292,068)		(6,635)	(26,068)	(48,678)	(176,572)
(5) Regulated service-private	3	45,175	6%	6,095	19,352	15,065	19,748
(6) Regulated service-hospital-based	1	11,680	2%	NA	NA	NA	NA

1 For a list, see Appendix D
2 Per cent of region's population

policemen or firefighters. A fourth set, mostly large communities, use public ambulances operated under the auspices of a full-time public safety department. Three communities get primary emergency coverage from private ambulance services, and one uses a hospital-based and - operated ambulance. There is some variation within each group, as no two towns have exactly similar arrangements. The towns in each type are listed in Appendix D. A description of general characteristics of each class follows:

Little can be said about towns which apparently have no ambulance-type vehicles of their own because little is known. Some use sedan cruisers to transport patients, calling on an adjacent ambulance service when a patient needs to be transported in a supine position. Others rely on adjacent services for regular coverage as well. A few of the smallest also rely on neighbors for police or fire support in non-medical situations. Eleven towns, comprising only two percent of the region's population, are included here. Improvement in ambulance coverage in these towns will be hindered by the small demand generated.

Of the second group relying primarily on "dual purpose" vehicles operated usually by the police department, the service is normally provided without charge,[3] and is limited in all cases to the town only, that is, to town residents or to persons injured or incurring illness while in the town. The vehicles are station wagons. In the larger communities, they may be used as cruisers, and police chiefs take pride in the rapid response that is enabled by having them on the road. In the smaller towns, the force in on-call only and the vehicle must be activated for both general police duty and for medical emergencies.[4] Generally, first aid equipment is very limited and the first aid rendered minimal. Even in the larger towns, often only one policeman is in the vehicle. Twenty-one towns rely heavily on dual-purpose vehicles. Three others use them occasionally to back up private or hospital ambulances. Of the twenty-one comprising seventeen percent of the region's population, twelve are within the active service district of a certified ambulance, which some use whenever possible for emergency work. Five towns, all adjacent to Worcester, have a wagon cruising

twenty-four hours a day; another half dozen have a wagon cruising part-time. Officially, the vehicles should only be used for medical transport in "emergency" situations. That requirement is interpreted loosely, since alternative coverage may be minimal. Also police and fire departments are reluctant to question a claimed emergency unless the misuse is blatant.

Twenty-eight percent of Central Massachusetts residents live in the thirty-one towns of the third category. These towns are served by the Department of Public Health-regulated ambulance services using volunteer or on-call personnel.[5] The vehicles are Cadillic-type ambulances, for the most part. The services use municipal or public safety dispatch systems. In twenty-nine, the regular service districts include the town only. Of the other two, one serves five towns. The idealism tends to be high and the first aid competent. Often there is no charge for the call. The major difficulty with this service is the unavailability of personnel during the working hours, but these are small services with low utilization rates. Nine of the services are part of private ambulance company districts.

Full-time police or fire departments handle the ambulance function in eight communities. The exact format varies. In some cases, a number of the personnel may be part-time only. In the largest cities, the ambulance personnel are assigned specifically to this function, in some cases as their first assignment with the force. In other communities, the first available men act as the ambulance crew when a call arrives. The service areas are limited in all but one case to the community itself, except in mutual aid situations. The equipment for rendering first aid is much greater than in towns using cruiser-wagons, but the training of the men may not be greater. These are the busiest services in the region and the men are frequently exposed - for better or worse - to emergency situations. Two cases included here, Winchendon and Shrewsbury, are not presently certified. The Department of Public Health files show the Winchendon service as having been terminated and have no information or record of Shrewsbury, although it has operated two ambulances for some time. Six of these

are part of active service districts of private ambulance companies as well. The eight constitute forty-five percent of the region's population.

The communities which depend on private, for-profit companies for their ambulance coverage include only a sixteenth of the residents of Central Massachusetts. They are Gardner, Milford, and Lancaster. Gardner pays a monthly fee to Wood's Ambulance Service to provide service on a twenty-four hour basis, and Milford has two services which share the business and to which the police department alternately refers its calls. All get some back-up, but only Lancaster has a station wagon available as back-up in each community, the chief of the department with back-up responsibility felt satisfied with the arrangement. In all three cases, the company provides ambulance service beyond the town itself.

The only other major type, found in just one town, is that of a hospital-owned and-operated service, using a certified vehicle. This is in Palmer, affiliated with the Wing Memorial Hospital. The critically important difference between this coverage and that of the private services described below is that a much higher level of medical care can be provided at the scene and underway. In addition, the medical supervision is much more effective since it uses registered nurses from the emergency room and has radio contact with the emergency room. The police can provide transportation back-up with a station wagon but have very little first aid capability. The Wing Hospital ambulance serves six towns on a regular basis.

Three private ambulance services, based in Worcester and Holden, also provide some emergency service, but do not have primary responsibility for emergency outreach in any community. Their major function is transporting elderly and convalescent patients on a scheduled call basis. This service is, in two of the cases, provided to a large number of towns in the Worcester and Holden emergency medical services system. The third company serves Worcester primarily. One firm actually operates under two names, one for Worcester and one for the Holden-West Boylston area.

A good deal of medical transportation is provided in police

cruiser sedans, besides that in dual purpose wagons. The Worcester Police Department has the responsibility, for example, to provide transportation to welfare and old age assistance cases, which runs into "hundreds of calls each month."[6] The concern here, however, is that the cruisers are used in medical emergencies. The occasions of such use arise when other vehicles are unavailable, when ambulances take too long, and when the patient's condition warrants quick medical attention but still allows the patient to sit up. The use of cruiser sedans is clouded because no separate record is kept, but should probably be reduced because the vehicle is not equipped or designed to handle many medical needs. The survey of arrival modes at the five largest hospitals indicated that fifty-eight percent of the cases arriving by cruiser or cruiser-wagon are urgent, amounting to more than ten cases per day at the five hospitals. A review of daily accident reports in the Worcester Telegram over a three-month period turned up a number of cases where cruiser transportation of emergency patients had apparently occurred after serious accidents in the Central Massachusetts area. One such case, probably justified, is reported in a newspaper article reproduced in Appendix F.

The State Police also respond in certain emergency medical situations. Other than on the Turnpike, their involvement is generally limited to mutual aid in traffic accidents on state highways. State Police no longer have ambulances or station wagons equipped with first aid gear, except on the Turnpike and in isolated other areas. Nor do the men automatically go through the first aid course formerly required. A phone conversation with the state office supported the inference that they would prefer to reduce their responsibility for emergency medical outreach.

2. Hospital Emergency Care.

Twenty hospitals are located within the study area, not including the U.S. Army Hospital at Fort Devens (which, though it does provide service to the civilian community in critical situations, will not be considered a part of the delivery system for the purposes of this study.[7] Of the twenty, one hospital - Doctors' of Worcester - has no emergency service and will not be considered in detail.

Table 2: Summary of Hospital Emergency Facility Statistics *

HOSPITAL	LOCATION	BEDS	TOTAL ADMISSIONS	EMERGENCY[1] FACILITY CATEGORY	TOTAL ER VISITS	ER VISITS: TOTAL ADMISSIONS
Athol Memorial	Athol	103	3,118	Provisional	2,279	0.7 : 1
Nashoba Community	Ayer	84	2,892	Basic 2	3,968	1.4 : 1
Clinton	Clinton	82	2,625	Basic 2	6,068	2.3 : 1
Burbank	Fitchburg	247	7,999	Basic	14,015	1.8 : 1
Henry Heywood Memorial	Gardner	152	5,363	Basic	8,809	1.6 : 1
Holden District	Holden	85	3,203	Basic 2	7,858	2.4 : 1
Leominster	Leominster	126	5,170	Provisional	15,231	2.9 : 1
Milford	Milford	126	4,933	Basic 2	6,505	1.3 : 1
Whitinsville	Northbridge	30	549	Provisional	1,895	3.5 : 1
Wing Memorial	Palmer	80	1,941	Basic	10,449	5.4 : 1
Harrington Memorial	Southbridge	102	4,470	Basic 2	12,259	2.8 : 1
Mary Lane	Ware	79	2,989	Provisional	2,774	0.9 : 1
Hubbard Regional	Webster	55	2,483	Basic	7,390	3.0 : 1
Winchendon	Winchendon	46	1,570	Provisional	?	?
Doctors	Worcester	120	4,123	Referral	NA	NA
Fairlawn	"	103	3,977	Basic 2	2,023	0.5 : 1

Table 2 continued

HOSPITAL	LOCATION	BEDS	TOTAL ADMISSIONS	EMERGENCY 1 FACILITY CATEGORY	TOTAL ER VISITS	ER VISITS: TOTAL ADMISSIONS
Hahnemann	Worcester	215	8,963	Basic	24,000 ?	2.73: 1
Memorial	"	379	14,238	Major	28,004	2.0 : 1
St. Vincent	"	600	16,509	Major	23,927	1.5 : 1
Worcester City	"	448	11,866	Major	53,305	4.5 : 1
U.S. Army Hospital	Fort Devens	320	4,382	Basic	?	?

1 Classification of American Hospital Association

2 This emergency room, though listed as basic, has limited MD coverage and is in that way similar to a provisional unit

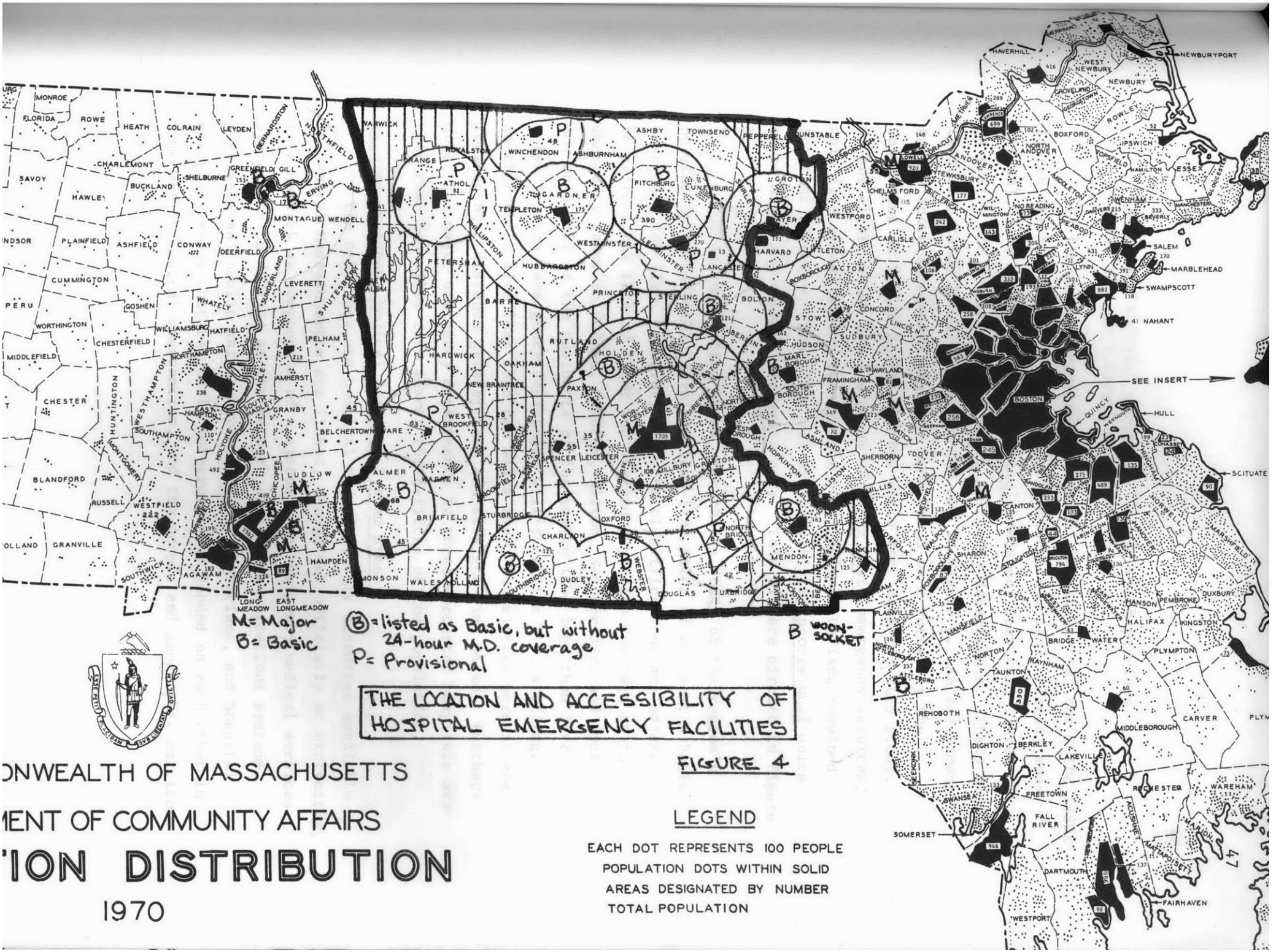
* Source: GUIDE ISSUE, Hospitals, JAHA, August 1971; Annual Statistical Reports, Department of Public Health, 1971

These hospitals are the principal end points of emergency medical services delivery within Central Massachusetts. Other hospitals which have some significance for emergency care in the region are the Woonsocket, (Rhode Island) Hospitals to the south; the Framingham Union, Marlborough, and occasionaly Emerson (Concord) Hospital to the east of the region; and the Greenfield and Springfield hospitals to the west.

As Figure 4 indicates, the hospitals are distributed throughout the region with the largest gap being in the rural area around the Brookfields and Barre. The distances between hospitals in Region II are relatively large for Massachusetts but not as great as in the western part of the State.[8] Eighty percent of the population of the region lives with five miles of an emergency facility.

Hospitals vary in their policies and capacities pertaining to emergency service. They differ as to their staffing patterns and the depth of experience and expertise of the personnel, scope of their direct and support services, and the size and comprehensiveness of their facilities. In its most recent annual GUIDE ISSUE of its journal,[9] the American Hospital Association introduced a self-classification system to allow hospitals to identify the kind of emergency service they offer. Four classes were listed:

> MAJOR EMERGENCY DEPARTMENT: "Organized facilities and services capable of rendering advanced surgical and medical procedures, staffed twenty-four hours a day by medical and support personnel, with diagnostic facilities, blood bank, and special purpose operating rooms continuously available."
>
> BASIC EMERGENCY DEPARTMENT: "Organized facilities and services capable of rendering care for most life-threatening emergencies but without highly specialized resuscitative and surgical capabilities, staffed twenty-four hours a day by medical and nursing personnel, diagnostic services and blood bank continuously available."
>
> PROVISIONAL EMERGENCY UNIT: "Limited to minor conditions and emergency resuscitation with professional nursing personnel available twenty-four hours a day, and part-time or on-call physician service. Diagnostic and supporting equipment are continuously available."



THE LOCATION AND ACCESSIBILITY OF HOSPITAL EMERGENCY FACILITIES

FIGURE 4

ONWEALTH OF MASSACHUSETTS

MENT OF COMMUNITY AFFAIRS

TION DISTRIBUTION

1970

LEGEND

EACH DOT REPRESENTS 100 PEOPLE

POPULATION DOTS WITHIN SOLID AREAS DESIGNATED BY NUMBER TOTAL POPULATION

EMERGENCY REFERRAL SERVICE: "A unit which provides first aid and referral services only."

Of the twenty hospitals in Central Massachusetts, the GUIDE ISSUE listed one in the referral category (Doctors' Hospital, already mentioned), five as providing provisional emergency services, eleven as basic, and three as having major emergency departments. These are listed in Table 2 and located on the map in Figure 4. An adjustment to the above categories has been made based on a survey by the Department of Public Health and the field work done for this study. Of the eleven which are listed as offering basic emergency services, only five actually have twenty-four hour medical staffing required for that category. The other six are essentially provisional units as to night and weekend emergency care. This six are circled in Figure 4.

During the daytime hours, two-thirds (68%) of the region's population lives within five straight-line miles of at least a basic emergency facility. However, when the classifications are adjusted to reflect the lack of night and weekend physician coverage at the emergency rooms in Holden, Clinton, Milton, Southbridge, and Ayer, now only half of the residents of the region live less than five miles from an emergency department will full-time M.D. staffing. Another third live less than ten miles away, but sixteen percent are located at a distance greater than ten straight-line miles. Furthermore, the major emergency departments in three Worcester hospitals are more than ten miles from almost three-fifths of the population.

Mapping Emergency Medical Services System Areas

The ambulance and hospital emergency care resources available in Central Massachusetts are linked, though not officially or explicitly, in a network as components of a system. An emergency medical services system can be defined as the network of all communications systems, ambulance and public safety organizations, physicians, and hospital emergency rooms that regularly interrelate or depend on each other in some way in medical emergencies, and the people and geographic territory they serve.

Though all emergency medical services in the region can be considered as part of a single delivery system, there are benefits to be gained from breaking the whole down into a set of smaller scale systems to allow comparisons as to geographic and other variables as data is presented. In addition, smaller system areas will turn out to correspond more closely to the pattern of day-to-day operations and interactions of provider entities. The succeeding paragraphs describe the method used to derive eleven catchment areas, each served by relatively complete and independent emergency medical services networks. The number has no meaning, in itself. It is simply the result of the process of attempting to get a manageable number and to eliminate dependent networks.

The analysis will be taken through two stages at this point. First, the emergency catchment areas of individual hospitals will be defined, based primarily on the identification by ambulance services of the hospital to which they transport most frequently in emergency situations.[10] Some of the networks so defined turn out to be incomplete and dependent on other networks or inconsistent with other information, such as the service districts of ambulance organizations, the patterns of referral and M.D. staff assignments, and general community orientation. These inputs will result in some redefinition of system areas and a reduction to a more manageable number.

Seventeen hospitals, including two not in the study area, were initially identified as primary destinations of ambulance services, Four Region II hospitals other than Doctors' Hospital were not named by an ambulance service as a primary hospital: Whitinsville, Winchendon, and Fairlawn and Hahnmann in Worcester. The last one, Hahnmann, which has a high-volume emergency department, may be in this group because no response to this question was available from Boylston, the town closest to the hospital. The two hospitals outside the region boundaries which are primary nodes for ambulance services in the region are the Marlborough Hospital - for the towns of Northboro, Berlin, and Bolton - and the Woonsocket Hospital - for Millville, Blackstone, and much of Bellingham. The towns with the most unclear linkages are Boylston, Douglas, Hardwick. North Brookfield, and New Braintree. The seventeen areas are shown in dotted lines in Figure 5.

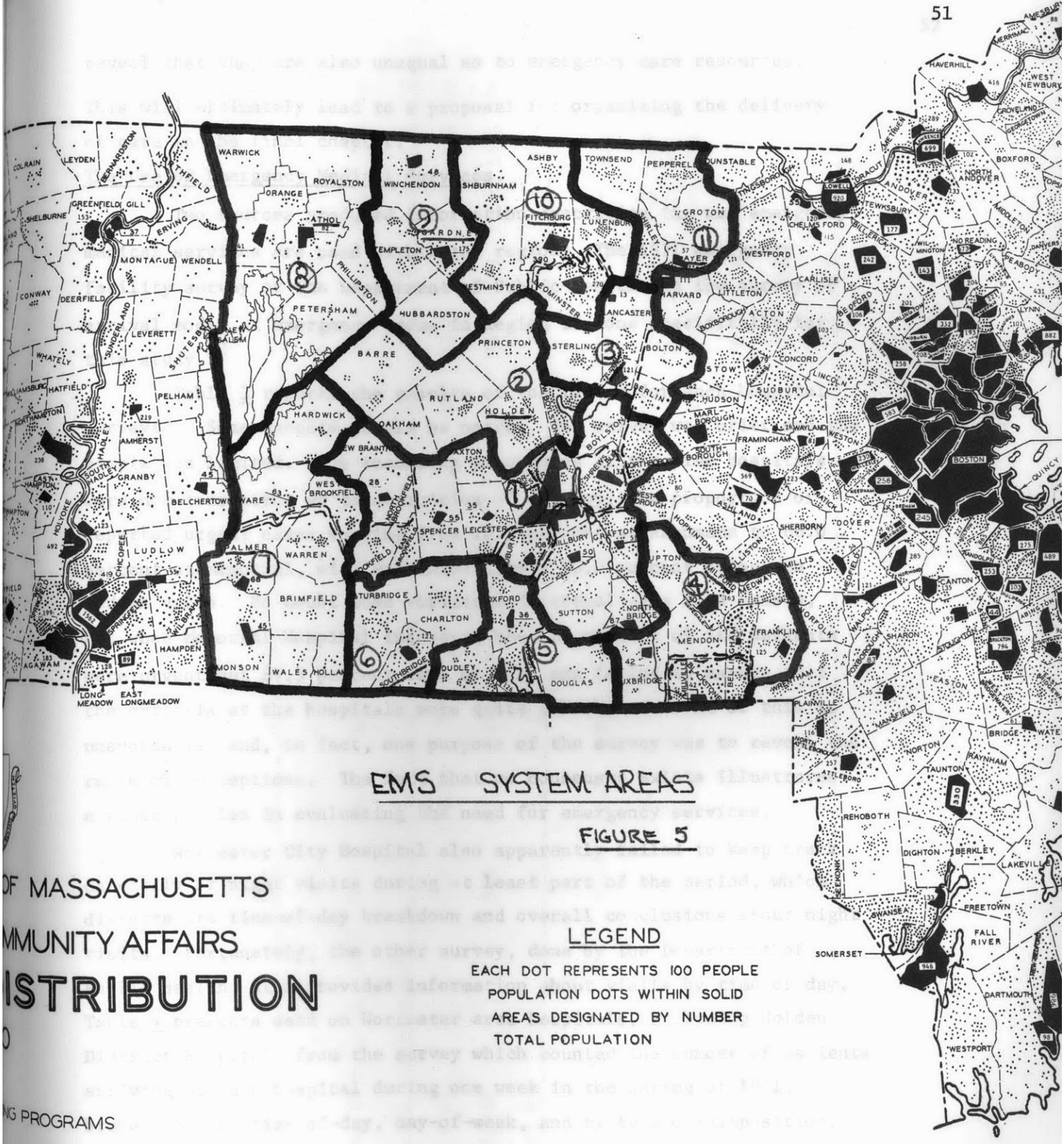
The results of this initial description were unsatisfactory for Worcester. A division into three emergency medical systems is an artificial state which does not take into account a number of features of emergency medical services delivery which cannot be so divided. First, the residents of the city do not divide in their choice of hospital emergency facilities on clear geographic lines. Second, the ambulance services in the city serve all of the hospitals on occasion, even though the prime emergency ambulance provider, the Worcester Police Department, transports as a general policy to the Worcester City Hospital.[11] In addition, the hospitals share an area-wide disaster plan and overlapping physician pools, Hence, the Worcester case was redefined a single system area, incorporating the emergency catchment areas of the Memorial, St. Vincent, and Worcester City Hospitals. One system makes more sense in terms of the unifying forces mentioned and allows the inclusion of Fairlawn and Hahnmann Hospitals and the town of Boylston.

The emergency service areas of Mary Lane Hospital in Ware and of Wing Hospital (Palmer) were considered as a single catchment area as were those of the Leominster and Burbank (Fitchburg) Hospitals for reasons of interdependence similar to those cited in the Worcester case.

The towns in the partial systems area of non-Region II hospitals were circumscribed into service areas of the Region II hospitals with which they have an affiliation: Northboro into the Worcester system; Berlin and Bolton into the Clinton area; and Bellingham, Blackstone, and Millville with the Milford emergency medical services area.

Finally, the four other towns without clear assignment were included in the hospital emergency service area to which they seem to have the most ready geographic access.

The eleven system areas are shown in heavy lines in Figure 5. Their member towns are listed in Appendix C along with basic population data. As can be observed, the areas are by no means uniform as to size - either i- terms of population or geography. The following pages will



EMS SYSTEM AREAS

FIGURE 5

OF MASSACHUSETTS

MMUNITY AFFAIRS

ISTRIBUTION

O

NG PROGRAMS

LEGEND

EACH DOT REPRESENTS 100 PEOPLE

POPULATION DOTS WITHIN SOLID AREAS DESIGNATED BY NUMBER

TOTAL POPULATION

20 30 40

MILES

ORMATION

CENSUS

72° 00'

71° 00'

reveal that they are also unequal as to emergency care resources. This will ultimately lead to a proposal for organizing the delivery of care in the final chapter.

The Use of Emergency Medical Services.

Two sources produced information describing the way emergency medical services are used within the region: The 1971 emergency facility survey of the Department of Public Health and the survey of arrival modes at emergency rooms in Region II done specifically for this study.[12]

Table 3 reports the results of the latter for each hospital surveyed. Some caveats should be noted: The survey was brief and the sample was limited. The recording procedures at the five hospitals were not consistent as to definition of urgency, the proportion of reported urgent cases varying from 10.5 percent at Hahnmann to 86.0 percent at Memorial, with Worcester City's 55.0 percent being the median value. No doubt some variation in actual case load exists, but when Memorial Hospital indicated that 86 percent of its patients were urgent but 87.5 percent came by car, one is led to assume that the criteria at the hospitals were quite different. Some of this is unavoidable, and, in fact, one purpose of the survey was to reveal the range of perceptions. The fact that no consensus exists illustrates a basic problem in evaluating the need for emergency services.

Worcester City Hospital also apparently failed to keep track carefully of night visits during at least part of the period, which distorts its time-of-day breakdown and overall conclusions about night visits. Fortunately, the other survey, done by the Department of Public Health, also provides information about visits by time of day. Table 4 presents data on Worcester area hospitals, including Holden District Hospital, from the survey which counted the number of patients arriving at each hospital during one week in the spring of 1971, broken down by time-of-day, day-of-week, and by type of disposition.

Together, these two sources indicate that night visits (from 11 p.m. to 7 a.m.) make up less than 10 percent of the total daily

Table 3: Utilization Data for Large Emergency Facilities, by Hospital *

ITEM	WORCESTER CITY	%	MEMORIAL	%	ST. VINCENT	%	HAHNEMANN	%	BURBANK	%	TOTAL	%
"TOTAL VISITS"	729	100.0	375	100.0	343	100.0	387	100.0	266	100.0	2100	100.0
day (7 a.m.-3 p.m.)	443	60.5	155	41.5	152	44.0	221	57.0	133	50.0	1104	52.5
evening (3 p.m.-11 p.m.)	239	33.0	185	49.0	145	42.0	145	37.5	108	40.5	822	39.2
night (11 p.m.-7 a.m.)	47[2]	6.5	35	9.5	46	14.0	21	5.5	25	9.5	174	8.3
age: 0-11	165	22.5	99	26.5	79	23.0	90	23.0	39	14.5	472	22.5
12-64	500	68.5	249	66.5	231	67.0	270	70.0	202	76.0	1452	69.1
65 +	64	9.0	27	7.0	33	10.0	27	7.0	25	9.5	176	8.4
Mode of Arrival: private car	547	75.0	328	87.5	258	75.0	328	85.0	203	76.5	1664	79.2
police cruiser	33	4.5	12	3.0	39	11.5	17	4.5	4	1.5	105	5.0
municipal ambulance	44	6.0	8	2.0	12	3.5	10	2.5	28	10.5	102	4.9
private ambulance	6	1.0	4	1.0	3	1.0	2	0.5	8	3.0	23	1.1
taxi	36	5.0	3	1.0	4	1.0	14	3.5	11	4.0	68	3.2
other	63	8.5	20	5.5	27	8.0	16	4.0	12	4.5	138	6.6

Table 3 continued

ITEM	WORCESTER CITY		MEMORIAL		ST. VINCENT		HAHNEMANN		BURBANK		TOTAL	
		%		%		%		%		%		%
Urgent Visits [3]	399	55.0	323	86.0	68	20.0	41	10.5	153	57.5	984	46.8

1 Visits during six days beginning Feb. 8 through Feb. 14, 1972.
2 This number represents an incomplete count.
3 "Urgent" was defined simply as needing "immediate Medical attention".
* Source: Survey of Arrival Modes, February 1972. 100 per cent sample for six days, including a weekend. Entries made by ER personnel.

Table 4: Emergency Room Visits by Time of Arrival, Disposition, and Relationship to Physician Coverage* - Worcester Area Hospitals.[1]

	NUMBER OF VISITS[2]	% OF TOTAL
Total Visits	2854	100.0%
Time of Day		
-day (7 a.m. - 3 p.m.)	1465	51.0%
-evening (3 p.m. - 11 p.m.)	1106	38.2%
-night (11 p.m. - 7 a.m.)	283	9.8%
Weekend Visits	693	24.3%
Visits during Low Coverage Period[3]	1731	60.7%
Treated and Discharged	2284	80.0%
Admitted to Hospital	293	10.3%

1 Fairlawn, Hahnemann, Memorial, St. Vincent, Worcester City, and Holden District Hospitals.
2 Totals for one week.
3 Weekday evenings and nights plus all day Saturday and Sunday
* Source: Hospital Emergency Facility Survey, Bureau of Resource Development, Department of Public Health.

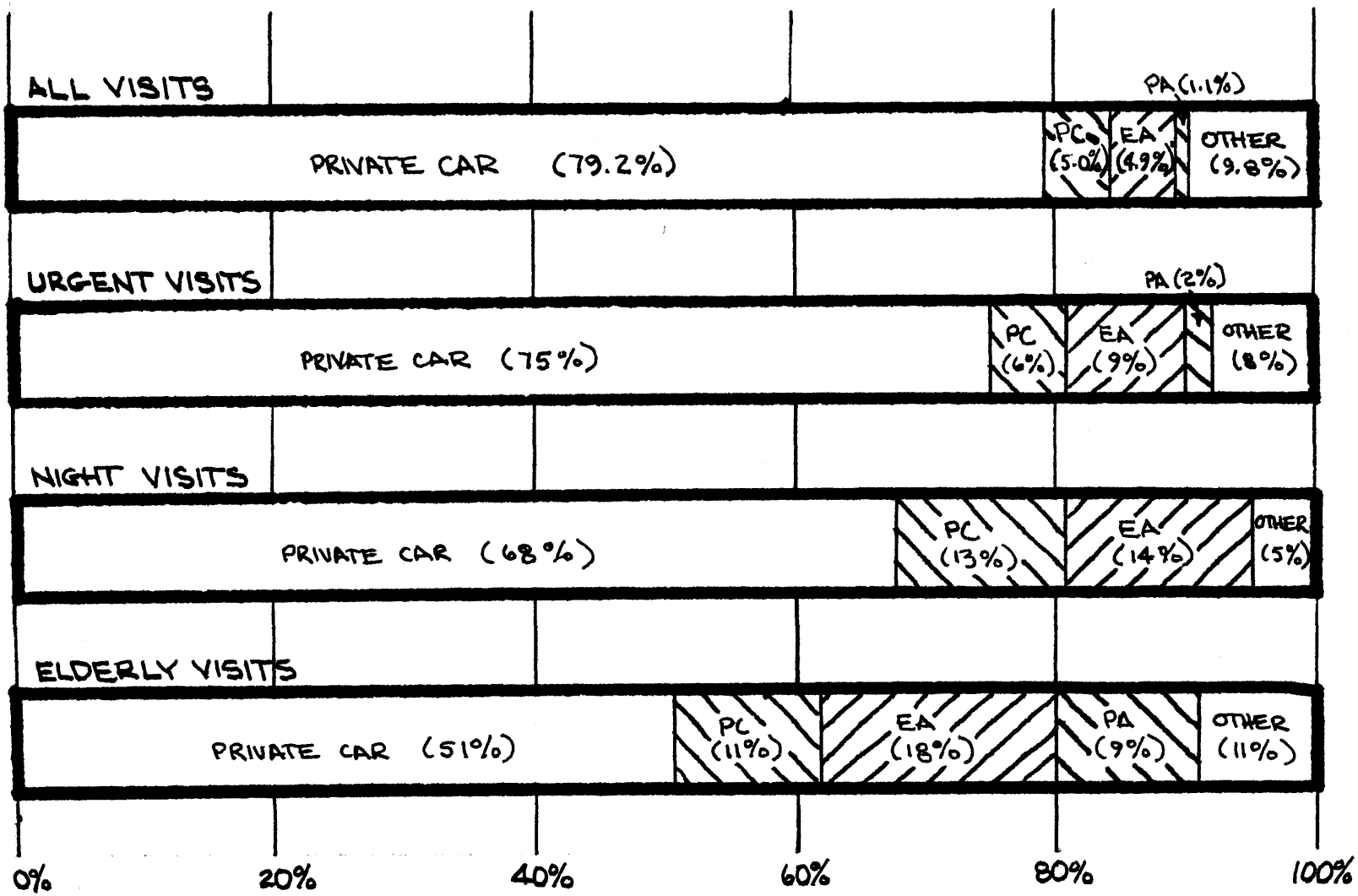
volume of the emergency rooms, yet the evening shift (from 3 p.m. to 11 p.m.) sees almost two-fifths of the total daily volume. Both shifts are times of low M.D. coverage in the region as a whole. From the arrival modes study, 58 percent of the visits during these hours are classed as urgent. When weekend visits are added to weekdays, evening, and night visits, the total equals 61 percent of all visits - thus, three-fifths of the visits come when physician coverage is weakest.

Eighty percent of all visits during the period were taken care of in the emergency room and discharged. Only one-tenth were admitted (the proportion at Holden was one-sixth) and of the remaining 10 percent, two-thirds were referred to the out-patient clinic or another facility.

As to the means of transportation used, emergency vehicles accounted for 11 percent of the arrivals (see Fig. 6) but 17 percent of urgent arrivals. If the Memorial Hospital figures are excluded, the latter proportion is 22 percent. Interestingly, the variable with the strongest association with the use of emergency vehicles is age: 38 percent of the patients sixty-five or older came by police cruisers or public or private ambulance. Night visits are also more likely to arrive by emergency transportation (more than one-fourth of those visits, as opposed to the expected 11 percent).

Analyzing the types of emergency transportation separately - public ambulances are used predominantly (85 percent) for urgent cases and their use is skewed toward transporting elderly patients (30 percent of their business.) They are used at night three times as often as would be expected (24 trips instead of the expected 8.4), based on their overall share. Patients arriving by private ambulance have urgent conditions 70 percent of the time, are elderly in three-fourths of the cases, and mostly come during the day shift (17 of 23 cases).[13] Patients arriving by police cruisers or cruiser wagons are less distinctive than those coming by ambulance but still tend to be elderly, to be in urgent need of care, and to arrive at night.

Nevertheless, three-fourths of emergency room patients, including



PC = POLICE CRUISER EA = EMERGENCY AMBULANCE PA = PRIVATE AMBULANCE

THE CHOICE OF TRANSPORTATION MODES FIGURE 6

urgent ones, are said to come by car.[14] As pointed out previously, these patients seldom give advance notice of their arrival, which means that emergency rooms must be ready for whatever shows up. The statistic may also indicate a lack of faith in or knowledge of how to use the ambulance services in the area. The major ambulance organizations serving these hospitals are full-time, and the marginal cost of additional demand for their service would presumably be minimal, based on the number of ambulance vehicles, for serving these hospitals. Each public ambulance presently brings only about one urgent patient per day and each private ambulance, about one every two days.

Capabilities of the System

1. Communications and Dispatching.

Almost every town has a municipal communications and dispatching system, which handles calls for ambulance service, where it is town-provided, as well as the general public safety functions and others. The larger communities have serarate police and fire systems, and calls for ambulances use one or the other, depending upon which runs the service. A few small communities, including those which "borrow" ambulance coverage, use another town's dispatch system. In one instance, Bolton and Berlin are experimenting with a shared system. Through these systems, the dispatching station can communicate with all vehicles using the system, which allows ambulances and police cruisers to have mutual access to each other in the towns where ambulances are municipally dispatched. This enables a patrolman in a cruiser to call for ambulance assistance directly.

The private services and the hospital-based service also have radio-dispatched vehicles in every case, though one service reported that at times it has had to share its frequency with an automobile towing and repair firm's dispatching operation. In these instances regular phone lines must suffice as the link between public safety and ambulance dispatching.

All licensed services are nominally listed on the Department of Public Health records as having twenty-four hour dispatching. However, in many smaller communities and in the case of some of the

private services, at least at night and on weekends, calls are taken at someone's home. If the personnel are on an on-call status, the dispatcher must then make phone calls to a list of people until a crew responds. Some of the private services, without primary emergency responsibilities, actually close down in the evening, for all intents and purposes, and a caller would have a difficult time contacting the service if he tried at night.

The study did not attempt to ascertain in great detail the policies which guide the actions of operators handling incoming calls. The nature of their training for the assignment, the decision criteria they use in determining how to advise callers or whom to contact, the cases in which they refer or transfer calls - these aspects, along with data concerning volume and frequency of service, would be important topics as a follow-up to this report. Ambulance services do have standard practices of screening and verifying calls, which amount to implicit policies of sorts. Two services specifically reported that they do not send an ambulance to a call until they get physician or police cruiser confirmation. A number of others attempt to screen out non-emergency requests for service using implicit criteria. On the other hand, some are quite willing to provide service whenever requested. Volunteer groups who operate at very low volumes and a few public safety services do so because they see it as their duty to "give the public what they pay for." Services which depend on the revenue produced by a large volume of service (especially true of profit-making private companies) are naturally anxious to provide as much service as they can.

The communications and dispatch systems are the means by which a kind of logistical control can be exerted: that is, control over the deployment of resources in the individual case so that the victim of a medical emergency is provided with what he needs where he needs it, without delays, confusion, or mobilization of unneeded equipment or personnel. Present systems in Central Massachusetts use a technology that in many cases is too expensive for the scale at which it is applied. Because of the constrained budgets and the town-by-town pattern of systems, many communities depend on rather

makeshift ways of using the hardware that would be subjected to severe strain in a serious situation.

2. Training and Experience.

This section will present statistics on the training and experience of ambulance personnel in Region II. A 1957 statute requires that every ambulance attendant must be "certified as having successfully completed the senior Red Cross course of first aid training, or has received training....equivalent thereto."[15] However, the methods of gathering information about and enforcing conformance to this requirement are weak. The primary source for the data that will be presented on the training aspect are the Reports of Training and Experience of Attendants, which regulated services are to file with the Department of Public Health for each individual attendant. Because these reports do not always come in, are not kept current, and are not validated as to the claims made, the following statistics are presented not as a clear reflection of reality but as the only picture we have.

Eight percent of the recorded ambulance personnel of regulated services have had only a standard first aid course.[16] The bulk of the ambulance attendants and drivers in the region have an advanced first aid certificate - 81 percent - which is to be expected since this is the implicit requirement. The remainder, about 11 percent, have additional training beyond advanced first aid such as cardio-pulmonary resuscitation, the training course of the American Academy of Orthopedic Surgeons, or military medical corpsman training. (See Table 5)

Illustrative of the deficiencies which exist in the present reporting and validating mechanism are the responses to a question on the December, 1971 survey pertaining to training beyond the advanced first aid course. The services were asked to give the percentage of their personnel with training beyond the advanced first aid course. Eleven of the twenty-five responses differed substantially[17] from what is recorded in the Department of Public Health records. It is unclear which statistics are more reliable. As a consequence, trying to assess skill levels is difficult. An explanation may be that, the services which give themselves a higher percentage in answering the survey counted related "short courses," as part of the extra training.

Table 5: Training of Ambulance Personnel, by System Area *

SYSTEM AREA	STANDARD FIRST AID OR LESS # [1]	STANDARD FIRST AID OR LESS % [2]	ADVANCED FIRST AID #	ADVANCED FIRST AID %	TRAINING BEYOND ADVANCED FIRST AID #	TRAINING BEYOND ADVANCED FIRST AID %	TOTAL PERSONNEL #	TOTAL PERSONNEL % [3]
I Worcester	11	7%	126	77%	26	16%	163	20%
II Holden	1	2%	58	95%	2	3%	61	7%
III Clinton	7	6%	75	66%	32	28%	114	14%
IV Milford	18	15%	99	80%	7	5%	124	15%
V Webster	0	0	52	100%	0	0	52	6%
VI Southbridge	11	14%	63	82%	3	4%	77	9%
VII Palmer	2	5%	36	92%	1 [4]	3%	39 [4]	5%
VIII Athol	4	10%	34	90%	0	0	38	5%
IX Gardner	0	0	19	100%	0	0	19	2%
X Fitchburg	12	13%	65	69%	17	18%	94	11%
XI Ayer	5	10%	42	86%	2	4%	49	6%
Total Region	71	8%	669	81%	90 [4]	11%	830 [4]	100%

1 Number of ambulance crew members listed as having standard first aid training or less.
2 Per cent of total personnel in system area.
3 Personnel in system area as a percentage of the regional total.
4 Does not include the RN's who serve on the Wing Hospital ambulance.

* Source: Bureau of Health Facilities files, Department of Public Health.

Those courses are not entered normally on Department of Public Health records. The police and fire services, except in one case, were in line with Department of Public Health records, and these organizations do less with ambulance-related training outside the requirements because of their other missions.

3. Equipment.

The aspects that seem important to present in this section are the kinds of equipment available in non-regulated dual-purpose vehicles, the degree to which regulated services conform to Department of Public Health requirements, and the kind of vehicles used for emergency transportation in Central Massachusetts.

Substantial disparity exists between the regulated and unregulated ambulance services in terms of equipment available. Dual-purpose vehicles are almost always station wagons, not designed to store medical supplies and equipment along with other equipment necessary for police or fire work. In nine towns interviewed, all had stretchers in their vehicles, seven had oxygen available, six had basic first aid kits, two had splints, and none had long spine boards. These are, for the most part, larger communities near Worcester with full-time forces. Smaller towns might have even less.

On the other hand, interviews revealed that many of the more detailed items of equipment and supplies maintained by regulated services are on hand simply to meet Department of Public Health requirements and pass annual inspections, and are not considered helpful. In the words of one volunteer ambulance committee chairman, "Some of the things they make us keep are useless. Even the nurse-inspectors don't know what we would do with them."

All of the regulated services are shown on Department of Public Health records as generally meeting equipment requirements. Some might view this statistic skeptically given the reporting process and the anecdotes about switching equipment and supplies from one vehicle to another.[18] Four small services are recorded as missing at least one item of medical equipment required, but this is a much better average than was the case a couple of years ago.

The other important aspect to mention here is the nature of the vehicles used. The station wagons used for dual purposes have only a cost advantage. In addition to their other limitations already mentions, they are too confined inside to allow first aid treatment to be rendered underway. Most licensed services use traditional-style Cadillacs or similar makes. In too many cases, however, these are well past their prime: One town, for example, must depend on a fifteen-year-old vehicle. Seven of the sixty-three ambulances licensed within the region are Carryall or Econoline vehicles. These have the advantage of allowing much more room to work inside, but the disadvantage of providing a less smooth ride. No service in the region has a vehicle comparable to the Schwab ambulance model, (which Boston's Department of Health and Hospitals is purchasing) which is generally considered the best ambulance type available and is not as expensive as a new Cadillac.

4. First Aid Practices and the Choice of Hospitals.

Ambulance services within the region-- especially "dual-purpose" services - tend to emphasize getting the patient to a hospital as fast as possible, with a minimum of first aid rendered at the scene and underway, hoping that there "somebody who knows what they're doing" can take care of the victim. An alternative policy would emphasize the need for stabilizing the patient's condition before transporting him and ensuring that his immediate situation and acute medical needs are accurately assessed and taken care of. The policy is justified by ambulance operators on the basis of the limited training of personnel and the proximity to hospitals.

All regulated ambulance services responding to the December, 1971 survey answered that they "routinely give emergency first aid care, when it is warranted, before and during transport," but the interpretation of that statement may vary. Based on interviews, it seems that there are some differences as to care given. Volunteer rescue squads, on the whole, tend to render more first aid, and police services which have no specifically assigned ambulance squad tend to do less - compared to some average for all services in the region. The Wing Hospital ambulance

service is in a class by itself because registered nurses act as the ambulance attendants. Its level of initial care is much higher than any other service.

The nonregulated services rely almost completely, in all but two of the cases were information is specific, on getting to the hospital quickly. Even the two exceptions give little first aid. They will give oxygen but seldom do they splint or even apply dressings to wounds.[19]

Because of these reasons, almost all ambulances have a simple decision as to the choice of hospital emergency rooms: They go to the closest one, if the distances between the hospitals are significant (as they are in all areas but Worcester and perhaps Fitchburg-Leominster). In Worcester, they go to the hospital with which they have developed a relationship, where they know what to expect, even though they may, in a given case, actually be nearer to another hospital. However, the "nearest hospital" effect is still often apparent in the initial decisions which led to the relationship. The communities adjoining Worcester divide up on a distinct geographic basis in their primary hospital linkage. In ten cases within the region, the location of the town or the distribution of the population within the town was such that either of two primary hospitals might be chosen, depending on the location of the emergency.

If the difference in the quality of the available emergency facilities is marked, the more comprehensive one may be chosen even if somewhat more distant. This, however, only seems to hold as far as primary linkages where the distances to each are either very small or quite great (e.g., Worcester, North Brookfield).

Two conditions may alter the ambulance crew's decision: The severity of the patient's condition and the patient's expressed preference for a certain hospital. Of thirty secondary affiliations listed - that is, hospitals to which the ambulance service transports second most frequently - twelve relate to a greater capacity on the part of the second hospital to handle severe cases. A number of services in the Holden and Clinton systems will bypass those hospitals and go on into Worcester if the need seems sufficiently great. The

other eighteen linkages, however, were apparently not related to the quality of the other hospital but rather were the result of patient requests. For the services doing a good deal of routine transport, patient requests may dominate the pattern of hospital linkages.

5. Ambulance-Hospital Relations.

The nature of the relationship between an ambulance service and a hospital is more subtle than can be fully ascertained or explained in this sort of study, when nineteen hospitals and three times that many ambulance services are involved. Nevertheless, certain descriptors are available which help define the objective relationship, and they will be discussed in the following paragraphs. Data will be presented concerning ambulance-hospital communications capabilities, advance notification of the emergency room by the ambulance service, equipment and supplies exchange agreements, evaluation and in-service training of ambulance personnel personnel by emergency room staff, and information exchange. The quality of the emergency care delivered is dependent on the quality of these and the more subtle aspects of the relationship.

The Wing Hospital ambulance is the only emergency vehicle in the region that can make direct radio contact wit the hospital emergency room from the scene or underway. Such communication capability has the marked advantage of allowing medical professionals to give instructions as to the care the victim should receive and to get first-hand information about the patient's condition so that the appropriate staff and facilities can be ready when the ambulance arrives. The others must rely on regular phone connections.

In the 1970 Department of Public Health ambulance survey, 71 percent (twenty-five) of the thirty-five responding answered that they "almost always" notify the emergency room in advance of arrival; however, the Worcester Police Department, the service with the greatest volume, was one of those which did not so answer. Telephone notification from the ambulance dispatcher leaves much to be desired. Some emergency room personnel expressed dissatisfaction because the dispatcher has little information about the patient or the circumstances. As a result, they say the calls are useless in helping hospital personnel prepare. Ambulance personnel arrive, expecting everyone to be on the scene and

ready to go, and dismayed when such is not the case. The result is cynicism about the hospital emergency service. A common complaint was expressed this way by one ambulance service: "We don't get cooperation in emergency hospital rooms. Doctors are not there and ready when the ambulance arrives, even though a call has been made ahead when the patient is in serious condition."

Equipment exchange is perhaps a mundane feature of the interface between ambulances and hospitals but is an indicator of the cooperation that exists. The term refers to arrangements whereby the hospitals loan or replace any ambulance equipment and supplies which ought best stay with the patient until his condition is brought under control. It also relates to agreements in which the hospital provides the ambulance service with clean linens. Half (eighteen) of the certified ambulance services responding to the 1970 Department of Public Health survey have such agreements with the hospitals they regularly use. Two-thirds (thirteen) of the hospitals in the region respond similarly. The systems that lack such arrangements are Fitchburg and Ayer in the northeast and Webster and Southbridge in the south. It is possible that, in a few cases, services using dual purpose vehicles have such agreements. However, none have been discovered, so none are indicated.

In response to questions regarding review and on-the-job training of ambulance personnel, only five hospitals in the region claimed to "make any evaluation of the treatment given by ambulance personnel prior to admission." These were Holden District, Hubbard Regional, Leominster, Milford, and Wing Memorial Hospitals. One ambulance service has prepared a letter to be sent to the hospitals it uses, proposing a specific means of feedback and evaluation of the treatment the ambulance crews render.

Depending on the ambulance and the hospital and individual people involved, an ambulance attendant may or may not become familiar with the work of the hospital emergency room. Factors which affect his involvement with the emergency room are the volume of "business" handled by the emergency room and the frequency with which he answers a call for emergency medical assistance. Again with the exception of the Palmer system, no regular program of in-hospital training or work exists, and what exposure ambulance personnel do have is from just "sticking around and helping out" after the

patient has been delivered.

As to the exchange of information about the patient, other than the Wing Memorial Hospital and ambulance service, no case of actual records transfer from ambulance to hospital exists in Region II, but the ambulance organizations interviewed say that they usually convey verbally some information about the circumstances at the scene and the treatment they rendered. Unfortunately, the information-exchange process is rendered less effective by the mutual lack of understanding of each other's perspective. Hospital personnel complain that ambulance personnel can't answer their questions, while ambulance services respond that they do the best they can be expected to do, given the low status accorded their work and the lack of interaction with physicians.

> "The ambulance service of today has a multitude of problems that relate to the quality of patient care. I would say one of our larger problems is recognition by the community, hospitals, etc., as to our part in the emergency medical field. With the increasing demands for better health care, we find that we are no longer just ambulance drivers and attendants, but a vital link in the proper care of the sick and injured."[20]

From the above and from interviews with hospital administrators and ambulance service managers, it seems clear that the interface between the ambulance and the hospital should be the focus of some attention by both parties and by emergency medical systems planners. The ambulance must become not only in theory but in reality, and extension of the emergency room. Even if cooperation between the emergency room staff and ambulance personnel is good - which it no doubt is in many cases - the ambulance attendant is without the support at the front line: He cannot communicate with the emergency room staff, he does not have access to their experience, and he may not be certain that they will be ready when he arrives.

6. Hospital Emergency Care.

In the final analysis, the most important element in the emergency medical services delivery process is the ability of the emergency facility to give the appropriate and necessary. If deficiencies exist here, even an excellent ambulance service cannot fully compensate.

Region II has a relatively large number of hospital emergency rooms but these tend to offer a limited range of services. Again using the American Hospital Association classification, Table 6 shows the region's actual and expected shares of the state's emergency rooms of each class. The region has four-thirds the expected number of emergency facilities, based on its population, and over twice the expected number of provisional emergency units.

Of special interest is the proportion of emergency facilities with extensive capabilities. Defining the expected proportion of such units in a region as equivalent to the proportion for Massachusetts as a whole, Table 7 gives the ratios of the actual number of major emergency rooms to the expected number for the four regions of the state outside of Greater Boston. A Region II hospital is the least likely to be a major facility.

The Department of Public Health surveyed all hospitals in the state a year ago to ascertain their capabilities and characteristics as to emergency care. The results for Region II are summarized in Table 8 along with percentages for the entire state. The percentages refer to the proportion of hospitals responding affirmatively to a given question. It is apparent that the region has a lower proportion of hospitals with almost every capability than does Massachusetts as a whole. Only in the percentages of hospitals with twenty-four hour R.N. coverage and with a training program for attending staff does the region's percentage slightly exceed the state's. The largest differences are in terms of hospitals with the capabilities to handle head and chest injuries, those with twenty-four hour in-hospital M.D. coverage, and with full-time availability of radiologists and anesthetists. Region II, in fact, has the lowest proportion of hospitals with around-the-clock physician coverage of all eight regions.

One cannot necessarily conclude that the total supply of these capabilities in the region is inadequate, just that what is available is centralized in fewer hospitals. It is vital that the public and, especially ambulance personnel understand the limited range of emergency services at many Central Massachusetts hospitals.

Table 6: Region II's Share of Emergency Facilities by Category *

	MASSACHUSETTS	REGION II's ACTUAL SHARE	REGION II's 4 EXPECTED SHARE	ACTUAL AS A % OF EXPECTED
Population		713,700	(12.6%)	100%
Major units	32	3	4.0	75%
Basic units	59	11	7.4	149%
Provisional units	18	5	2.3	220%
All emergency rooms [2]	109	19	13.7	138%

1 The expected share is the number in relation to the state total that is proportionate to the region's share of the state's population (12.6%). Thus, 12.6% (or 4) of the major emergency rooms in the state would be expected in Region II.

2 Emergency rooms of non-military, short-term general hospitals.

*Source: GUIDE ISSUE, Hospitals, JAHA, August 1971.

Table 7: Comparative Numbers of Major Emergency Departments by Region for Outlying Regions *

	MASS.	REGION I[1]	REGION II	REGION VII	REGION VIII
Total emergency units[2]	109	14	19	16	9
Major units	32	3	3	3	3
Expected # of major units[3]	(29.4%)	4.1	5.6	4.7	2.6
Actual as a % of expected	100%	73%	54%	64%	115%

1 Region I-Western Massachusetts, Region VII-Southeastern Massachusetts, Region VIII-Northeastern (Merrimack Valley).
2 Emergency rooms of non-military, short-term general hospitals.
3 The expected number of major units is that number which, in proportion to total emergency rooms, equals the state relationship. (29.4% of all emergency rooms are major units).

* Source: GUIDE ISSUE, Hospitals, JAHA, August 1971.

Table 8: Hospital Emergency Facility Capabilities *

	1 (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	CENTRAL #	MASS. %	MASS. %
Number of Hospitals	6	1	1	1	1	1	2	1	2	2	1[2]	19	100%	100%
Capabilities														
Prepared to give extensive treatment for:														
contagious diseases	x[3]	x				x	x			x	.	8	42	56
pychiatric disorders	x						x			x		5	26	28
crushed bones	x	x					x	x	x	x	.	11	58	78
severe burns	x						x		x	x		9	47	65
severe head injuries	x								x	x		6	32	60
severe chest injuries	x	x				x			x	x		9	47	70
Emergency admission bypass procedures	x	x		x	x		x	x	x	x	x	17	90	97
All ER patients seen by MD	x	x	x	x	x		x		x	x	.	16	84	87
MD's on duty in ER required to be in hospital	x				x		x		x	x	.	9	47	77
ER staffed 7 days/24 hrs. by MD/trainee	x				x		x		x	x	.	8	42	69

Table 8: continued

	1 (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	CENTRAL #	MASS. %	MASS. %
Radiologist on duty more than 8 hrs/day	x			x								5	26	53
Anesthetist on duty more than 8 hrs/day	x			x		x	x	x	x	x	x	12	63	90
RN on duty in ER 7 days/24 hrs.	x	x	x	x	x	x	x		x	x	x	18	95	93
An EMS training program for attending staff took place last year	1	0	0	1	1	0	1	0	2	0	.	6	32	30
The Hospital has an Intensive Care Unit (ICU)	x	x		x	x	x	x	x	x	x	.	13	68	NA

1 1) Worcester System, 2) Holden, 3) Clinton, 4) Milford, 5) Webster, 6) Southbridge, 7) Palmer, 8) Athol, 9) Gardner, 10) Fitchburg and 11) Ayer.

2 The Fort Devens Army Hospital is also located in this EMS system and it responded affirmatively to the items dotted and can support the civilian system in an emergency. However, it is not counted in regional totals.

3 A check indicates that at least one hospital in the system has this capability, not that every hospital does.

* Source: Survey of Emergency Facilities, Massachusetts Department of Public Health, Division of Medical Care 1971.

Table 8 also breaks the capablilities down by emergency medical system area. The Worcester area is adequately covered on all points. The Fitchburg system lacks only night time radiologist coverage, and the Gardner area lacks that and, in addition, must look to Fitchburg in emergency cases involving contagious diseases or psychiatric disorders. The Palmer emergency medical system is next in line, having to look to the Springfield area hospitals for help in aspects where the Wing and Mary Lane Hsopitals are deficient.

In the other seven systems, hospital emergency care capabilities are sharply limited. Thirty-six percent of the people of Central Massachusetts live in these areas and would normally be taken to one of these hospitals if they were to call an ambulance service for emergency assistance.

One of the things that makes the subject of emergency care difficult to deal with is that the human consequences of the processes of service delivery are great, and no provider is especially anxious to admit to shortcomings. In Central Massachusetts, negligence on the part of providers is clearly not a problem. Almost all seem earnest in their desire to carry out their role with regard to emergency care responsibility.

Yet sincerity is not enough. The case presentation preceding has revealed the weakness of the system as it stands - not because ambulance services and hospitals and police forces are not trying - but because each has too limited a role, defined so by the cumulative effect of public apathy, town parsimony, the low priority of emergency

care on the overall agenda of many providers, and the absence of co-operative planning. The result is fragmentation and lack of accountability. Both the response and guidance systems as they stand within the Region are more primitive and more unreliable than they ought to be.

The following chapters will first pursue in depth the character of the deficiencies and then develop a direction of change, as well as the means to and effects of that change.

NOTES

[1]For a list see Appendix C.

[2]The major resistance to the Governor's Ambulance Bill will be from the Selectman's and Police and Fire Chiefs Associations who fear the added costs forthcoming if these vehicles are brought under Department of Public Health jurisdiction.

[3]One town interviewed did have a $12. fee for this service.

[4]It is possible that a few of the towns counted in the first group (as having no in-town ambulance) in fact provide service on this basis.

[5]West Boylston is included here because it uses a special ambulance vehicle which it says meets all state requirements, even though the Department of Public Health has no record of its existence.

[6]Deputy Egan, interview.

[7]Data on the 20 is presented in Table 2.

[8]Compared to many states the linear distances are small. However, the slower speeds possible on New England roads make for heavy friction with distance. Travel times will not be given explicit consideration in this study because the only means discovered for estimating travel times on the rural roads in Central Massachusetts would have been to drive them - a process too laborious to be done for this study. Such information is important for regional planning and ought to be available.

[9]Hospitals, Journal of the American Hospital Association, August, 1971.

[10]The regulated ambulance services were asked to rank the hospitals they serve as a part of both the 1970 survey of ambulance services administered by the Department of Public Health and the December, 1971 survey done for this study. The same question was asked of non-regulated police and fire services interviewed.

[11]In an interview, Deputy Chief Daniel F. Egan explained that this policy is based on the fact that, by experience, they know that City emergency ward staff and facilities are always ready to handle whatever they might bring in.

[12]No sampling of hospital emergency room records was done - which would have produced additional data-relating to patient origins and to types of conditions - because such a sample had already been taken and coded

as part of an ambulatory care study in which the Comphrehensive Health Council was involved. Though it was expected that data processing would be completed in time for inclusion of the results in this report, it was not. Only preliminary variable frequency counts are available, and these are of minimal use here because they include data from outpatient clinics as well as emergency rooms.

[13]Most of the work of these private services involves scheduled "routing" transfer of patients. If they are coming to a hospital, they are usually already under physician care and are admitted directly. Consequently they do not show up in the figures presented here.

[14]A survey done by the Athol Hospital during January had basically similar results: 82.5 percent came in their own or a relative's car, 11 percent were brought by the police or fire, and 9.5 percent came some other way.

[15]Chapter 90, Section 7F, General Laws, Commonwealth of Massachusetts.

[16]Almost all police and firemen in the nonregulated services would seem to fit into this category, based on interviews.

[17]A difference of more than 20 percent was counted.

[18]In an interview, one person said that he knew of cases where an organization with two vehicles would empty the one of equipment on the day of inspection and hide it, then claiming it had suddenly been called on a run to Boston. The inspector would have to return to inspect the second vehicle, this time with the first gone.

[19]Interviews with the department chiefs.

[20]Santor, Stanley F., Jr., President, Scott-McAvoy Ambulance Service, January 3, 1972.

Chapter IV: An Evaluation: The Effects of Policy on the Delivery System

Gauges to measure and evaluate the output of the emergency medical services delivery system are, as with almost all social services, hard to come by. We cannot determine with confidence, for example, a causal relationship between mortality figures from emergency conditions and characteristics of the delivery system; there are simply too many uncontrollable variables.[1] As a consequence, the delivery of services must be accounted for on the basis of input indicators.

The previous two chapters have provided a description of the services and the means for guiding their delivery. This chapter will attempt to evaluate the success of the guidance process and the resulting effectiveness of the delivery system on the basis of the input criteria which were set out at the beginning of the study: quality of the response, geographic accessibility of services, and economic efficiency.

The Tradeoffs

These basic criteria are difficult to harmonize fully. In part they conflict or cannot be measured in terms relevant to one another. Thus, the policy-making process has to be one of assigning priorities among the three. As shall be made evident, imposing higher standards as to quality (e.g. twenty-four hour physician-covered emergency rooms, full-time emergency medical technicians as ambulance attendants, etc.) and maintaining criteria of economic efficiency entails sacrificing some accessibility and vice-versa. Because the relative merits of the aspects involved in the trade-offs cannot be fully assessed, the choice and priority-assigning process is dependent to some extent on value judgments and is strongly affected by external considerations.

It would seem that the towns in central Massachusetts have implicitly favored geographic accessibility over economic efficiency and quality of care, as a result of the long-standing tradition of town autonomy. They have opted for town-based ambulance districts in the great majority of cases. Within that framework, they have opted for low cost

ways of providing service such as dual-purpose or used vehicles and on-call personnel, ahead of considerations of the quality of care. This is not to say that issues of quality have been left out entirely; rather, the other concerns have simply seemed more important. One gets the impression that local decision makers feel that quality of medical care is not particularly affected by town determinations about ambulance service, viewing quality of care as "the doctors' problem" and as affected by hospital practices, rather than by ambulance work, which they feel is after all only transportation.

Hospitals seem also to place a higher priority on accessibility because some operate emergency services for which there is no apparent need. Hospitals would clearly rather offer some emergency service even though guarantees as to the quality of service may be weak. They are willing to provide service at a loss (thus, inefficient in one sense), but may not be willing to make the outlay necessary to meet the desired state standard of twenty-four hour M.D. coverage.

The state, in turn, seems to place greater weight on either quality standards, such as its ambulance requirements, or efficiency criteria, which predominate in "determination of need" evaluations, even if the net effect is to make services less accessible by some degree. There is no ill intent--it is simply a perception of priorities.

For the most part, the decisions which, in their cumulative effect, shape these policies are made independently by the parties involved. The consequences are unnecessary confusion, lack of cooperation, and distrust in the delivery and guidance of emergency medical services. No forum exists in the region or elsewhere where ambulance providers and hospital administrators and physicians, etc. meet to develop policy for emergency care, except on an occasional adversary basis, as in legislative hearings. The Department of Public Health is not required to involve individual providers in emergency services guidance activities. The proposed emergency medical services Advisory Board would formalize a means of representation but only taps statewide interest groups.[2]

It is understandable, however, that at the state level participation in policy-making is necessarily diluted. The problem is that

what representation at the state level does exist seems to favor the Greater Boston providers who are immediately accessible and may be the more visible members of associations and interest groups. As a result, there is no assurance that the characteristics and capacities of other areas are fully accounted for. Also, the absence of regional planning and policy-making machinery in Central Massachusetts makes it difficult to achieve the kind of dialogue necessary to resolve the various perspectives.

The rest of the chapter will attempt to apply the three criteria separately to highlight the delivery system and the effects of policy from all three perspectives and to demonstrate the interplay between the criteria. The final section will examine the processes of feedback by which accountability is achieved.

The Quality of Care

As was discussed in the first chapter, aspects of the quality of care that are important are the triage or sorting procedures to quickly recognize those with emergent needs, the initial care rendered to stabilize the patient's condition as much as possible until definitive treatment is possible, and the speed with which physician management of care is established. These relate to the training of personnel (and the equipment they have access to), to the arrangements between ambulances and hospitals, and to the policies of each.

1. State Standards.

The present statutory basis for standards pertaining to quality and the means of accounting for compliance with them is limited. Distilling existing standards and regulations, the state has four major standards:

1. Ambulance crew should have "senior first aid".
2. Emergency Rooms and ambulance services should provide twenty-four hour service.
3. A physician should be "available at all times for service in the emergency room.
4. Ambulance should be designed and equipped and used only for that purpose.

Chapter III described the delivery system on the basis of those requirements.

The policy development efforts now being pursued would, if successful, expand the requirements substantially (though possibly also differentiating the requirements into categories according to the capacities and service of the provider): The services using "dual purpose" vehicles would be brought under the regulatory provisions. The training requirements for emergency ambulance attendants would eventually go well beyond present first aid requirements. Emergency rooms would have to have twenty-four hour in-house physician coverage; and area-wide planning and state determination of need would become more important.

The existing delivery system does not fare well against these criteria, even though they are still insufficient in some ways, especially relating to the means of establishing physician management of care. Presently, few ambulance attendants have training beyond first aid; only eleven of nineteen hospitals now meet the requirement of physician coverage; and little area-wide planning or determination of service characteristics occurs that is based on regional needs.

2. Improving Physician Management of Care Delivered.

Beyond what proposed standards will specifically require, other aspects pertaining to the effectiveness of physician supervision can be evaluated.

No case was discovered of an ambulance service with a physician advisor. The advantages of an ambulance service having regular access to a doctor are clear. Not only can he help them determine appropriate training programs, but he can also help them choose and learn how to use supplies and equipment, evaluate their individual capabilities and their handling of specific situations and act as a liaison to hospitals. The lack of such regular interaction is a loss both to the ambulance organizations and to a medical staff who would likely benefit from a better perspective on the skills and attitudes of the outreach personnel.

The lack of in-hospital work experience for almost all ambulance personnel not only has implications for training, which were mentioned earlier; it is an additional instance of non-interaction between the outreach personnel and the medical profession, further extenuating the

effective management of care. The lack of regular evaluation of care also mentioned in relation to training, is still another demonstration of deficient quality control processes as expressed in physician supervision of care.

One of the most crucial defects in present arrangements is that the medical staff of an emergency room have no direct involvement with the patient's condition until he arrives at the emergency room (with the exception of Wing Hospital). If adequately notified, they may prepare but at best that is of rather limited utility. Present communications technology would allow very easily and inexpensively the establishment of two-way radio links between ambulances and hospitals which would allow the exchange of information and instructions as emergency outreach systems in various parts of the country have proven. Some have even demonstrated rather successfully, in high volume settings, the benefits of ambulance-to-hospital telemetric monitoring of vital signs.

No doubt one reason for the lack of such radio communications links is that ambulances use more than one hospital, partially as a result of patient requests. Yet technically it is not a major problem to establish channels for key hospitals. The relationships among an ambulance service, the hospital(s) it uses, and the catchment areas of each could well be more systematic and efficient, and such would tend toward improvement of a number of the features mentioned in the last few pages. However, tightening these relationships would necessarily involve not only establishing ambulance-hospital radio contact and improving policy as to the choice of hospital emergency rooms but also would necessitate creating emergency staff privileges for physicians at hospitals other than those they regularly use. If such a policy of granting emergency privileges were standard, not all hospitals (in Worcester, for example) would have to maintain full-scale emergency services. Furthermore, patient requests as to hospital would diminish if patients knew their physician could treat them at the emergency room to which they were taken. This would tend to enhance the quality of hospital-ambulance cooperation as regular relationships would be established. The objective of continuity in care delivery would also be better met.

Not discussed in the preceeding is the competence of a physician. It is not the place of this study to suggest which physicians or specialties meet that criterion. However, it can be said that a physician only rarely exposed to conditions associated with medical emergencies will be less prepared to deal with them. Some cogent arguments are made by proponents of small group-practice coverage of a hospital's emergency service as to the benefits of having experts in the care of trauma handling the emergency case load, and Burbank Hospital plans to adopt this type of system shortly. However, opponents make a case for other disadvantages of that kind of coverage, especially its failure with respect to the continuity of care objective. The matter will be left to professionals to consider.

3. Effects of Utilization.

Not expressed as a standard but nonetheless significant for emergency care is the high ratio of provider personnel to requests for service in Region II. Because of this ratio there is a danger of loss of skills or inexperience with certain kinds of situations. The number of people involved is large because of the common use of part-time and volunteer staffing of ambulances and of rotation as the method of hospital emergency room staffing. The demand for emergency medical services is diffused and relatively low per providing unit because of the low population density over most of the region. The analysis of utilization of human skills and capital resources will be considered in greater detail in the later section on economic efficiency.

The predominant use of private cars to get to the emergency room also has implications for quality of care in that it means that triage and stabilization do not occur until the patient arrives at the hospital. By not taking advantage of medical outreach and transportation, people deprive themselves of initial care and assistance. On the other hand, if emergency resources are over-used, they are less available to those who might need them more urgently. However, over-use ought probably not to be a serious concern in Central Massachusetts.[3] Perhaps if an improved ambulance service existed in which people had more confidence, the utilization of ambulances would be higher.

Geographic Access

From this point on, the evaluation of delivery has no "official" standards to rely on. Certainly, the policy of all emergency medical services providers and planners is that services be as accessible as possible to everyone, but no attempt is made to define a minimum desirable level of geographic proximity to services. The same holds true of the economic efficiency criteria. Judgments about what constitute acceptable or desirable levels are hard to come by and without consensus. Hence, evaluation of present delivery patterns must be based on comparisons with other areas or with possible alternative modes of delivery.

Measuring the accessibility of services to a population must take into account a number of variables, including population densities, characteristics of the road network, weather, traffic, habits as to travel and effects of stress factors associated with distance on the patient's condition.

Because of the complexity of these variables, accessibility can only be described in simple and somewhat arbitrary terms. Since, however, the purpose will primarily be to show the effects of policy and to allow intraregion adjustments in the distribution of services, these terms are adequate.

A three-way geographic breakdown (within five miles, five-ten miles, more than ten miles) will be used to represent three levels of accessibility to hospital emergency service. These distances are obviously arbitrary but do relate satisfactorily to the scale of the region and to present characteristics of distribution. Almost all are within ten miles of a hospital with an emergency service.

The categorization of emergency rooms used by the American Hospital Association is a surrogate for the classification system proposed in the revisions of state emergency facility regulations.[4] If the hospital facilities are grouped according to those categories, adjusted for the physician coverage as in Chapter III, then these can be related to the three-way proximity breakdown above. The result is ten zones of accessibility which are, for simplicity's sake, presented in three classes:

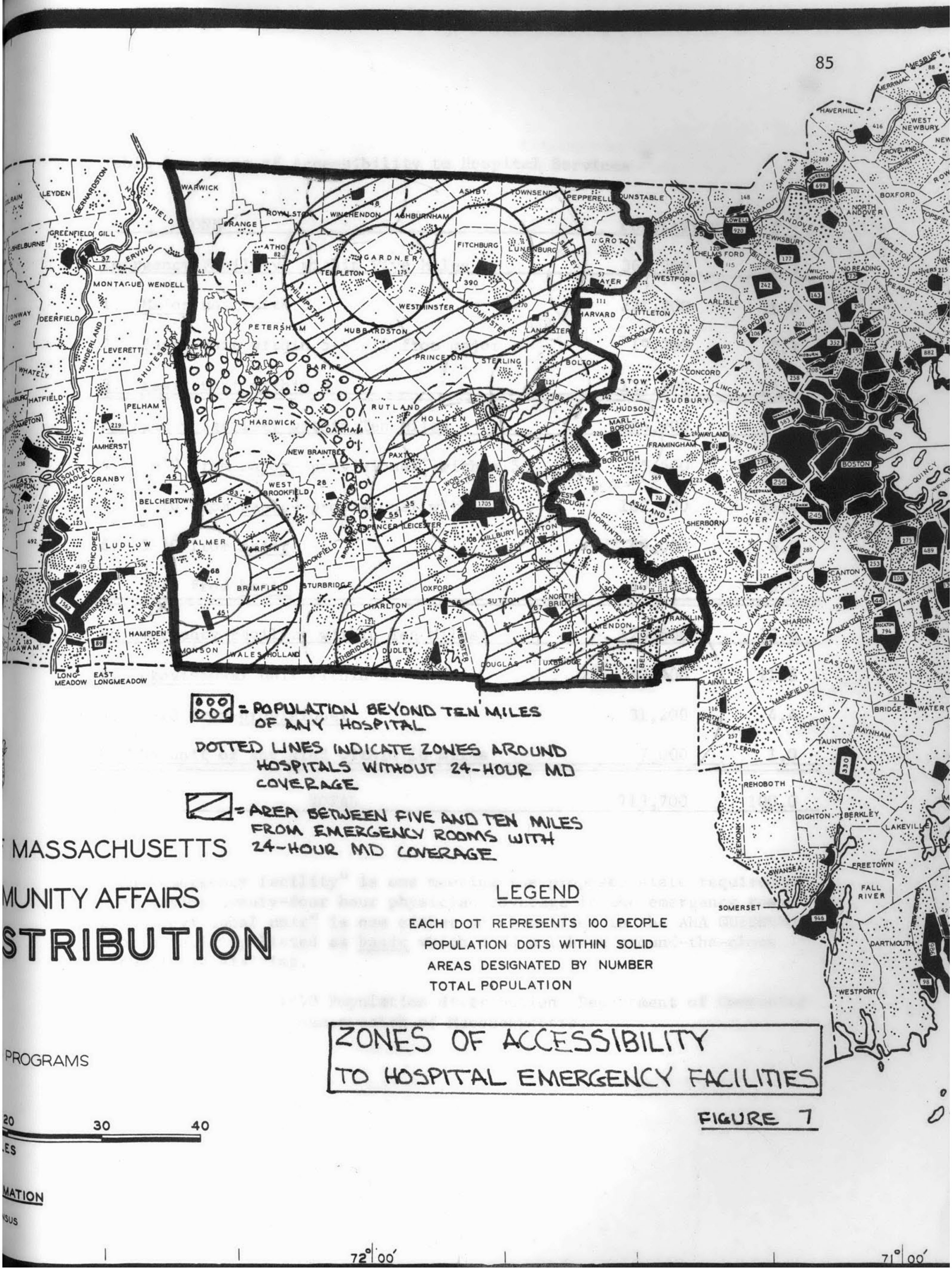
population within five miles of emergency service (as defined in proposed regulations), population five to ten miles of emergency service, and population without a hospital emergency service within ten miles. The areas within each are mapped in Figure 7. Tabel 9 lists the ten zones and the population within each.

The important categories to note are No. 4, No. 5, and No. 8 -- those people presently within five miles of an emergency room without twenty-four hour in-house M.D. coverage. Presently 4/5 are within five miles of an emergency room of some sort (No. 1-5, No. 8). Only one per cent of the population is beyond ten miles from an emergency department. If the state's proposed policy of requiring emergency services to have twenty-four hour in-house medical coverage were to go into effect abruptly with no change in hospital staffing patterns, the percentage of the population within five miles of an emergency service (No. 1 - No. 3) would then drop to fifty per cent and the proportion farther than ten miles from a recognized facility would increase to seventeen per cent.

If outlying areas such as Palmer and Webster were unable to meet the requirements for "routine" emergency service, (if, for example, the retiring doctors could not be replaced) the population within five miles of an emergency facility might be as low as forty per cent (No. 1 and the part of No. 3 served by Burbank Hospital) of the region's total and the percentage more than ten miles away might be as high as forty per cent.

Table 10 shows the situation in each emergency medical system area given the three alternative circumstances. Table 11 analyzes this pattern of accessibility for five of the eleven systems which are focused on emergency facilities with twenty-four hour M.D. coverage and for the six which do not have such service available. Only six per cent of the population in the other six system areas is within five miles of a basic or major facility. In fact, a total of 95,000 people (forty-four per cent) in these six areas lived more than ten miles from an emergency room with twenty-four hour M.D. coverage, and eleven per cent have no access to even a provisional emergency room within five miles.

Five western towns in the Worcester and Holden systems (the Brookfields, Barre and Oakham) are out of range of any emergency room,



ZONES OF ACCESSIBILITY TO HOSPITAL EMERGENCY FACILITIES

FIGURE 7

Table 9: Zones of Accessibility to Hospital Services *

ZONE	POPULATION	%
Emergency Facility[1] within Five Miles	366,300	51.3
1. Major unit with 5	221,200	31.0
2. Basic unit within 5--5-10 from major	19,200	2.7
3. Basic unit within 5	125,900	17.6
Emergency Facility within Ten Miles	226,900	31.7
4. 5-10 from major--provisional[2] within 5	25,500	3.6
5. 5-10 from basic--provisional within 5	102,900	14.4
6. 5-10 from major	49,000	6.8
7. 5-10 from basic	49,500	6.9
No Emergency Facility within Ten Miles	120,600	17.0
8. provisional unit within 5	82,400	11.6
9. 5-10 from provisional	31,200	4.4
10. No unit of any kind within 10 miles	7,000	1.0
TOTAL	713,700	100.0

1 An "emergency facility" is one meeting the proposed state requirement of having twenty-four hour physician coverage in the emergency room.
2 A "provisional unit" is one either so classified in the AHA GUIDEBOOK or a facility listed as basic which does not have around-the-clock physician staffing.

* Source: Data on 1970 Population distribution, Department of Community Affairs, Commonwealth of Massachusetts.

Table 10: The Effect on Accessibility of Alternative Policies Regarding Hospital Emergency Service, by System Area*

SYSTEM AREA	PRESENT POLICY[1]		PROPOSED POLICY[2]		POLICY[3] FAVORING URBAN ER's	
	Within 5[4]	Beyond 10	Within 5	Beyond 10	Within 5	Beyond 10
I Worcester	240,000	3,000	223,500	20,600	220,500	23,400
II Holden	19,100	4,000	800	8,500	800	8,500
III Clinton	25,000	0	900	5,100	0	24,800
IV Milford	58,300	0	10,800	38,200	0	85,000
V Webster	27,900	0	27,900	0	0	31,200
VI Southbridge	21,800	0	0	5,500	0	25,700
VII Palmer	29,600	0	16,400	5,000	0	21,600
VIII Athol	17,400	0	0	19,900	0	21,000
IX Gardner	31,000	0	24,200	0	0	29,700
X Fitchburg	85,200	0	61,800	0	61,800	0
XI Ayer	17,000	0	0	17,800	0	17,800
Total Region	572,300	7,000	366,300	120,600	283,100	288,700
%	80%	1%	51%	17%	40%	40%

[1]Catchment populations of all hospitals presently offering emergency service

[2]Catchment populations of all hospitals with twenty-four hour MD staffing of ER

[3]Catchment populations of the Worcester, Fitchburg, Springfield, and Framingham ER's.

[4]Within five air miles of an emergency facility

*Source: 1970 Population distribution data from the Department of Community Affairs, Commonwealth of Massachusetts

Table 11: Disparity of Access to Hospital Emergency Services *

	TOTAL POPULATION	POPULATION BEYOND 5 MI. FROM EMERGENCY FACILITY [1]		POPULATION BEYOND 10 MI. FROM EMERGENCY FACILITY		POPULATION BEYOND 5 FROM PROVISIONAL [2]	
Six system areas served by ER's with limited MD coverage	217,300	204,800	94%	95,000	44%	23,900	11%
Five system areas with ER's covered around the clock by MD's	496,400	142,700	29%	25,600	5%	14,300	3%
Region Total	713,700	347,500	49%	120,600	17%	38,200	5%

[1]An emergency room offering twenty-four MD coverage in-house.

[2]An emergency room not offering night and weekend MD coverage in-house.

*Source: Data on 1970 population distribution, Department of Community Affairs.

relative to other areas in the region at least, and most of the western part of the study area is more than ten miles to an emergency room if in-house M.D. staffing is required. In that case, much of the Ayer, Clinton, and Milford system areas are also more than ten miles away. It is also apparent that the distances to the major emergency services in Worcester are substantial from the corners of the region.

The preceding analysis confirms the need to examine what the access benefits would be if emergency services that are presently provisional (or basic without M.D.'s in-house at night) could be upgraded. Table 12 presents the populations added to the upper two classes of accessibility, if the hospital were able to organize so as to maintain an emergency physician in-house twenty-four hours a day. The numbers cannot be totaled since Ayer, Clinton, and Holden overlap in the areas they serve.

In terms of total population benefitted, the order of priority for hospital service upgrading would be: Milford, Clinton, Leominster, Holden, Harrington, Ayer, Northbridge, Athol and Ware.

Because most ambulance service is limited to a single community, access to ambulance service will, for the present, be defined on that basis: Ambulances outside the boundaries of the community under examination are considered inaccessible to that community for emergency service.

The preceding chapter pointed out that at most two per cent of the region's population lived in towns without at least a dual-purpose station wagon in the town. We have already seen, however, that if the requirement is that regular transporting of patients must be done in fully equipped vehicles designed and used solely for ambulance work, then almost one-fifth of the population is without effective access to ambulance service. If on-call personnel were disallowed, almost half of the residents of Central Massachusetts would be considered without access to ambulance service, according to the above criterion of accessibility. The next section will re-examine this issue.

Access to emergency ambulance service, by system area, is indicated in Table 13. Three areas have 100 per cent coverage. Seven of the eleven areas have licensed service in at least half of the towns. The towns surrounding Worcester constitute the largest population aggregate without

Table 12: The Effects on Accessibility of Upgrading Hospital Emergency Services *

HOSPITAL [1]	POPULATION ADDED WITHIN 5 [2]	POPULATION ADDED WITHIN 5-10	TOTAL POPULATION AFFECTED	RANK
Fairlawn	0	0	0	11
Holden District	16,000	9,100	25,100	4
Clinton	26,600	2,600 [3]	29,200 [3]	2
Milford	38,900 [3]	6,000	44,900 [3]	1
Harrington Memorial	22,400	1,800	24,200	5
Nashoba Community	17,000 [3]	6,000 [3]	23,000 [3]	6
Leominster	26,800	0	26,800	3
Athol	17,400	2,200 [3]	19,600 [3]	8
Mary Lane	13,000	8,900	21,900	9
Northbridge	23,700	0	23,700	7
Winchendon	6,600	0	6,600	10

[1]Hospital emergency facility with limited physician coverage. Assumed in each case is that the emergency service is upgraded to meet the proposed state requirement of continuous MD staffing.

[2]The population living within five miles of the named emergency facility without similar access to any higher order emergency facility.

[3]Additional population would be served in communities outside the region.

*Source: Hospital Emergency Facilities Survey of the Department of Public Health; data from Department of Community Affairs.

Table 13: Access to Ambulance Service, by System Area *

SYSTEM AREA		TOTAL NUMBER OF LOCALITIES	LOCALITIES WITH AMBULANCE SERVICE [1]	PER CENT OF TOTAL POPULATION SERVED
I	Worcester	16	6	72%
II	Holden	6	3	64%
III	Clinton	5	5	100%
IV	Milford	10	6	86%
V	Webster	4	4	100%
VI	Southbridge	3	3	100%
VII	Palmer	9	4	57%
VIII	Athol	7	2	82%
IX	Gardner	4	1	59%
X	Fitchburg	6	4	92%
XI	Ayer	5	3	61%
Region Total		75	41	80%

[1] Ambulance service licensed by the Department of Public Health.

*Source: Ambulance statistics of the Bureau of Health Facilities, Department of Public Health.

regulated service: 78,400 people relying on dual-purpose vehicles (or, in the case of Shrewsbury, uncertified ambulances).

Since, however, certain areas have real difficulties as far as proximity to hospital emergency services, present forms of ambulance service cannot be considered as adequately meeting the needs of those areas for access to services. Communities located in the middle and western parts of the region that have no emergency room nearby or have one with serious inadequacies need ready access to a more sophisticated level of outreach to them to compensate for inaccessible hospital emergency care.

Economic Efficiency

Medical care is delivered in a framework of limited resources. If the system of delivery uses the available resources inefficiently, then it is able to do less overall than it optimally might. A concern of the citizenry and public and institutional officials faced with constrained budgets is to "hold the line" on costs. If emergency medical services delivery is to improve, policies must be developed which insure that the organization of the response system is effective in this regard.

1. Measuring Utilization.

The primary issue is that of utilization--the demand per unit of supply. Initially here, demand will be measured simply by the frequency of requests for service.[5] As pointed out previously, there are no clear standards here as to what ought to be; hence, we will move in the discussion toward testing out maximum levels of utilization by hypothesizing alternative modes of delivery.

Data necessary for a thorough evaluation on the basis of efficiency are not available to this study. What is presented deals primarily with ambulance services and is intended to outline the methods. It ought to be sufficient, however, to reveal policy effects.

A rule of thumb commonly used with respect to ambulance work is that a population of one thousand generates about thirty-five emergency calls per year.[6] This figure does not include non-emergency requests, such as for routine transfer work. The figure was checked against

available data on ambulance runs in given service areas and it holds up surprisingly well--certainly well enough to use here, since comparable data from all areas of the region on numbers of runs are not available. This figure can be used to compute demand for service within areas of the region, and the demand can then be related to the numbers of vehicles and personnel.

Using that rule of thumb, Region II generates 25,000 calls per year or about sixty-nine per day. With sixty-three ambulances (not counting dual-purpose vehicles), the average use is 1.1 calls per day. In Worcester, where two Worcester Police ambulances responded to 5,134 calls in 1971,[7] each ambulance made about seven trips per day. The total does include some no-service calls and some calls which might not have been emergencies but that hardly mitigates the difference between the Worcester rate and the region rate. For contrast, adjacent Leicester, using two cruiser wagons, answered 425 calls for medical transportation--about 0.6 calls per day per ambulance.

Table 14 gives the breakdown by system area, ranging from the Clinton area, where the average number of trips per ambulance per day is 0.4, to the Worcester system where the daily average is almost five times that. Most cluster around one trip per day.

A similar analysis is possible for crew members of ambulance services, which has implications both for the criterion of economic efficiency and that of quality; 830 people are members of licensed ambulance organizations within the region. If they respond to calls two at a time, they each participate on the average, in sixty calls per year or about one every six days. In Worcester, with thirty people manning the city ambulances, each participated in 340 calls in a year or nearly one every day. The statistics for each system area are shown in Table 15. Again, the Worcester and Clinton systems are the extremes.

Using this kind of analysis with regard to hospital emergency facilities is hampered by the lack of definition for a provider unit other than the emergency room itself and the lack of uniformity as to capacity among emergency rooms.

Table 14: The Utilization of Ambulances, by System Area *

SYSTEM AREA	POPULATION	NUMBER of AMBULANCES [1]	POPULATION PER AMBULANCE	TRIPS PER DAY [2]
I Worcester	293,200	15	19,550	1.9
II Holden	28,400	4	7,100	0.7
III Clinton	27,700	6	4,600	0.4
IV Milford	86,000	8	10,750	1.0
V Webster	36,300	6	6,050	0.6
VI Southbridge	26,600	4	6,650	0.6
VII Palmer	39,600	4	9,900	1.0
VIII Athol	21,000	2	10,500	1.0
IX Gardner	33,700	3	11,250	1.1
X Fitchburg	93,700	8	11,700	1.1
XI Ayer	27,600	3	9,200	0.9
Total Region	713,700	63	11,300	1.1

[1] Ambulances licensed by the Department of Public Health of similarly designed and equipped.

[2] Assuming 35 trips per year per 1000 population or almost 0.1 trip per day.

*Source: census data, Bureau of Health Facilities ambulance records.

Table 15: The Utilization of Ambulance Personnel, by System Area *

SYSTEM AREA	CALLS PER YEAR [1]	NUMBER of PERSONNEL [2]	CALLS PER YEAR PER CREW MEMBER	DAYS BETWEEN CALLS PER CREW MEMBER
I Worcester	10,200	163	125	3 days
II Holden	990	61	32	11 "
III Clinton	970	114	16	23 "
IV Milford	3,010	124	49	7 "
V Webster	1,270	52	49	7 "
VI Southbridge	930	77	24	15 "
VII Palmer	1,380	39 [3]	? [3]	? [3]
VIII Athol	740	38	39	9 "
IX Gardner	1,180	19	124	3 "
X Fitchburg	3,280	94	70	5 "
XI Ayer	970	49	40	9 "
Total Region	25,000	830	60	6 days

[1] Assumes 35 emergency calls per year per 1000 population.

[2] As derived from the Files kept by the Bureau of Health Facilities on ambulance personnel of regulated services.

[3] The number of personnel listed for the Palmer area does not include the RN's at Wing Memorial. Hence, the utilization indicators would be confusing.

*Source: The Census and Files from the Bureau of Health Facilities.

If standards of desired utilization had been established, the regional average utilization of vehicles and personnel could be evaluated on the basis of desired rates (which might be the state averages or some proportion thereof, or the present regional averages might be set as minimum standards for the communities of the region). No such standards exist, but indications are that utilization is unnecessarily low, except in Worcester. If so, the possibility of increasing rates should be pursued in order to achieve a better system. But increasing utilization by decreasing the number of provider units or by expanding the service area must be examined for its impact on quality of care and accessibility.

2. Comparison With An Alternative Pattern of Delivery.

One way to test out the effects of increasing utilization is to hypothesize an alternative pattern of delivery. For example, the delivery system in Region II presently relies heavily on the resources of community hospitals with ambulance personnel performing, for the most part, only a minimal medical care function. An alternative state would place much greater emphasis on sophistication in the outreach and transportation components, so as to lessen the burden especially on small emergency rooms in outlying areas where physician resources are thin. This would involve changing from a town-based system of ambulance services using on-call personnel to area-wide services with full-time on-duty emergency medical technicians.

Such a change would have many impacts in the form of costs and benefits over the present ones. In a number of cases, these would be difficult to evaluate. However, the effects on economic efficiency can be seen quite readily and can be set in the context of effects on quality and accessibility.

This section will rely on a set of concepts and a methodology explained in a technical appendix (Appendix E). The reader is referred there for the specific meaning of demand intensity, utilization, probability of dispatch delay, and expected dispatch delay. The technical appendix also sets out the assumptions on which the succeeding analysis is based. These are important to examine.

For purposes of illustrating this methodology, a case area will be used containing ten towns along the southern edge of the Region.[8] The area has a population of 87,600 and contains 277 square miles for an average density of 320 per square mile. Other characteristics are noted in Table 16.

The density, at coarse grain, is assumed to be uniform across the case area. That is, each ambulance service area, however defined, has approximately the same population per square mile.[9] Travel times would be 2.2 minutes per mile.

The minimum number of ambulances staffed by on-duty crews which could serve this area, given a maximum radius of 5.5 miles per service area and a maximum service area of 95 square miles, would be three. Thus, three ambulances, distributed effectively, could cover the entire area without exceeding present response times. See Figure 8. This will represent the lower extreme--no improvement on response time but a reduction of nine vehicles over the twelve ambulances presently used within the region.

At present within the area, these ambulances are available for service outside the town in which they are located only on a mutual aid basis. If we assume that mutual aid agreements are easy to activate and that all twelve vehicles are essentially part of one system, the probability of dispatch delay is almost zero. However, if they are viewed as nine distinct town systems, the probability of delay and the expected delay are higher. For example, in Northbridge, with 11,800 people and one ambulance, the expected delay is sixty-three minutes and a dispatch delay will occur, on the average, 4.6 per cent of the time.

With three vehicles staffed full-time and available to each other as part of a centrally dispatched system, the probability of dispatch delay is less than two per cent and the expected delay is twenty-three minutes. This small probability of delay could be essentially eliminated by backup vehicles at the station to be manned, when needed, this would occur only infrequently by volunteers or public safety officers.

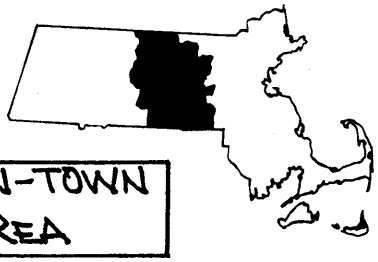
Thus, three primary and two to three backup vehicles at three well located sites could provide service of the same effectiveness

* = LOCATION OF AMBULANCE BASE (HOSPITAL)

= AREA BEYOND 5.5 MI. FROM BASE

THE COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF COMMERCE
DIVISION OF PLANNING
WORCESTER COUNTY

5 0 5 10
SCALE IN MILES



THE TEN-TOWN CASE AREA

FIGURE 8

Table 16: Ambulance Utilization Statistics for Ten-Town Case Area

STATISTIC	PRESENT	ALTERNATIVE	RATIO[1]
Total Population	87,600	same	NA
Total Area (square miles)	277.0	same	NA
Average Density (persons per sq. mile)	320	same	NA
Total Emergency Calls per Year [2]	3,060	same	NA
Demand Intensity [3]	.35	same	NA
Total Ambulances	12	5	.42:1
Total Primary Ambulances	9	3	.33:1
Utilization per Primary Ambulance	.04	.12	3:1
Probability of Dispatch Delay [4]	--	0.5%	--
Expected Dispatch Delay (minutes) [4]	7 min.	23 min.	3.3:1
Number of Ambulance Stations	9	3	.33:1
Average Service Area (square miles)	30.8	92.3	3:1
Average Maximum Radius (miles)	3.13	5.4	1.7:1
Average Maximum Travel Time [5]	6.9 min.	11.9 min.	1.7:1
Average Maximum Response Time	14.9 min.	14.9 min.	1:1
Number of Dispatching Centers	9	1	.11:1

[1]Ratio of Alternative Model's Statistic to Present System's.

[2]Assuming 35 calls per year per 1000 population.

[3]Assuming 60 minutes service time per call on the average.

[4]For primary vehicles only. With secondary vehicles added, the probability of delay is essentially zero in both the present and alternative arrangements and the expected delay is reduced to 5 minutes under present arrangements and to 11 minutes in the alternative model.

[5]At 2.2 minutes per mile.

[6]Assuming 8 minutes mobilization time for on-call services and 3 minutes for on-duty services.

(measured by response times and probability of dispatch delay) as twelve vehicles at nine stations presently provide. The number of dispatching points would also be reduced. Table 16 gives the full comparison. Clearly, the level of efficiency would be much higher.

The difference is that crews would have to be full-time. The added costs of on-duty personnel would not be small but could be defrayed by added revenues from charges and third-party payments and by spreading the cost of the personnel between ambulance work and either hospital, routine transfer, or public safety work.[10]

Increased utilization would also enhance quality by the use of well prepared personnel with frequent emergency experience[11] and by making the investment in better equipment more feasible. A central dispatching system would allow more competent disptaching personnel and a more effective control over the deployment of resources.

This kind of analysis could be carried out for the entire region with similar results. Reducing substantially the number of ambulances in the region would have little negative effect on dispatch delay and would not hurt travel time if personnel could be utilized that were immediately available around the clock. Aggregating demand in this way would help spread the greater expenditures necessary for the salaries that full-time employees require. However, areas with average densities of less than 285 would either have to pay a higher amount per citizen or be content with the slightly greater maximum response times necessary to enclose an area of sufficient population, if they were to have full-time on-duty service. A compromise which would help such communities would be to staff ambulances with on-duty personnel only during the day, using on-call personnel at night.

The Effectiveness of Feedback in the System of Guidance

Two aspects are important here: The information processes and the effectiveness of regulation in achieving desired ends.

The difficulty of learning about the functioning of the emergency medical services delivery system in Central Massachusetts and about the overall system of guidance because of the inadequacy of existing information processes has been pointed out.

Requirements as to the nature and format of records are limited and affect only certain segments of the emergency care delivery system. Public safety organizations, entities providing communications services, and physicians providing non-hospital based emergency medical care feed little planning information into the system on a regular basis. As noted, however, even regulated ambulance services, are not required to submit data on operations (such as number of runs, response times, first aid rendered, times of calls, etc.) other than to their town officials and individual services vary considerably, as a result, in their ability and willingness to produce such information when requested. With forty-six regulated services in the region alone, it becomes an arduous task to poll each without regular reporting mechanisms, especially because the quality and meaning of the responses vary.

Hospitals have, of course, much more elaborate information gathering systems but still do surprisingly little planning analysis of their emergency services. Again, the definitions and the data-recording processes differ sufficiently to impair the quality of the analysis of data collected from them (as was evident in the arrival modes study reported in the previous chapter).

The state regulatory systems problems relating to information collection have been described. Some simple improvements in the forms and the procedures of collection and in the policies for the use of data would be beneficial.

The two major defects in the regulatory process are the difficulties inherent in relying on a single set of standards for all emergency services providers of one type within the state and the ineffectiveness of the enforcement process. The first, in part, impairs the second. The second tends to mitigate somewhat the first, and both together, when coupled with the lack of information capabilities, tend to make the regulatory process an uninspired effort.

Neither in the case of transportation nor in the case of hospital care services does the Department of Public Health make a distinction for different types within the class, even though some ambulances are used almost entirely for medical taxi service and some emergency rooms

are simply unscheduled primary care facilities. Other ambulance services and emergency rooms get many of the worst emergencies that occur in an area. In this respect, the proposed revision of the hospital emergency service regulations is a step forward because it will allow differentiation of regulation by grade of service offered. The Governor's bill to improve the regulation of ambulance services leaves open the option of also setting up classes of ambulance service.

Still the basic requirements of the proposed regulations (twenty-four hour M.D. coverage, substantially expanded training requirements for ambulance attendants) would represent a major hardship on many existing providers within the state and probably will be resisted, unless means are developed to take the variety of needs into account in the development of regulations. Otherwise, three effects are possible: the smaller providers would be edged out, leaving more rural areas without service; the proposed rules would be weakened or rejected, despite their positive features; or the regulations established would not be enforced effectively.

The dilemma of managing the delivery of any social service is how to effectively establish and monitor the progress towards the achievement of system objectives. Emergency medical services delivery is simply one more example. The emphasis on twenty-four hour coverage by a physician, on bringing all purveyors of emergency medical transportation services under the jurisdiction of Department of Public Health ambulance regulation, and the methods used here to attempt an evaluation of equity of spatial distribution and efficiency of the overall allocation of resources--these are all attempts to measure the system's effectiveness. The study has also discussed the problems of evaluating the more subtle and less quantifiable aspects of the guidance system, particularly as to the effectiveness with which participation and accountability are ensured.

None of these measures, however, can fully succeed in determining how well the system operates, nor does expressing them in terms of regulations or planning powers (e.g. determination of need) necessarily guarantee an effective delivery of service, for these measures cannot take into account extenuating or mitigating circumstances in the individual case. For example: a hospital in a relatively small community

may not have a doctor on the premises at all times but may have M.D.'s living within minutes, and in contrast, a large hospital with a high-volume emergency service may have a very poor system of physician management of care despite having an M.D. in the emergency room.

Such circumstances can be perceived fully only at rather close range, yet decision-making at that level suffers from the lack of perspective of the whole and from potential loss of objectivity. Hence, a composite of both perspectives is needed.

The findings of this report argue that the Department of Public Health emergency medical services planning must place a heavy emphasis on involving local providers, consumers and area-wide emergency medical services planners, and must act to decentralize some of its decision-making power to area-wide emergency medical services planning bodies, retaining primarily only review responsibility. It should, for example, establish a sliding scale rather than a fixed standard, with the exact requirement to be determined by the regional planning body. Thus, regional input would be felt in the regulatory process to the extent of participating in the establishment of criteria and standards.

NOTES

[1]This conclusion was reached after having spent a good deal of time trying to ferret out those relationships for Central Massachusetts from data on accidental and emergency deaths and injuries.

[2]Massachusetts Medical Society, Massachusetts Hospital Association, Massachusetts Ambulance Association, Massachusetts Heart Association, American Red Cross, Massachusetts League of Cities and Towns, Massachusetts Chiefs of Police Association, Massachusetts Fire Chiefs Association, etc.

[3]See section on economic efficiency.

[4]Major = comprehensive, basic = routine, and provisional plus referral = no emergency-referral only.

[5]At a later point, the concept will be expanded to "demand intensity" which additionally takes into account the time required to provide service.

[6]Keith A. Stevenson, op. cit., p. 14

[7]Data provided by the planning section of the Worcester Police Department.

[8]Charlton, Douglas, Dudley, Northbridge, Oxford, Southbridge, Sturbridge, Sutton, Uxbridge, and Webster.

[9]This is not true, of course, but is sufficiently accurate for the purposes at hand.

[10]The last, as noted before, is the way it is presently done in the majority of towns with full-time ambulance service, but has the disadvantage that ambulance work generally gets less attention that the other activities in which police and fire departments engage.

[11]See Appendix F.

Chapter V: Conclusions and Recommendations: Towards an Improved Delivery System

No one, when it comes right down to it, argues that emergency care delivery in the United States is adequate as it presently stands. The fact is that it is woefully inadequate. The toll in human suffering, productive capacities, and lives is far greater than necessary.[1] The Central Massachusetts situation is no exception. The shortcomings, however, are not due primarily to conscious malfeasance on the part of providers or of central misuse of power. To a large extent, the failings have arisen out of the lack of attention we have given to emergency medical services as a public priority. As an almost inevitable consequence, fragmented patterns of decision-making and service provision have developed as hospitals, public safety departments, interest groups; and governmental agencies have had to fill the vacuum with a hodgepodge set of "make-do" arrangements.

Not all aspects of health care would benefit by "rationalization", for the freedom to choose among providers of care is vital and should be enhanced. However, an emergency medical response system is, by definition, a means to assist individuals when they are unable to manage their own care. For this reason and because the response system has to be prepared for so many eventualities, the requirement for system efficiency and rationality is high.

Consequently, improving the delivery system in Central Massachusetts must involve an effort to increase the "system" characteristics of delivery itself, such as the interrelatedness of the various components, and the consistency of their processes of communication and action. As we have seen, the nature of the guidance mechanisms of planning, decision-making, and control have a very important impact on the degree to which EMS delivery is "Systematic".

Improving guidance processes is, as a result, a necessary first step to improving the delivery system and ought to be the initial consequence of this study. Recommendations with respect to the guidance

system will be presented in the first section of this chapter. The second major section will present recommendations for improving the organization of the Region II delivery system. The report will conclude with a final assessment of the prospects for improvement and the nature of the constraining conditions.

Though a certain consensus as to the nature of the problems is wide-spread, solving them is not simply a matter of passing legislation or even appropriating funds. Achieving better means of delivering emergency medical services depends on the concern of both providers and consumers, on the leadership of local and state political leaders and the commitment of the citizenry. Those communities now held up as models of desirable emergency medical service programs have in every case achieved this through a community-wide willingness to work together creatively. These recommendations are presented with the hope that interest and commitment both in Central Massachusetts and in the state as a whole is nearing the "critical mass" necessary for such collaboration to occur. The study is offered as input to that process.

Improving the Guidance Processes

Necessary elements of the guidance system are a participatory effort by providers, users, and planners of emergency services aimed at learning about t e system and evaluating the effects of change and an effective means for making decisions and setting objectives and monitoring the success of steps taken to achieve those objectives. Recommendations as to improving planning, then, relate to three needs: (1) the need for creating a regional emergency medical services planning process, (2) the need for improved policy development and implementation at the state level, and (3) the need for improving data-gathering and update methods.

1. Creating a Regional Planning Process.

The material presented in preceding chapters illuminates the problems that arise when decision-making is almost completely disaggregated. Yet, centralized planning and regulation also has problems in the form of unintentional consequences that result from a lack of understanding of the less tangible aspects of EMS delivery, less amenable to measurement

by standards. Massachusetts suffers from both to some extent (though the problem of overly fragmented decision making is perhaps more pronounced), because regional emergency medical services planning has lagged.

There is a great need for an effective planning and guidance effort relating to emergency care in Central Massachusetts that derives from the participation and collective determination of policies and objectives by both providers and interested citizens. Establishing such interaction will, in itself, catalyze further improvement.

Opening up channels of communication through area committees or task forces should be an immediate step. Initially, the membership and definition should be very open in order to allow all interested and affected parties to participate. At the same time, the entire effort needs direction and legitimacy and staff assistance. The Comprehensive Health Planning Council seems the obvious sponsor organization because of its legal mandate and because of the commitment it has already made by supporting the study reported in these pages.

Ambulance and hospital people across the region need to talk with themselves and with each other, to explore the different perceptions of emergency care delivery, to establish some consensus about the nature of the problems and the resources available, and to engender a region-wide commitment. Out of the dialogue should come a kind of "inside information" that this document cannot hope to provide.

The discussion, stimulated by the Health Planning Council, ought to be promoted both in a central council (bringing region-wide participants together) and at a local level between those who are part of the same delivery system and depend on each other.

An initial task is to establish a framework of common definitions, terms, and standards. Additionally, the methods and findings of this report should be evaluated, with particular attention to viewing the region as a set of area-wide delivery systems and to the importance of integrating the compontents of those systems to ensure effective management of the medical care rendered. The other important task of the early stage involves structuring the regional planning system by agreeing on appropriate

composition and functions and powers of a regional emergency medical services committee and by creating community emergency medical services councils. More specific tasks will be presented in the section on organizing the delivery system.

2. Improving State Policy-Making and Regulation.

Efforts at the regional level to achieve consensus and cooperation are critical if the state emergency medical services planning program is to be effective. The legislators, Department of Public Health planners and other policy makers depend on inputs from those closer to the scene, and particularly so now, when policy formulation will occur rapidly.

The thrusts being taken by the state are basically good but have been and will continue to be influenced (unavoidably) by the characteristics and problems of a high-density urban setting and by the natural and unconscious tendency of state planners to favor centralization of planning and regulatory powers. Both providers and consumers of emergency medical services in Region II need to respond to present and propose standards and programs at the state level, if for no other reason than that they can bring a different perspective to bear than is apparent from an office in downtown Boston.

2.1. The Need for Differentiated Standards

An important outcome of state-regional cooperative planning in terms of state regulatory activity, ought to be the development of differentiated standards, geared to regional and subregional capabilities and needs. Relying solely on making exceptions for "hardship" cases, as is now done (although not, perhaps, in such explicit terms), is not sufficient, for it weakens the entire standard enforcement process. For example, a decision about whether an emergency facility provides an appropriate type and quality of service needs to take into account the size of the physician pool, the population of the catchment area, the distance to other emergency rooms, and so forth.

Most of this need would be met by a good classification system of emergency rooms and ambulance services. To be effective, the system must be initially descriptive, rather than prescriptive; require that the

individual provider take into account regional planning considerations in choosing a level of service; and be informative to the public. The last requirement means that the classes must be reasonable and few in number. In order to not be discriminatory, however, these few classes might have to be regulated according to a sliding scale that would consider variables such as those mentioned above in relation to emergency rooms or such as demand intensity, travel times, and so forth, in relation to ambulance services.

2.2. Hospital Emergency Facility Classification

If one were to fault the categorization method of the proposed emergency facility regulations, it would be that the requirements for a minimum emergency service are set too high to be completely realistic. Perhaps the intent is to allow some room to negotiate during the approval process, but it would seem much better to adjust the regulations to apply more clearly to the many hospitals who do not have in-house coverage of the emergency room by a physician on a twenty-four hour day basis but which nevertheless perform an important function in their community.

Three alternatives seem possible: First, an additional category, corresponding to the American Hospital Association provisional category, could be added, with a statement of limitations as to the service such facilities could provide. Second, the regulations could contain a provision to the effect that a hospital more than a certain number of miles from another emergency facility might offer routine emergency service, even if it could not meet the requirement for physician coverage, if it had an effective alternative means of ensuring physician management of care and had established relationships with another hospital in the region for consultation and transfer in serious cases. The regional comprehensive health planning agency, with the approval of the state health department would have to determine that these arrangements were adequate. Or, third, the regulations might simply state that such hospitals would be encouraged to offer unscheduled outpatient care, subject to the regulations covering outpatient services, and would be available, in extraordinary situations, to provide emergency medical services according to a plan.

Clearly, each of the alternatives would have different effects. The choice between them will require careful evaluation of potential impacts and should be made in consultation with the comprehensive health planning agencies. For Region II, the second alternative including a criterion of distance from other hospitals into the consideration appears the best, though actually, encouraging unscheduled outpatient care is not thereby excluded: A few hospitals in the region might be given routine emergency service status, because of their distance from other hospitals, while others would continue to provide unscheduled outpatient services but would no longer announce themselves as a regular emergency room.

The purpose of the comprehensive category in the proposed regulations is unclear. If it is to indicate major "trauma units", then more state involvement in the designation of such units is needed, since presumably they would be few in number; hence, the designation ought not to be left simply to the inclination of the individual hospital.

The routine-comprehensive distinction as proposed seems unlikely to be particularly helpful to consumers of emergency services. A purpose of the emergency medical services delivery system is to get emergency victims under physician supervision as soon as possible so that they can be sorted according to their need. A citizen should not have to choose between emergency rooms. He should be able to go to the nearest announced emergency facility (well-marked by signs, etc.) and have the patient's condition quickly ascertained and his care managed. On the other hand, state inspectors, health planners, ambulance and public safety and emergency room personnel, and physicians all need to have more detailed decision criteria, and the "comprehensive" category is a step in that direction. For regulation, it is perhaps sufficient, but for planning and actual delivery of care, more information about hospital capabilities is needed.

A final point on the proposed regulations: They are too weak in their emphasis on communications and other linkages with ambulance services. Rather than simply being "urged" to set up communications capabilities, these should be required.

2.3. Classification of Ambulance Services.

A categorization system for ambulance services is also needed. One class should be "routine transfer only," which would cover a number of private services. Vehicles used for such service could be of the Cadillac type, would have to be clean and carry certain minimal supplies. Identifying them as "ambulances" should be discouraged as they would not be set up to provide first aid underway. Their purpose would be to provide transportation to bedridden patients to and from medical facilities and rest homes, etc., most likely on a scheduled basis. Twenty-four hour service and immediately ready vehicles and personnel would not be required. Still, there might be advantages to having them dispatched through the same system used for emergency ambulances.

A second category should cover fire and police services using "dual-purpose" vehicles. Personnel should be required to have certain training in first aid. Vehicles should be equipped with basic life-maintaining equipment and supplies such as airways, sterile compresses, resuscitation units, blankets, and forced entry equipment. The regulations should tend, over the long run, to discourage these organizations from transporting patients, as more appropriate means become available, and should rather emphasize their role in providing on-the-scene stabilizing care and assisting ambulance personnel. Those towns now relying on dual-purpose vehicles should be given a period of time to connect with regional emergency medical services planning and work out an arrangement providing a higher level of outreach to the town.

Broad requirements, including those in the previous paragraph, should be made of all organizations providing outreach and assistance in medical emergencies on a regular basis - a third category. They would be minimum training specifically oriented to ambulance work (at a level beyond advanced first aid) and annual testing of those skills; vehicular design that allows safety and interior working room; equipment for rendering care, extricating and transporting victims, and for communicating both with the base station and with hospitals.

A top category, arising from the previous one, would have more stringent requirements than the previous one as to training, full-time availability of service instantaneously, and vehicle design and communications capabilities. This category would be encouraged in planning efforts and given special recognition and priority,[2] in hopes of ultimately replacing services of lower orders.

2.4. The Need for Supportive and Facilitating Programs.

Presently, the primary role of the state is in informing minimum standards and applying negative sanctions. The critical need for the future is for the state to adopt positive policy stances that encourage and facilitate cooperation and improvement. The watchdog role does have to be strengthened to some extent, in the ways outlined in the preceding paragraphs, but should receive overall, less emphasis than the programs that would assist regional planning and improve delivery, such as technical assistance as to planning methods, equipment purchase, training programs, and encouragement of demonstration projects showing the feasibility of area-wide ambulance systems and ambulance-hospital collaborations.

3. Improved Information Methods.

This is a fertile area about which much could be said and proposed that goes beyond the scope of this report. Present methods of collecting, storing, and using data about emergency care are inadequate in a number of ways for effective planning and guidance processes, as is no doubt obvious from the earlier chapters. Principle needs for the immediate future which will be discussed here are standardization of descriptive terminology and means of recording data, increasing the compatibility of record-keeping systems as to forms design and coding, increased requirements for reporting operations data to regional planning committees, and an economic analysis of the costs of providing service and the sources of revenue.

3.1. Standardization of Terminology - Description.

Perhaps the most fruitful pursuit initially would be to establish a more clear scale of urgency by which to record the patient's condition. The classification ought to be descriptive of not only the perception of

of the provider but also of the patient's perception of his situation (because immediate medical attention may be just as necessary in a certain case to allay patient fears as to treat bodily injury in another). Both ambulance and hospital records should contain such a notation assessing urgency. After examination, the physician should make a summarizing assessment that would include an evaluation of the appropriateness of the services provided.[3]

Other items which should be recorded uniformly are, for ambulances, the nature and the circumstances of the situation, including causes (if discernible); the location of the victim; the mobilization, travel, and total service times; the distances from base to the scene and from the scene to the hospital; and the first aid rendered. For hospitals, such items are arrival modes; patient origins; and methods of reporting diagnoses and disposition. In neither case would these pose significant additional burdens in terms of time or effort.

3.2. Compatible Record-Keeping Systems.

These efforts should be coupled with an attempt which should be made to achieve greater compatibility of record-keeping systems. Model ambulance forms should be designed and forms technologies should be encouraged that allow passing a copy of ambulance forms along to the emergency room. Special emphasis should be place on uniform coding and other data-recording devices that are readily compatible with computer systems (such as optical scanning). Periodic update is much easier if data, definitions, and forms are uniform and readily accessible.

3.3. Improved Data Reporting Policies.

Particularly in the early period, there is a need to develop a base of information at regional and state planning levels. Ambulance services and hospitals should be required to provide quarterly and annual reports emphasizing utilization and operations data, not so much to serve the "watchdog" function as to allow system "learning" to take place. The regional emergency medical services committee should get regular reports from the providers about patient origins, runs per man, active personnel rosters, cross-tabulations of urgency with arrival modes, with time of visits, with disease category codes, etc. As patterns become evident,

the frequency and number of items reported could decrease.

3.4. The Need for an Analysis of Costs.

A thorough input-output analysis of costs and revenues in the delivery of emergency medical services is needed in Central Massachusetts and for the state as a whole. Each provider and each planning body should report total and per service unit costs along with a breakdown of how the costs are generated. Also, the sources and amounts of revenue covering those costs should be noted. This information is essential if effective resource allocation is to occur and if public support of emergency medical services is to improve. For neither of these will happen without some reliable expressions of cost-effectiveness.

Structuring the Delivery System

This section will present recommendations in terms of basic themes, relating them to the fundamental criteria of quality of care, geographic accessibility and economic efficiency. After discussing the implications of these themes for the delivery of emergency medical services in Central Massachusetts, we will propose a model of how the regional delivery system could be organized. The section concludes with recommendations for the process of transition and setting priorities for the staging of change.

1. Regionalization: Organizing Service at a Larger Scale than the Towns.

We have spoken of the need for larger-scale planning for emergency medical services, but Chapters III and IV also pointed out the benefits from the standpoints of efficiency and quality of larger-scale delivery of services.

1.1. Hospital Emergency Care.

Hospitals are less influenced in their delivery of care by town boundaries than ambulance services presently are, but they obviously are influenced by institutional boundaries. In conjunction with the establishment of a categorization of services, hospitals will need to improve the networks of emergency facilities, both the geographic networks for cooperating in disasters, etc. and the hierarchical networks for referral and transfer of patients and for consultation. A purpose of categorization

is to improve triage.[4] For that purpose to be fulfilled, hospitals of lower orders will need good working relationships with higher order hospitals, including arrangements for transfer of records, for exchange of supplies, and for regularly granting emergency staff privileges to physicians of patients being transferred so that continuity of care is not impaired. Thus, the delivery of hospital care could be viewed as occurring in a nested set of emergency facilities.

The other aspect to regionalization is that not every hospital need provide emergency service. A good Emergency Department is costly to maintain and, as utilization data for this region and others have shown, often ends up providing care to patients who are only emergencies in the sense that they need to see a physician soon but cannot find access to one. In areas where two or more hospitals are located in close proximity, some emergency rooms could be converted into unscheduled outpatient departments with evening and weekend service, and "real" emergencies would then be diverted from those facilities to designated emergency rooms at other hospitals. At the same time some other hospitals must be upgraded in terms of their emergency services. Of course, for this to succeed, the hospitals will have to collaborate and share staff and financial resources to some extent. In addition, those hospitals relieved of formal emergency responsibility must be ready to maintain the episodic care need of the population.

No final recommendation of the fate of each of the present emergency facilities will be attempted here. That must be a task of the regional emergency medical services council(s).[5] However, some suggestions will be made, based on the findings of this study. They will be discussed in the presentation of the model of delivery.

1.2. Ambulance Services.

Organization of ambulance services primarily on a town scale is not adequate because of economic inefficiency, the wide variation in the quality of service, and the potential for delay and error in the processes of receiving calls and dispatching. The population of most communities in Central Massachusetts is too small to support an effective full-time ambulance service. The choice has been to rely on the public safety

forces to carry out the ambulance function as a sideline (using, in many cases, the same vehicles as are used for regular work) or to use volunteer squads with the consequent possibility of long time delays assembling a crew and often with used vehicles.[6] It is recommended that communities work together to support area-wide ambulance services using full-time personnel. In many parts of the region, the population density is sufficient to allow the support of a service which could be effectively utilized and still be able to respond to calls as quickly as town volunteer services now do. Where possible, the personnel should be ready on a full-time basis around the clock, but some areas will have to rely on day-time on-duty and night-time on-call arrangements. A few sparsely settled areas will still need to depend on volunteer services.

1.3. Dispatch and Communications.

Dispatching should also be on an area-wide basis and, ideally, should encompass all ambulances, no matter how organized. The cost of communications "hardware" and personnel time is reduced thereby, and the efficiency with which vehicles can be utilized is enhanced. As the example in Chatper IV demonstrated, a central dispatching system would allow three vehicles manned by on-duty crews to serve a part of Central Massachusetts at roughly the same level of service (defined as the probability of delay due to all vehicles being in use) as is presently provided by nine separate services. Area-wide systems would simplify procedures of handling major emergencies of "disasters," as present mutual aid agreements would then be, for the most part, rendered unnecessary by the shared dispatch and communication facilities. The other advantage is that with fewer dispatching points, the dispatchers could be more expert in their function, which is a critical factor in insuring the quality of the response.

2. Identifying Ambulance Personnel as Emergency Medical Technicians.

The title, Emergency Medical Technician (EMT), is in itself simply a gimmick. The need is real, however, to create an identity for the people who provide emergency medical outreach services. It is not sufficient that it simply be their first assignment as a rookie firefighter or whatever.

The job deserves a much higher status and priority than it is often accorded. In cases where policement and firemen operate the ambulance, they ought to do so because they enjoy the work. They should belong to a special squad or patrol and have emergency care as their principle function on a long-term basis. It should be similar with other providers.

Part of the way to achieve this is by better training and better methods of recognition. Many have pointed out that the Red Cross first aid courses were never intended for ambulance personnel. Hence, creating more relevant and specific training programs and providing the means, such as scholarship funds, to facilitate personnel getting this training would add to the esprit d'corps. The state is pressing for a legislative mandate to increase training requirements. Whether or not that effort succeeds, providers within the region should make a commitment to improving training programs, particularly as to in-hospital experiences. Under the auspices of a regional emergency medical services council, a program should be carried out to test the present capabilities of all persons on ambulance rosters in the region, not with punative intent, but rather in an effort to determine training needs. The possibility of using the test developed for the Emergency Medical Technician Registry program should be explored, for those who pass then have the added status of being a "registered" emergency medical technician.

The ideal would be to give prospective emergency medical technicians training similar to the military medical corpsmen, as a junior or community college program. Certainly, an expanded identity for emergency medical technician's could be used as a magnet to draw in veterans with corpsman experience.

A remaining hurdle to be overcome in this regard would be that of the legal constraints on the care that ambulance personnel can render. In a few states, California being one, laws have been passed specifically giving emergency medical technician's the authority to render care beyond first aid under physician supervision (for which radio contact counts). However, William Curran, Professor of Legal Medicine at Harvard Medical School has opined that existing legislation in Massachusetts is sufficient.[7]

The other side of the same coin is whether a more extensive role would open the Pandora's box of malpractice suits. The Massachusetts Ambulance Association, comprised of private companies, apparently fears this:

> "If (malpractice) is a problem for doctors today, what will it be when ambulance paramedical personnel start administering to the patient--even if it is under the supervision of a doctor in the emergency room?"[8]

Curran seems to feel that, again, existing legislation is adequate to deal with the malpractice problem, but the case is by no means clear.

Creating a special identity for the ambulance attendant, even if not so glamorous as television might suggest[9] would have another benefit of releasing police forces in many communities from the burden of having to take full responsibility for emergency medical outreach. Police officers will, of necessity, always have some involvement in many medical emergencies and ought to be trained to deliver initial first aid, but their role is best at the scene of the accident or injury, their advantage is that of rapid response. For them to have to leave the community to take an emergency case to a hospital, as often occurs, is to leave the community short-handed. It is recommended that where special ambulance service exists or can be developed, regular patrolmen be used to provide initial care and ascertain the circumstances surrounding an emergency and then defer to the ambulance personnel when they arrive.

3. The Hospital Emergency Facility as the Nerve Center.

Improvement in the delivery of emergency medical assistance will occur to the extent that the system is built on outreach from centers of medical care. Only thereby can management of the delivery of care by competent medical professionals be ensured, for, in the present system of health care delivery, physician resources are necessarily hospital-based.

3.1. Communications.

It is quite clear that the future will see an expanding role for communications technology in the work of hospitals as medical care know-how centralizes and population disperses and as the time and effort and cost of overcoming distance by transportation become greater than the

costs of bridging distance by communications media. Such changes are particularly apparent in emergency care.

There are three levels to the communications role of emergency rooms. The first objective should be to establish radio voice contact with ambulances in the region. Although the technical requirements of such a system were not reviewed to any great extent for this study, there are numerous examples of systems operating in other parts of the country which could be used as models. Not all hospitals would have to be in the regular emergency network. Presumably, if some had given up their emergency service, they might not normally communicate with ambulance services.

The second aspect of communications is telemetry--electronic monitoring of the vital signs of a patient in the ambulance, received and interpreted in the emergency room. Telemetry involves a more complex technology, is much more expensive, and is only practical in settings where the demand intensity is high. At the moment, this does not seem feasible within the Region.

Having central dispatching done from a hospital base, receiving all medical emergency calls there, is a more practical and very beneficial aspect. Like poison and crisis centers (which could be related to this in some way), a hospital-based dispatching system would more easily allow telephone counseling and instruction as well as simply taking the call and sending an ambulance. If the citizenry could be assured that, when an emergency arose, they could call the medical emergency number day or night and get advice as to what to do, how to best use the emergency services system, where to go, etc., this would be a substantial improvement in service. Having the dispatching there would also simplify ambulance communications systems. Obviously not every hospital would have this. In fact, perhaps, only a third of the hospitals in the region would be so designated.

3.2. Hospital-Based Ambulance Personnel.

The advantages to having ambulance personnel located at hospitals are great in terms of quality of care and efficiency in the use of resources. If he performed in a paramedical or assisting role at a

hospital, the ambulance attendant could be using his time and training effectively between calls. He would be sharpening his skills, as training would continue almost automatically, with ongoing feedback from more experienced medical people. He would have a much better sense for the role of ambulance work in the total scheme of care delivered. Physicians could better assess his understanding and capabilities which would enhance the effectiveness of radio supervision. This innovation would mesh well with hospital-based dispatching and would also shorten total service time in the cases where the patient was taken to the hospital at which the crew and vehicle were based. Finally, being at a hospital would make it easier for RN's and even physicains to go with the ambulance in major emergencies.

The issue of accessibility cannot be ignored, however. The ambulances could only be based at hospitals where negative effects on response time were limited. Because of Central Massachusetts' rather effective distribution of hospitals, a delivery system could be created that would rely to a large extent on hospital-based vehicles, as will be illustrated in the following pages. Even if some of these hospitals were to cease offering emergency service, emergency medical technicians could presumabley have assignments in other departments. In these cases the ambulance would transport to a different hospital with an emergency room (mitigating somewhat a few of the comments made above, but by no means voiding the point of the argument).

3.3. Centralizing the Storage of Information.

By linking ambulances to hospitals and by assuming a more central communications role, the flows of information about the patient and his care would be improved. Fewer cases of duplicated and mismatched treatment by ambulance and hospital personnel would occur. The emergency room staff could act more quicly, if they could confidently use the preliminary information and history taken by the ambulance crew. Logistical control would be related to the control of quality of care which would likely have positive benefits for feedback and further improving the system.

To sum the themes then: Each of the three criteria dealt with in Chapter IV are important to an effective delivery system: services must be of a high and consistent quality, they must be provided efficiently so that economic resources are most effectively used, and they must be distributed across the entire geography as equally as possible and must be accessible to those who may require them. The cumulative effect of decisions and policies of providers has been to orient the delivery system toward the third--emphasizing accessibility and proximity--somewhat at the expense of the other two. The conclusion of this study is that, though certain improvements to the pattern of geographic distribution are needed, especially to offset the lack of nearby hospital emergency facilities in some areas, the greater emphasis should be directed to the system as to the other two criteria.

Quality of care criteria are most easily met when the care delivery is managed by a physician from the earliest possible stage by extending the emergency physician's influence from his location in the hospital through his involvement in the training of outreach personnel and his immediate ability to communicate with them by radio. Further, basing the ambulance personnel at hospitals and giving them a medical-related role between calls improves their effectiveness at outreach and the communication between emergency physician and ambulance attendant. Thus, having a doctor in the hospital at all times with an emergency room assignment is important for the effectiveness of the emergency room.

Criteria of efficiency would suggest that ambulance services be dispatched from a few, central points, that ambulance service areas be as large as possible to achieve a high demand intensity, that emergency services be consolidated in a few hospitals in a given vicinity and that the others provide simply outpatient services.

4. A Model of a Regional Delivery System.

On the basis of the foregoing, then, it is recommended that the region be organized into area-wide subsystems around key hospital emergency facilities, moving from the present implicit systems as described in Chapter III to formally organized systems with central

dispatch, area-wide ambulance services, and where possible, full-time medically-oriented personnel based at hospitals.[10]

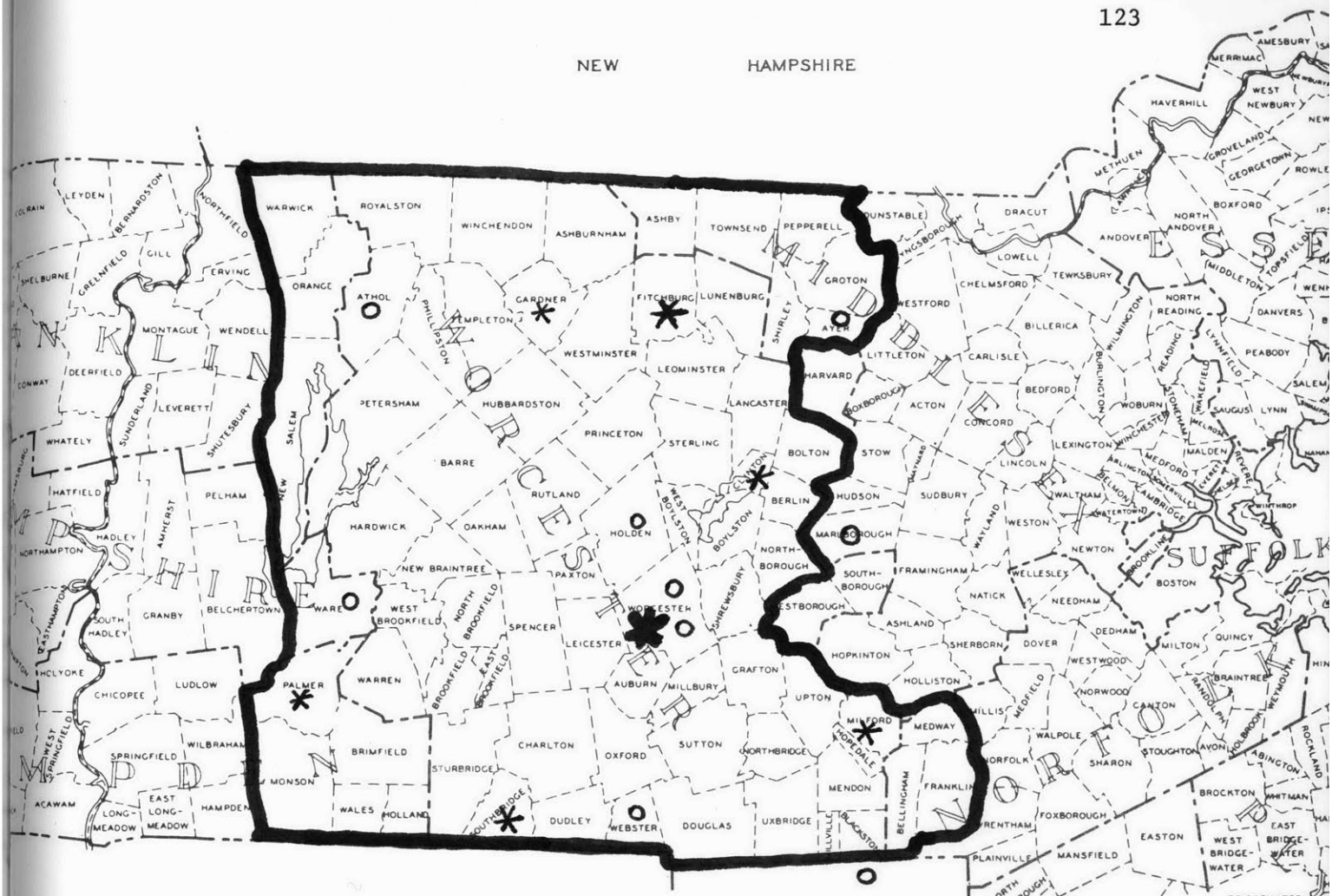
4.1. Identifying Key Hospital Emergency Facilities.

On the basis of the information available to this study, seven hospitals should be designated as the "nerve centers" of emergency care subsystems. There are a major Worcester emergency department (either Worcester City, St. Vincent, or Memorial Hospital), the Milford Hospital, the Harrington Memorial Hospital in Southbridge (or, possibly, the Hubbard Regional Hospital in Webster), the Wing Memorial Hospital (Palmer), the Henry Heywood in Gardner, and Burbank (Fitchburg). The Clinton Hospital would be the seventh as a node of a dependent subsystem. (See Figure 2.)

As stated earlier, the evaluation of hospital capabilities is a responsibility of the regional emergency medical services planning effort. These were chosen because they represent the best service available within their respective sections of the region. However, they are not equal in their capacities. The Milford, Harrington Memorial and Clinton Hospitals lack night and weekend physician coverage in-house and have limited capacities in other ways. These hospitals would have to be strengthened.

These hospitals would become, with the possible exception of Clinton (which might be covered by Worcester or perhaps Fitchburg), the central dispatching points and the major centers of medical supervision of ambulance work by radio. Presumably, the Worcester hospital would be the central communications point for the entire region.

The emergency services of other hospitals would also be affected: Hospitals in Athol, Holden, Ayer, and Ware serve areas not easily accessible to the primary emergency facilities mentioned above and, therefore, their night and weekend physician coverage also needs improvement. Their emergency service should not, for the near future at least, be terminated by state regulation. Three hospitals (Fairlawn and Hahnemann in Worcester and Leominster) are in close proximity to higher order hospitals and need not offer an emergency service, though at least Worcester Hahnemann and Leominster should continue their operations as unscheduled outpatient



THE LOCATION OF KEY EMERGENCY FACILITIES

FIGURE 9

TH OF MASSACHUSETTS

COMMUNITY AFFAIRS

ANNING PROGRAMS

AND COUNTIES

services. At least two others--Winchendon and Whitinsville (Northbridge)--cannot effectively provide an emergency service and should withdraw from doing so.

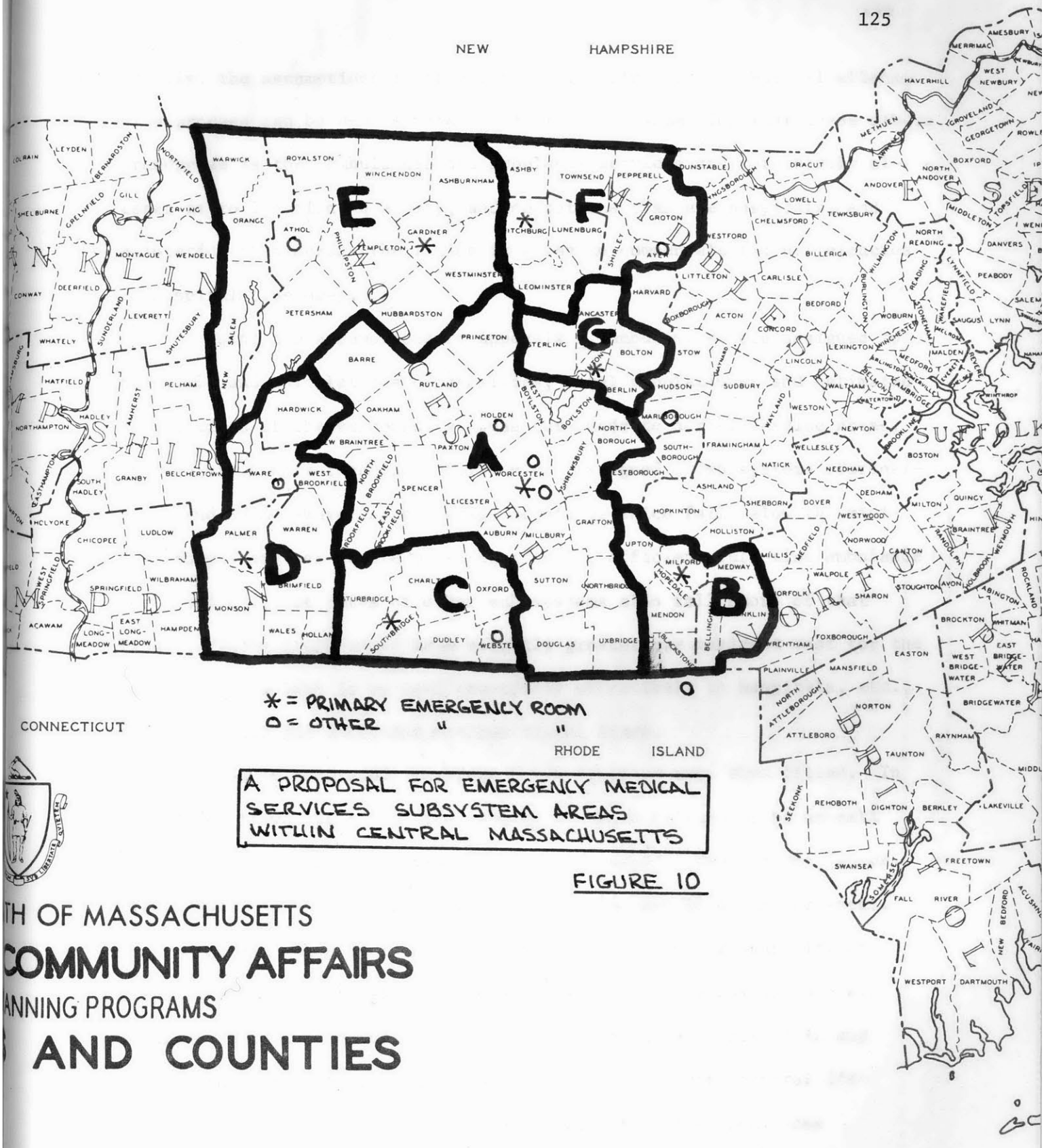
4.2. Mapping the System Areas.

This is essentially a repeat of the process carried out in Chapter III and preserves, wherever possible, the relationships that were revealed there. Additional inputs are the pattern of telephone directory service areas, accessibility factors which could be derived by inspection of population clustering and road connections, and the additional information that has been presented about emergency care resources in the various areas. The pattern has not altered substantially, except for combining certain systems, as can be observed in Figure 10.

All ambulances within these areas would be linked to a single dispatching point and would regularly use the hospitals within the system. Especially in the areas served by the more limited emergency facilities, however, the need would occasionally arise to go to a higher order hospital, say in Worcester. Through radio consultation with a physician at the subsystem emergency center, that decision could be made and the ambulance could then activate communications with the higher order emergency room as it proceeded in that direction.

4.3. Allocating Ambulances.

We have argued the benefits of having ambulance personnel on-duty around the clock and have pointed out that a certain level of demand and a certain base population are necessary to be able to support such a service. Because the minimum values of these factors are not known


72° 00'
71° 00'
NEW HAMPSHIRE
CONNECTICUT
RHODE ISLAND
E
F
G
A
D
C
B
* = PRIMARY EMERGENCY ROOM
O = OTHER "
A PROPOSAL FOR EMERGENCY MEDICAL SERVICES SUBSYSTEM AREAS WITHIN CENTRAL MASSACHUSETTS
FIGURE 10
TH OF MASSACHUSETTS
COMMUNITY AFFAIRS
ANNING PROGRAMS
AND COUNTIES
NOTE: NORFOLK COUNTY INCLUDES BROOKLINE AND COHASSET
20 30 40
E IN MILES
72° 00'
71° 00'

exactly, the assumptions in Appendix E are again made so that all allocative process can be demonstrated. (An initial assumption that these others presuppose is that ambulances and ambulance services are more easily altered as to location, quantity, and operations than are hospitals, and allocating them across the region is a way to compensate for deficiencies in hospital coverage).

Using the assumptions of Appendix E, ambulances were assigned to hospitals and calculations of densities, total populations, and estimated travel times of the surrounding areas were made to derive service areas. In some areas more than one ambulance was assigned. Two systems (Gardner-Athol and Palmer-Ware) have average densities which fall below the minimum 285 persons per square mile required for efficient full-time ambulance service areas, but parts of other sub-systems also fall short of that figure. These areas would have slightly greater per resident cost (or the personnel will have to be used especially effectively in hospitals, etc., between trips) and increased maximum travel times.

Gaps in geographic coverage which remained were then filled. In two cases, it was felt that the ambulances would be staffed by on-call personnel, so these were given small service areas. Four others, which might fall into the on-call category, were also assigned smaller areas.

At each step in this process the effect on the probability of dispatch delay and the expected delay were examined, assuming that all ambulance within a subsystem area would be available to assist in any part of the area, if necessary (as one would expect with central dispatching). In a number of cases, the number of active ambulances necessary in a subsystem to have optimal levels of probability of delay

Table 17: Allocation of Ambulances in Proposed Model

SUBSYSTEM	LOCATION	ACTIVE AMBULANCE	BACK-UP VEHICLES	AREA SERVED
A. Worcester	Worcester City or St. Vincent's Hospital	2	1	So. Worcester, Leicester, Auburn, Millbury, Grafton
	Memorial Hospital	1	0	No. Worcester, Shrewsbury
	Holden District Hospital	1	1	Holden, Rutland, Paxton, West Boylston
	I-290	1	1	Shrewsbury, Boylston, Northboro
	East Brookfield	1	1	Brookfields, Spencer
	Barre	1	1	Barre, Oakham, New Braintree
	Whitinsville Hospital	1	1	Northbridge, Sutton, Uxbridge, Douglas
B. Milford	Milford Hospital	2	1	Milford, Upton, Hopedale, Mendon, Medway
	Franklin	1	0	Franklin, Medway, No. Bellingham
	Blackstone	1	0	Blackstone, Millville, So. Bellingham
C. Southbridge/ Webster	Hubbard Regional Hospital	2	0	Webster, Dudley, Oxford
	Harrington Hospital	1	1	Southbridge, Sturbridge, Charlton
D. Palmer/Ware	Wing Hospital	1	1	Palmer, Monson, Brimfield, etc.
	Mary Lane Hospital	1	0	Ware, Warren, W. Brookfield, Hardwick
E. Gardner/Athol	Athol Hospital	1	1	Athol, Orange & surrounding towns.
	Henry Heywood Hospital	1	1	Gardner, Templeton, Westminster, etc.
	Winchendon Hospital	1	0	Winchendon, Ashburnham
F. Fitchburg/Ayer	Burbank Hospital	2	1	Fitchburg, Ashby, Townsend
	Leominster Hospital	1	0	Leominster, Lunenburg
	Nashoba Community Hospital	1	1	Ayer, Groton, Shirley
	Pepperell	1	0	Pepperell
G. Clinton	Clinton Hospital	2	1	Clinton & surrounding towns

Table 18: Statistical Profile of Proposed Delivery Model, by Area-Wide Subsystem

SUBSYSTEM	POPULATION	LAND AREA	DENSITY	PRIMARY EMERGENCY FACILITY	TOTAL ER'S	TOTAL HOSPITALS	ACTIVE AMBULANCES	BACK-UP AMBULANCES	AMBULANCE STATIONS	CALLS PER ACTIVE AMBULANCE	POPULATION PER ACTIVE AMBULANCE	P (d) [1] ACTIVE	E (d) [2] ACTIVE	MAX. [3] TRAVEL TIME
A. Worcester	332,800	585.2	570	Worcester Hosp.	4	8	8	5	7	1,460	41,600	1%	9 min.	11.6 min.
B. Milford	77,700	131.8	590	Milford Hosp.	1[4]	1[4]	4	1	3	680	13,400	1%	16 "	7.8 "
C. Southbridge/ Webster	60,000	161.0	373	Harrington	2	2	3	1	2	700	20,000	1%	22 "	9.2 "
D. Palmer/Ware	39,600	261.6	152	Wing	2	2	2	1	2	700	19,800	1-2%	33 "	13.7 "
E. Gardner/Athol	62,500	480.6	130	Henry Heywood	2	3	3	2	3	730	20,800	1%	22 "	15 "
F. Fitchburg/Ayer	113,500	219.2	520	Burbank	2	3	5	2	4	800	22,700	1%	13 "	8.7 "
G. Clinton	27,700	96.5	288	Clinton	1[4]	1[4]	2	1	1	480	13,800	1%	32 "	8.6 "
Region Total	713,700	1936	369	7	14	20	27	13	22	930	26,400	--	--	10.7 min.

[1]Probability of Dispatcher Delay, considering only the active ambulances.

[2]Expected Dispatch Delay, considering only the active ambulances.

[3]Assumes the total subsystem area is divided equally among the active ambulances.

[4]Hospitals outside the region are also accessible.

exceeded the constraint set above of 25,000 population minimum per vehicle. Presumably, these additional vehicles would be staffed only on an on-call basis. In the Worcester area, the number of vehicles was able to be reduced, because the concentration of population and vehicles allows effective cross-coverage.

The result is twenty-seven primary vehicles, allocated as shown in Table 17. Up to thirteen back-up vehicles would also be assigned to locales where a breakdown of the primary ambulance would leave the area stranded. Even with that number, the total number would be far below the number now in use (63 ambulances plus perhaps 30 cruiser-wagons) without impairing service (as defined by response time, probability of delay). And, hopefully, the quality of care would be substantially increased because of better trained personnel and improved equipment.

The service areas proposed (shown in Figure 10 in dotted lines) would, as mentioned, have very permeable boundaries. Upon receiving a call for emergency medical assistance, the central dispatcher in a subsystem would alert the ambulance crew located in the area where the emergency was located unless they were out on a call. In that case he would call the next closest available crew, but would rarely have to call outside the subsystem area. Table 18 summarizes the characteristics of the entire model by subsystem area.

5. Financing the System

It is the conclusion of this study that much higher levels of expertise can be made available to almost all of the population without major increase in cost, if services are organized in a way similar to that described in the previous section. Even assuming some increase in

cost to achieve the full level of sophistication proposed, the significance of the services to the health and welfare of the population would offset the added expenditure. In 1970, 398 people in Central Massachusetts died from accidents and injuries; 2,777 died from heart attacks. Those 3,175 constituted 44 percent of all deaths in the region.[11] If an improved delivery system reduced the number of deaths by 10 percent, saving 318 lives, most of whom would have man productive years ahead of them, the benefits to society just in terms of salvaged wage-producing capacities would easily offset any increase in the annual cost of the delivery system. Most sources suggest that 10 percent savings in lives is a conservative figure.[12]

The key, however, to the funding problem is achieving intercommunity and interinstitutional funding arrangements. Little has been said up to now about the problems involved. The proposed kind of system would require that towns contribute on a per capita basis to support the area-wide ambulance services and dispatch operations and that hospitals not providing emergency make some contribution to those who do. It would require, most likely, that some local tax revenues be given to hospitals to provide for ambulance garaging, for communications equipment, and for in-hospital EMT salaries.

Massachusetts towns and hospitals do not have a well-developed tradition of such cooperation in some ways, but regional school systems do provide a useful precedent. The author would argue, based on the findings of this study, that little substantive improvement in the delivery system is possible without such fiscal cooperation. If county

government were more viable and independent of the state, it could be the mechanism for collecting and distributing funds. A special-purpose district is another alternative, but arranging contributions from one town or hospital to another is probably a more desirable option.

In this regard, the reliance on revenues from fees for service to cover the costs of operating the ambulance system is unrealistic. The system exists and must maintain a state of readiness because everyone in the community is at risk. Those who actually experience a medical emergency should only have to pay as a fee the cost that their request for service adds over and above the cost of the service if no call had come in during that time. In addition, if the likelihood of overuse were great, some additional charge might be made to bring the total fee up to an amount sufficient to discourage irresponsible use of the emergency service. (Given present levels of utilization, the proposed system is not at all likely to face the threat of overuse.) The bulk of the cost of service should be covered by a charge assessed of every citizen, with some state and federal assistance to cover, as it were, the cost of having such service available for non-residents within the region. The local government might either contract with another town or with a non-government ambulance organization to provide ambulance service or support one itself, if demand warranted it. In theory, at least, a hospital emergency service could be financed in a similar way.

6. The Transition.

The preceding model is intended to provide a direction in which the Central Massachusetts delivery system ought to move. The process of transition and the detailed character of the objectives must be determined

by collaborative planning within the region and with the state emergency medical service planners. The following sketches a rough order in which steps could occur within the region that would lead toward the model presented. A more effective state policy framework must be developed simultaneously with the first of these steps taken at the regional level. The passage of the Governor's bill regarding ambulance services that was mentioned in Chapter II is vital, if state policy development is to proceed.

The first effort must be to begin developing the cooperative arrangements for planning and also for sharing resources. The key hospitals should then be identified and upgraded, and ever-closer liaison with ambulance services established. Ambulance services should thin their rosters of all inactive personnel and assess their commitment to emergency service(placing themselves in one of the ambulance categories proposed early in the chapter, for example). Towns covered by ambulance services with old vehicles or with marginal personnel rosters or otherwise constrained should consider the benefits of contracting with adjacent communities for ambulance service. Demonstrations of the utility of hospital-based services, financed at least in part by public support, should be carried out. Two-way radio communications should be established at hospitals, beginning with those doing the largest emergency business. During this time training programs should be upgraded and in-hospital experience of ambulance personnel increased. Recruiting efforts to draw ex-medics and other interested people into Emergency Medical Technician positions in special police and fire ambulance squads as well as in independent ambulance organizations should begin.

Almost more than anything, the issue of emergency care needs

to be brought before the public and the costs and benefits or present and alternative arrangements made explicit so that emergency medical services planning can take place in a context of awareness.

Summary

The study has shown that the effectiveness of the emergency medical response and outreach system depends on the effectiveness of the means of guiding it. Those means are the state planning and regulatory functions, the regional input to those activities and, in addition, the regional dialogue and determination of directions and priorities, in a planning process. In addition, the decision-making and control processes of providing organizations and institutions also create and shape policies, even if they remain "unwritten." The providers also perform the major part of accounting for the quality of care and for deployment of resources, both as to efficiency and accessibility. The study concluded that emergency medical services in Central Massachusetts were fragmented and underutilized, and that the access needs were not fully met. The reasons for this were, in part, related to the lack of effective information and accounting processes.

The study argued that the organization of emergency care ought to be a topic of high priority on the public agenda and that the response system must be evaluated and planned with a regional perspective, particularly as to the geographic distribution of services and the efficiency with which the resources involved are utilized. It recommended that organization of ambulance services by town give way to a pattern of area-wide services and that emergency medical care outreach succeed transportation as the predominant focus of ambulance service. In conjunction with

this, it recommended that hospitals become the centers of the emergency care delivery system and that, wherever feasible, ambulance personnel be based there and have on-going in-hospital assignments.

The study recognized that this is a somewhat distant objective that cannot be achieved by a wave of the hand. Key to achieving progress toward the objective are much improved financing mechanisms and a process of transition that involves participation of all concerned. The important themes which could guide efforts at improvement are adding legitimacy to the term "system," as applied to the organization of delivery, creating a guidance system that is informed by the participation of providers and consumers as well as by processes of data-reporting and regulation, and viewing the purpose as "medical care outreach." No perfect end state can be expected, but the means used to establish directions and evaluate performance ought to be carefully selected.

NOTES

[1]Medical World News, op. cit., P.S.

[2]As in the Boston Globe series, Jan. 18-20, 1972.

[3]Such as: Nonurgent--problem could have been treated at a later date.
RN or paramedical care sufficient.
Physician attention needed within twenty-four hours.
Urgent--Physician attention needed within six hours.
Urgent Plus--Immediate attention needed.
Emergency--Life-threatening condition.
Dead on Arrival.

The fourth, fifth and sixth could be combined with an indication such as "within our capacities," "we needed additional specialty assistance which was not immediately available," "beyond our capacities--the patient should go elsewhere."

[4]The sorting of patients according to the nature and severity of their condition.

[5]It will be an arduous task, involving some mutual sacrifice, but the benefits as to the overall quality of care and the conserving of increasingly scarce medical dollars will be worth it.

[6]As noted, three communities chose a third alternative, using private companies who also handle routine work.

[7]Boston Globe, Jan. 20, 1972.

[8]From a joint statement by Willima Conroy, president and Joseph Fisher, counsel, Massachusetts Ambulance Association, Boston Globe, Jan. 19, 1972.

[9]As in the ABC series, "Emergency!"

[10]These personnel can be police or fire people, but, if so, the emergency medical outreach assignment ought to become their primary function and their service area ought to be extended beyond a single community where necessary.

[11]Data from the Massachusetts Heart Association and the Department of Public Health.

[12]e.g., J.A. Walker, "Traffic Deaths," California Medicine, Oct. 1964, p. 272.

LIST OF APPENDICES

SURVEY OF CENTRAL MASSACHUSETTS AMBULANCE SERVICES DECEMBER, 1971
Comprehensive Health Planning Council of Central Massachusetts, Inc.

The following information is sought from all ambulance services in the region in order to inventory the resources available to assist a seriously ill or injured person.

"Emergency", when used below, refers to a serious medical condition: one that potentially threatens life or body function, that is accompanied by severe stress, and that requires immediate medical attention.

1. Please designate the area you normally serve, using the map which is attached to the questionnaire. On the map, number the locality you service most frequently as "1", the next most-frequently serviced locality as "2", and so on. Localities serviced with equal frequency may have the same number.

2. List the number of runs of each of the following types made during November.

____ TOTAL RUNS
____ No-service runs
____ Routine transfer
____ Emergency
____ Other (Specify) _____

3. Of the emergency runs, list the number of each of the following:

____ Traffic accidents
____ Accidents in home
____ Accidents at work and elsewhere
____ Acts of violence
____ Heart attacks
____ Complicated childbirth
____ Other severe illness
____ Other (or have no record)

4. Do your personnel routinely give emergency first aid care, when it is warranted, before and during transport?

____ yes
____ no

5. Do you feel that your personnel get sufficient training and practice to deal with the medical emergencies that might arise?

____ yes
____ no

6. What percentage of personnel who staff ambulances have had training beyond an advanced first aid course?

____%

7. Which of the following is the most frequent source of calls for emergency assistance?
(check one)
____ private citizen directly
____ hospital
____ physician
____ law enforcement agency
____ emergency telephone operator
____ other (specify) _____

8. Indicate the number of vehicle-crew units (one vehicle and two crew members) in each category at each of the times:

	WEEKDAYS		WEEKENDS & HOLIDAYS	
	6 a.m.-6 p.m.	6 p.m.-6 a.m.	6 a.m.-6p.m.	6 p.m.-6 a.m.
on duty at base station				
on call				
Unavailable for service				
TOTAL				

9. On the attached list of general hospitals, please rank the hospitals that you regularly serve by placing a "1" next to the hospital(s) that you transport to most often, a "2" by the hospital(s) served next most frequently, and so on.

10. List the percentages of your total revenue from each of the following sources:

____% fee for service from patient or family
____% private third-party (insurance, Blues)
____% public third-party (medicare, welfare)
____% municipal or state funds
____% other grants
____% other (specify) _____

11. We would also appreciate having a copy of whatever forms you use to log individual runs and record information about patients handled. Please enclose such with this questionnaire in the return envelope provided.

12. Describe on opposite side what you find to be the major problems of ambulance service and, in general, rendering emergency medical care. We would also be interested in what solutions you would propose.

GENERAL HOSPITALS

Please rank the hospitals that you regularly serve by placing a "1" next to the hospital(s) that you transport to most often, a "2" by the hospital(s) served next most frequently, and so on.

Rank	Name	Location
_____	Athol Memorial Hospital	Athol
_____	Henry Heywood Memorial Hospital	Gardner
_____	Winchendon Hospital	Winchendon
_____	Nashoba Community Hospital	Ayer
_____	Clinton Hospital	Clinton
_____	Burbank Hospital	Fitchburg
_____	Leominster Hospital	Leominster
_____	Holden District Hospital	Holden
_____	Doctors Hospital of Worcester	Worcester
_____	Fairlawn Hospital	Worcester
_____	Memorial Hospital	Worcester
_____	St. Vincents Hospital	Worcester
_____	Worcester City Hospital	Worcester
_____	Worcester Hahnemann Hospital	Worcester
_____	Wing Memorial Hospital	Palmer
_____	Harrington Memorial Hospital	Southbridge
_____	Mary Lane Hospital	Ware
_____	Hubbard Regional Hospital	Webster
_____	Milford Hospital	Milford
_____	Whitinsville Hospital	Whitinsville/ Northbridge
_____	Boston Hospitals	Boston
_____	Emerson Hospital	Concord
_____	Fort Devens US Army Hospital	Fort Devens/ Ayer
_____	Framingham Union Hospital	Framingham
_____	Greenfield Area Hospitals	Greenfield
_____	Marlborough Hospital	Marlborough
_____	Springfield Area Hospitals	Springfield, Holyoke, Ludlow
_____	Rhode Island Hospitals	Rhode Island
_____	Other _____	_____

THE COMMONWEALTH OF MASSACHUSETTS

DIVISION OF HOSPITAL FACILITIES

RULES AND REGULATIONS

RELATIVE TO

AMBULANCES

April 10, 1968

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH

DIVISION OF HOSPITAL FACILITIES

Rules and Regulations Relative to Ambulances

FOREWORD

The Department of Public Health acting under the authority of General Laws, Chapter 111, Section 8B, hereby prescribes and establishes the following Rules and Regulations Relative to Ambulances.

These rules and regulations shall apply to all ambulances within the Commonwealth used for the transportation of sick or injured persons, except any such motor vehicles owned by, or operated under the direct control of the Federal Government.

Following a public hearing on April 3, 1968, these rules and regulations herein set forth were adopted by the Department on April 9, 1968, effective April 10, 1968.

These Rules and Regulations Relative to Ambulances were filed with the Secretary of State April 10, 1968.

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH

DIVISION OF HOSPITAL FACILITIES

Rules and Regulations Relative to Ambulances

I. Definitions

A. "Ambulance" is defined as any aircraft, boat or motor vehicle, however named, whether privately or publicly owned, which is specially designed, constructed and equipped for the purpose of transporting patients. It shall not include a hearse.

B. "Patient" shall mean any individual who is sick or injured. An injured person shall include a disabled person.

C. "Person" shall include any individual, firm, partnership, association, corporation, trust, foundation, company or any group of individuals, however named, concerned with the operation of an ambulance service. "Person" shall also include any governmental agency other than the Federal Government.

D. "Ambulance Service" shall mean regularly engaging, within the Commonwealth, in the transportation by ambulance of the sick or injured.

E. A qualified attendant shall mean an individual at least 21 years of age, certified as having completed the standard and advanced American Red Cross First Aid Course or have equivalent training approved by theDivision of Hospital Facilities.

F. "Commonwealth" shall mean the Commonwealth of Massachusetts.

G. "Department" shall mean the Massachusetts Department of Public Health.

H. "Division of Hospital Facilities" shall mean the Massachusetts Department of Public Health, Division of Hospital Facilities.

I. "Registered Motor Vehicle" shall mean a motor vehicle currently registered by the Commonwealth of Massachusetts, Registry of Motor Vehicles.

J. "An Ambulance Certificate of Inspection" shall mean a "Certificate of Inspection" issued by the Department of Public Health to an applicant for a period of one year in accordance with the Rules and Regulations, prescribed and established under the authority of General Laws, Chapter 111, 8B.

I. Definitions (cont'd.)

K. "Original Certificate" shall mean a certificate issued for an ambulance not previously certified, or a certificate issued for an ambulance in which there has been a change in ownership or location.

L. "Disinfection" shall mean any process, chemical or physical, by means of which pathogenic agents or disease-producing microbes are destroyed.

M. "Sanitization" shall mean a process whereby organisms present on an object are reduced in number to a level considered safe for human use.

N. "Sterilization" shall mean any process by means of which all forms of microbial life are killed.

II. Ambulance Certificate of Inspection

A. No person, either as owner, agent or otherwise, shall operate, conduct, maintain or profess by advertising or otherwise to operate, conduct and maintain a business for transporting patients upon any way or place of the Commonwealth, unless he holds a current Ambulance Certificate of Inspection for each ambulance issued pursuant to these rules and regulations. Said Certificate of Inspection shall be framed and conspicuously posted in each ambulance and no official entry made upon an Ambulance Certificate of Inspection shall be defaced, removed or obliterated.

B. An Ambulance Certificate of Inspection shall not be required for a motor vehicle which:

1. Is rendering assistance to certified ambulances in the case of a major catastrophe or emergency.
2. Is operated from a location or headquarters outside the Commonwealth, and is transporting patients to locations within the Commonwealth. However, no such outside ambulance shall transport patients from one area to another within the Commonwealth, unless there is compliance with these rules and regulations.

C. An Ambulance Certificate of Inspection shall be issued for a specific ambulance and shall not be transferred to another ambulance.

II. Ambulance Certificate of Inspection (cont'd.)

D. Representatives of theDivision of Hospital Facilities are authorized to enter and examine any ambulance, to determine if such vehicle is properly staffed, maintained and equipped in accordance with these rules and regulations. Any attempt to prevent any such representative to enter and examine any such ambulance or garage, or to examine records as required shall be punishable in accordance with "XIV Penalty" of these Rules and Regulations.

III. Application for Ambulance Certificate of Inspection

A. Applications for an original or renewal Ambulance Certificate of Inspection shall be made in writing upon forms provided by the Department and shall contain:

1. Name and address of the applicant and of the owner of the ambulance.
2. Trade or other name, if any, under which the applicant does business and/or proposes to do business.
3. Training and experience of the applicant and attendants in the transportation and care of patients.
4. Description of each ambulance, including the make, model, year of manufacture; vehicle identification number; current Massachusetts registration number; and the color, insignia, name, monogram or other distinguishing characteristics, if any, to be used to designate applicant's ambulance.
5. Location of the place or places from which it is intended to operate.
6. Such information as is necessary for the Department of Public Health to carry out its responsibilities under these rules and regulations.

IV. Change in Ownership

A. Upon change of ownership, an Ambulance Certificate of Inspection shall terminate and the new owner shall be required to file an application for an Ambulance Certificate of Inspection, in conformance with all the requirements for an original or renewal Ambulance Certificate of Inspection, herein set forth.

IV. Change in Ownership (cont'd.)

B. When a registered or certified notice is received by mail by the Division of Hospital Facilities that a change of ownership of an ambulance has occurred or a new ambulance has been acquired, such notice shall have the effect of an ambulance certificate of inspection for a period not to exceed thirty days.

V. Certification Procedure

A. The Director of the Division of Hospital Facilities upon receipt of an application for an Ambulance Certificate of Inspection shall cause to be inspected, the ambulance, equipment and premises designated in each application hereunder to determine compliance with the rules and regulations.

B. The Department shall issue an Ambulance Certificate of Inspection for a specified ambulance to be valid for a period of one year.

VI. Revocation of Ambulance Certificate of Inspection

A. The Department may revoke an Ambulance Certificate of Inspection issued hereunder for cause. Failure of a holder of an Ambulance Certificate of Inspection to comply with the rules and regulations of the Department promulgated hereunder, shall be sufficient cause for revocation, after a public hearing held in accordance with General Laws, Chapter 30A.

VII. Return of Ambulance Certificate of Inspection

A. Each Ambulance Certificate of Inspection shall be returned to the Division of Hospital Facilities immediately by registered or certified mail upon:

1. Expiration of certificate.
2. Revocation of certificate.
3. Change in ownership of ambulance.
4. Change of name of ambulance service.
5. Discontinuance of use of vehicle as an ambulance.

VIII. Ambulance Equipment

A. Each ambulance and its equipment shall be maintained in a sanitary manner and in good operating condition.

B. Each ambulance shall be quippped with the following:

1. Two-way radio communication system.
2. Recording Tachometer.
3. Siren.
4. Flashing red roof light.
5. Fire extinguisher (Underwriter's Laboratory) approved.
6. Explosion proof flashlight.

C. Each ambulance shall be equipped with the following equipment or its equivalent when approved by the Division of Hospital Facilities:

1. Hinged half-ring lower extremity splint with web straps for ankle hitch.
2. Two or more padded boards 4 1/2 feet long and 3 inches wide, and two or more similar padded boards 3 feet long by 3 inches wide, of material comparable to four-ply wood, for coaptation splinting of fracture of leg or thigh.
3. Two or more padded 15 inch by 3 inch wood or cardboard splints for fractures of the forearm.
4. Short and long spine boards with accessories.
5. Oxygen tanks with regulators and single use disposable masks of assorted sizes.
6. Hand-operated bag-mask resuscitation unit with adult, child and infant size masks, capable of being attached to oxygen supply.
7. Simple suction apparatus with catheter.
8. Mouth to mouth, two-way resuscitation airways for adults and children.
9. Oropharyngeal airways.
10. Mouth gags.
11. Universal dressing.
12. Sterile gauze pads.
13. 1, 2 and 3 inch adhesive tape.

14. Six inch by 5 yard soft roller type bandages.
15. Triangular bandages.
16. Safety pins, large size.
17. Bandage shears.
18. Collapsible stretcher with straps.
19. Two sandbags.

D. Linen and Patient Equipment

1. At least two pillows with removable washable protective covers.
2. A minimum of six individually packaged pillow cases, preferably disposable.
3. A minimum of six individually packaged sheets, preferably disposable.
4. Sufficient towels to protect the patient's head and face, as indicated.
5. A sufficient number of washable blankets in accordance with seasonal requirements.
6. A sufficient supply of laundry bags, preferably disposable, including a special color or suitable identification for precaution linen.
7. A sufficient supply of towels, tissues and paper bags.
8. Emesis basins, preferably disposable.
9. Sanitized wrapped bed-pan.
10. Sanitized wrapped urinal.

E. Storage Facilities

1. There shall be adequate storage facilities for:
   a. Clean supplies and equipment.
   b. Clean linen.
   c. Soiled linen.
   d. Waste.

IX. Standards for Ambulance Certification

A. Each ambulance shall contain equipment conforming with the rules and regulations provided for herein and shall be:

1. Staffed at all times with a minimum of two qualified attendants, one of whom may be the driver.
2. Maintained in such a manner as to insure the health and safety of the patient.
3. Used exclusively for the purpose of transporting sick, injuried or disabled persons.

B. When not in service, an ambulance shall be protected in such a manner that it does not become unsanitary.

X. Records

A. Records of service rendered shall be maintained and stored in a satisfactory manner for a minimum of two years.

B. Record content shall include the following:

1. Date and time of arrival to transport patient, time of arrival at destination.
2. Name, address, age and sex of patient.
3. Transported: From - - To - -
4. Name of attendants.
5. First aid administered with date, time and signature of person administering same.

C. Personnel Records

1. A personnel file shall be maintained for attendants and shall include their qualifications and training.

D. Records required herein shall be available for inspection by representatives of the Division of Hospital Facilities.

XI. Personnel

A. Ambulance Attendants

1. The ambulance attendants shall be well groomed, appropriately attired in uniform, and shall practice good personal hygiene, including handwashing.

XII. Sterilization, Sanitization and Disinfection

A. Equipment and supplies requiring sterilization shall be processed by methods approved by the Division of Hospital Facilities.

B. Written policies for the routine disinfection of the interior of the ambulance, and for the disinfection and sanitization of all equipment, unless disposable, shall be established and enforced.

C. All equipment, unless disposable, shall be properly cleansed and sanitized after each use.

D. When an ambulance has been used to transport a patient known to have a communicable disease, the interior of the ambulance shall be disinfected before the next patient is transported.

XIII. Linen

A. Linen, unless disposable, shall be laundered after each use.

B. Disposable linens shall be discarded after each use.

C. Soiled linen, including disposable linen, shall be handled in such a manner as to avoid contamination of equipment and personnel.

XIV. Penalty

Whoever advertises, announces, establishes or maintains an ambulance and/or ambulance service, as defined herein, without the required Ambulance Certificate of Inspection, as set forth in these Rules and Regulations, or whoever being a holder of an Ambulance Certificate of Inspection as required herein, violates any provision of these Rules and Regulations as established by the Department in accordance with General Laws, Chapter 111, Section 8B, shall be punished by a fine of not more than $500.00 for any particular offense. A separate and distinct offense shall be deemed to have been committed on every day during which the violation continues after written notice thereof by the Department to the authority to whom the Ambulance Certificate of Inspection was issued.

XV. Separability

If any section,subsection, sentence, clause, phrase or portion of these Rules and Regulations is for any reason held invalid or unconstitutional by any court of competent jurisdiction, such portion shall be deemed a separate, distinct and independent provision and such holding shall not affect the validity of the remaining portions hereof.

XVI. An Emergency Situation

These rules and regulations shall not preclude the reasonable omission of any of the foregoing requirements when a law enforcement officer or a representative of a fire department determines an emergency exists.

APPENDIX C: Basic Demographic Data for each Locality, by System Area*

LOCALITY	POPULATION	LAND AREA	DENSITY
Auburn	15,347	15.70	976
Boylston	2,774	15.84	175
Brookfield	2,063	15.68	132
East Brookfield	1,800	9.89	182
Grafton	11,659	22.83	511
Leicester	9,140	22.70	403
Millbury	11,987	15.84	757
New Braintree	631	20.76	30
North Brookfield	3,967	21.11	188
Northboro	9,218	18.47	499
Northbridge	11,795	17.33	681
Paxton	3,731	14.87	251
Shrewsbury	19,196	20.78	924
Spencer	8,779	33.15	265
Sutton	4,590	32.48	141
Worcester	176,572	37.16	4,752
I. Worcester System	293,249	334.59	875

Barre	3,825	44.30	86
Holden	12,564	35.50	354
Oakham	730	20.99	35
Princeton	1,681	35.39	47
Rutland	3,198	35.42	90
West Boylston	6,369	12.69	502
II. Holden System	28,367	184.29	154
Berlin	2,099	13.01	161
Bolton	1,905	19.93	96
Clinton	13,383	5.36	2,497
Lancaster	6,095	27.65	220
Sterling	4,247	30.52	139
III. Clinton System	27,729	96.47	288
Bellingham	13,967	18.55	753
Blackstone	6,566	10.97	599
Franklin	17,830	26.80	665
Hopedale	4,292	5.12	838
Medway	7,938	11.60	684
Mendon	2,524	17.73	142
Milford	19,352	14.79	1,308
Millville	1,764	4.92	359
Upton	3,484	21.65	161
Uxbridge	8,253	29.29	282
IV. Milford System	85,970	161.42	532

Appendix C continued

Douglas	2,947	36.93	80
Dudley	8,087	21.07	384
Oxford	10,345	26.71	387
Webster	14,917	12.53	1,190
V. Webster System	36,296	97.24	374
Charlton	4,654	42.86	109
Southbridge	17,057	20.38	837
Sturbridge	4,878	37.39	130
VI. Southbridge System	26,589	100.63	264
Brimfield	1,907	35.37	54
Hardwick	2,379	38.40	62
Holland	931	12.35	75
Monson	7,355	44.84	164
Palmer	11,680	31.93	372
Wales	852	16.21	53
Ware	8,187	34.85	235
Warren	3,633	27.50	132
West Brookfield	2,653	20.67	128
VII Palmer System	39,577	261.62	151
Athol	11,185	32.34	346
New Salem	474	45.04	11
Orange	6,104	35.03	174
Petersham	1,014	54.27	19
Phillipston	872	23.70	37

Appendix C continued

Royalston	809	41.99	19
Warwick	492	37.19	13
VIII. Athol System	20,950	269.56	78
Gardner	19,748	22.02	897
Hubbardston	1,437	40.34	36
Templeton	5,863	31.49	186
Winchendon	6,635	42.53	156
IX. Gardner System	33,683	136.38	247
Ashburnham	3,484	39.15	89
Ashby	2,274	23.66	96
Fitchburg	43,343	27.47	1,578
Leominster	32,939	28.81	1,143
Lunenburg	7,419	26.63	279
Westminster	4,273	35.64	120
X. Fitchburg System	93,732	181.36	518
Ayer	7,393	8.82	838
Groton	5,109	32.54	157
Pepperell	5,887	22.79	258
Shirley	4,909	15.81	310
Townsend	4,281	32.66	131
XI. Ayer System	27,579	112.62	245
Regional Total	713,721	1,936.18	369

Appendix D: Region II Ambulance Service, by Type of Coverage

LOCALITY	NAME OF SERVICE	SPONSOR ORGANIZATION OR TYPE	NO. OF VEHICLES
(1) No Organized Ambulance Service Within the Town			
Brimfield	Not Applicable	Not Applicable	Not Applicable
Holland	Not Applicable	Not Applicable	Not Applicable
Hopedale	Not Applicable	Not Applicable	Not Applicable
Hubbardston	Not Applicable	Not Applicable	Not Applicable
Millville	Not Applicable	Not Applicable	Not Applicable
New Braintree	Not Applicable	Not Applicable	Not Applicable
New Salem	Not Applicable	Not Applicable	Not Applicable
Phillipston	Not Applicable	Not Applicable	Not Applicable
Royalston	Not Applicable	Not Applicable	Not Applicable
Wales	Not Applicable	Not Applicable	Not Applicable
Warwick	Not Applicable	Not Applicable	Not Applicable

Appendix D continued

LOCALITY	NAME OF SERVICE	SPONSOR ORGANIZATION OR TYPE	NO. OF VEHICLES
(2) Unregulated Service Using Dual-Purpose Vehicles			
Ashburnham	Not Applicable		Incomplete Data
Auburn	" "	Police	" "
Boylston	" "		" "
Brookfield	" "		" "
Grafton	" "	Police	" "
Holden	" "	Police	" "
Leicester	" "	Police	" "
Mendon	" "		" "
Millbury	" "	Police	" "
Monson	" "	Fire	" "
Oakham	" "		" "
Paxton	" "	Police	" "
Pepperell	" "		" "
Petersham	" "		" "
Rutland	" "	Police	" "

Appendix D continued

LOCALITY	NAME OF SERVICE	SPONSOR ORGANIZATION OR TYPE	NO. OF VEHICLES
Shirley	Not Applicable		Incomplete Data
Sutton	" "		" "
Templeton	" "		" "
Upton	" "		" "
Warren	" "		" "
Westminster	" "		" "

(3) Regulated Service - Volunteer or On-Call

Ashby	Ashby CD Ambulance	Volunteer	1
Ayer	Ayer Fire Dept. Ambulance Assoc.	Fire Department	1
Barre	Barre Police Dept.	Police Department	1
Bellingham	Town of Bellingham Fire Dept.	Fire Department	2
Berlin	Berlin Emergency Rescue Squad	Volunteer	1
Blackstone	Blackstone Ambulance Assoc., Inc.	Volunteer	1
Bolton	Town of Bolton Police Dept.	Police Department	1
Charlton	Charlton Ambulance Service, Inc.	Volunteer	1
Douglas	Douglas Fire Dept.	Fire Department	1

Appendix D continued

LOCALITY	NAME OF SERVICE	SPONSOR ORGANIZATION OR TYPE	NO. OF VEHICLES
Dudley	Dudley Fire Emergency	fire dept.	1
East Brookfield	East Brookfield Fire Dept.	fire dept.	1
Franklin	Town of Franklin Ambulance Service	fire dept.	1
Groton	Groton Volunteer Fire Dept.	volunteer	1
Hardwick *	Emergency Rescue Squad	volunteer	1
Lunenburg	Lunenburg Fire Dept.	fire dept.	1
Medway	Police Dept.	police dept.	1
Northboro	Northboro Ambulance Assoc.	volunteer	1
Northbridge	Northbridge Fire Ambulance Service	fire dept.	1
North Brookfield	North Brookfield Emergency Squad	volunteer	1
Orange	Town of Orange Fire Dept.	fire dept.	1
Oxford	Town of Oxford Police Dept.	police dept.	2
Princeton	Princeton Fire Dept.	fire dept.	1
Spencer	SpencerRescue & Emergency Squad	volunteer	1
Sterling	Sterling Firefighters	volunteer	1
Sturbridge	Town of Sturbridge	fire dept.	1

Appendix D continued

LOCALITY	NAME OF SERVICE	SPONSOR ORGANIZATION OR TYPE	NO. OF VEHICLES
Townsend	Townsend Police Association	volunteer	1
Uxbridge	Town of Uxbridge	volunteer	1
Ware	Town of Ware	volunteer	1
Webster	Webster Rescue & Ambulance	volunteer	2
West Boylston *	West Boylston Fire Ambulance	fire dept.	1
West Brookfield	West Brookfield Rescue Squad	volunteer	1
(4) Regulated Service - Full-Time			
Athol	Athol Police Dept.	police dept.	1
Clinton	Town of Clinton Police Dept.	police dept.	1
Fitchburg	City of Fitchburg Fire Dept.	fire dept.	1
Leominster	City of Leominster Fire Dept.	fire dept.	2
Shrewsbury *	Shrewsbury Police Dept.	police dept.	2
Southbridge	Town of Southbridge Fire Dept.	fire dept.	2
Winchendon *	Winchendon Police Dept.	police dept.	1
Worcester	City of Worcester Police Dept.	police dept.	2

Appendix D continued

LOCALITY	NAME OF SERVICE	SPONSOR ORGANIZATION OR TYPE	NO. OF VEHICLES
(5) Regulated Service - Private			
Gardner	Wood's Ambulance Service	private	2
Lancaster	R & R Ambulance Service	private	2
Milford	Ruggerio Brothers Ambulance Service	private	1
	Milford Ambulance Service	private	1
(6) Regulated Service - Hospital-Based			
Palmer	Wing Hospital Ambulance	hospital	1
Other Regulated Services Without Primary Emergency Responsibility			
Fitchburg	Montachusett Ambulance Service	private	2
Leominster	Leominster Civil Defense	volunteer	1
West Boylston	Himmer Ambulance Service	private	1
Worcester	Kane Ambulance Service	private	2
Worcester	Scott McAvoy Ambulance Service	private	3

*Licensure status with Department of Public Health is unresolved.

Appendix E: Technical Appendix on Ambulance Allocation and Utilization. 1

Four measures are used to indicate the work load imposed by various levels of demand on outreach resources: demand intensity, utilization, probability of dispatch delay, and expected dispatch delay.

1. Demand intensity is given by the equation:

$$DI = AR \times ST$$

where DI equals demand intensity, AR equals arrival rate of calls, and ST equals service time per call.

2. Utilization, U, is given by

$$U = \frac{DI}{N},$$

N being the number of provider units.

3. The probability of dispatch delay, P (d) is a complicated equation:

$$P(d) = \frac{DI^N}{N!} \left(\frac{N}{(N-DI)}\right) \left[\sum_{i=o}^{N} \frac{DI^i}{i!} + \left(\frac{DI}{(N-DI)}\right) \frac{DI^N}{N!}\right]^{-1}$$

and refers to the likelihood that any one request for service, assuming distribution of such requests is random over time, will encounter a delay because all provider units are occupied. More simply stated, P (d) is the average proportion of all calls that will experience some delay.

4. The expected dispatch delay E(d) is given by

$$E(d) = \frac{ST \text{ (in minutes)}}{N-DI}$$

and refers to the average delay encountered by these calls which are delayed.

These four parameters can be used to indicate the maximum rate of utilization possible for a given service, which maximum varies according to the number of vehicles, the demand levels, the time necessary to service calls, and so forth.

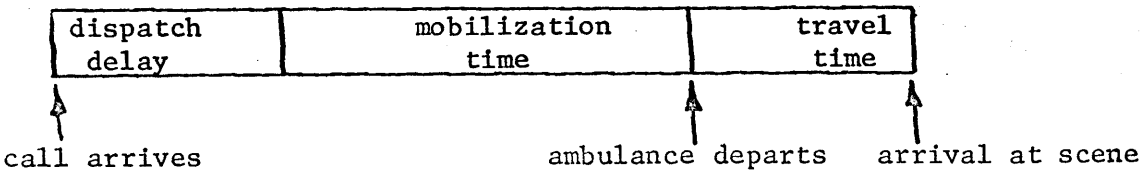
Utilization may be increased by either reducing N (the number of provider units) or increasing the demand intensity. Thus, the longer it takes to provide service in each case, the higher the demand. Also, if the frequency of use of the service increases (whether due to a larger base population, higher rates of incidence, or increasing consumer preference), the demand intensity increases.

As either of those factors change so as to increase utilization, the probability of dispatch delay and the expected dispatch delay begin to increase. At a certain point, the likelihood of delay and/or the length of the average delay exceed tolerable levels, which establishes a maximum utilization. No decision rules exist for setting levels of tolerance. In most cases, they are set by the limits on economic resources available for ambulance service. For our purposes here, the more important measure is the P (d). The P (d) is more sensitive to adjustments in the service provided, and if it is small, the size of some expected delay is unimportant because almost no one will encounter it. Both probability of delay and the expected delay increase rapidly with small increases in utilization when the number of provider units is small (i.e., under 3).

The number of vehicles and crew teams available at present in Central Massachusetts is so large that both figures are minimal for most of the region--despite the small organizational scale. Hence, a maximum tolerance level for the probability of delay would have to be set low, say, under five percent. Because distances in the region make service time and therefore expected delays relatively large, the probability of dispatch delay must be small so that delays seldom occur.

Increasing Utilization

Now, if the objective is to maximize utilization of ambulances, either the total demand must increase or the number of vehicles decrease. However, in either case, we do not want to exceed present response time levels. Response time is made up of three parts, mobilization time, dispatch delay, and travel time, as given below



Mobilization time is the period between the arrival of the call and the moment at which a crew and the ambulance are ready. If the likelihood of dispatch delay is very small, response time essentially consists of the time to get the crew and vehicle ready and the travel time to the scene. Assuming mobilization time is relatively constant, the maximum response time and be converted into a measure of distance to the periphery of the service area.

Further, if present maximum response times must not be exceeded, then the size of the service area--and, therefore the population served

and the resulting demand for service--can only be increased if mobilization time can be reduced, assuming travel times per mile remain unchanged. Such might occur, for example, with a shift from on-call to on-duty staffing of ambulances.

The number of vehicles can be reduced only if fewer vehicles can be distributed in a way that does not result in longer maximum response times than at present or in exceeding tolerable levels of delay. That would be possible, for example, if at one location the number of vehicles was excessive.

Illustrative Assumptions

In order to illustrate the effects of increasing utilization in the context of the case, certain simplifying assumptions have to be made.

1. Calls arrive at a rate of 35 per 1000 population per year.
2. Mean service time per call is one hour.
3. Average mobilization time is three minutes for on-duty services and eight minutes for on-call services.
4. Service areas are essentially circular[2] because of basically a radial street pattern from the town center.[3]
5. Travel speeds vary, with increasing density, from two to three minutes per mile as follows:

density (persons per square mile)	50	100	300	500	700	1000
travel time per mile	2.0	2.1	2.2	2.3	2.65	3.0

6. The maximum travel time is twelve minutes. Derivation: the

radius of the average service area--which is about 26 square miles in size--of present regulated emergency vehicles is approximately 2.9 miles. At an average density of 520, the travel time is seven minutes. Since most services are presently on-call and since higher utilization would be achieved by full-time on-duty personnel, we will consider the effects of having full-time crews. Putting crews on-duty full-time adds five minutes to the maximum travel time allowable since, from #3 above, the same amount is saved in mobilization. Thus, twelve minutes travel time indicates the maximum radius of a service area. That can be plotted for increasing densities and is shown in Figure E-1. The population of various densities within maximum service areas defined thereby are listed in Table E-1.

7. Finally, the population necessary to support a full-time service is assumed to be 25,000 with a demand intensity of 0.1. The distance to the perimeter of a service area of the size necessary to contain that population can be computed and plotted for increasing population densities. See Figure E-1. The point of intersection of the two curves (at about 285 persons per square mile and about 5.5 miles maximum distance) defines the size of the minumum service area which will support an on-duty ambulance service at present response times.

[1]A number of aspects presented here are derived from work done by Keith A. Stevenson of M.I.T. in a technical report titled Operational Aspects of Emergency Ambulance Services (M.I.T., May 1971). However, those aspects are stated less rigorously here than he presents them.

[2]A set of service areas then has some overlaps or gaps between areas, but these are not important here.

[3]Stevenson assumes a rectangular service area with a grid street system, which in some ways is more correct if one is concerned, as he is, with the expected travel times. Here we are only interested in travel times to define the size of service areas, for which purpose the radial assumption is more useful.

Table E-1: Maximum Service Areas and Populations at Various Densities, given a set maximum travel time of 12.0 minutes

(1) DENSITY	(2) TIME PER MILE	(3) MAX. RADIUS	(4) MAX. AREA	(5) POPULATION	(6) CALLS/YEAR
50	2.0 min.	6.0 miles	113 sq. mi.	5,650	200
100	2.1 "	5.7 "	102 " "	10,200	360
300	2.2 "	5.5 "	95 " "	28,500	1000
500	2.3 "	5.2 "	85 " "	42,500	1490
750	2.65 "	4.5 "	63 " "	47,800	1670
1000	3.0 "	4.0 "	50 " "	50,000	1750

(3)= 12.0/(2) miles = $\frac{\text{minutes}}{\text{minutes/mile}}$

(4)= $(3)^2$ square miles = x $(\text{miles})^2$

(5)= (4)x 1 population = persons/miles^2 x miles^2

(6)= (5)x 35/1000 calls/year = population x calls per year per population

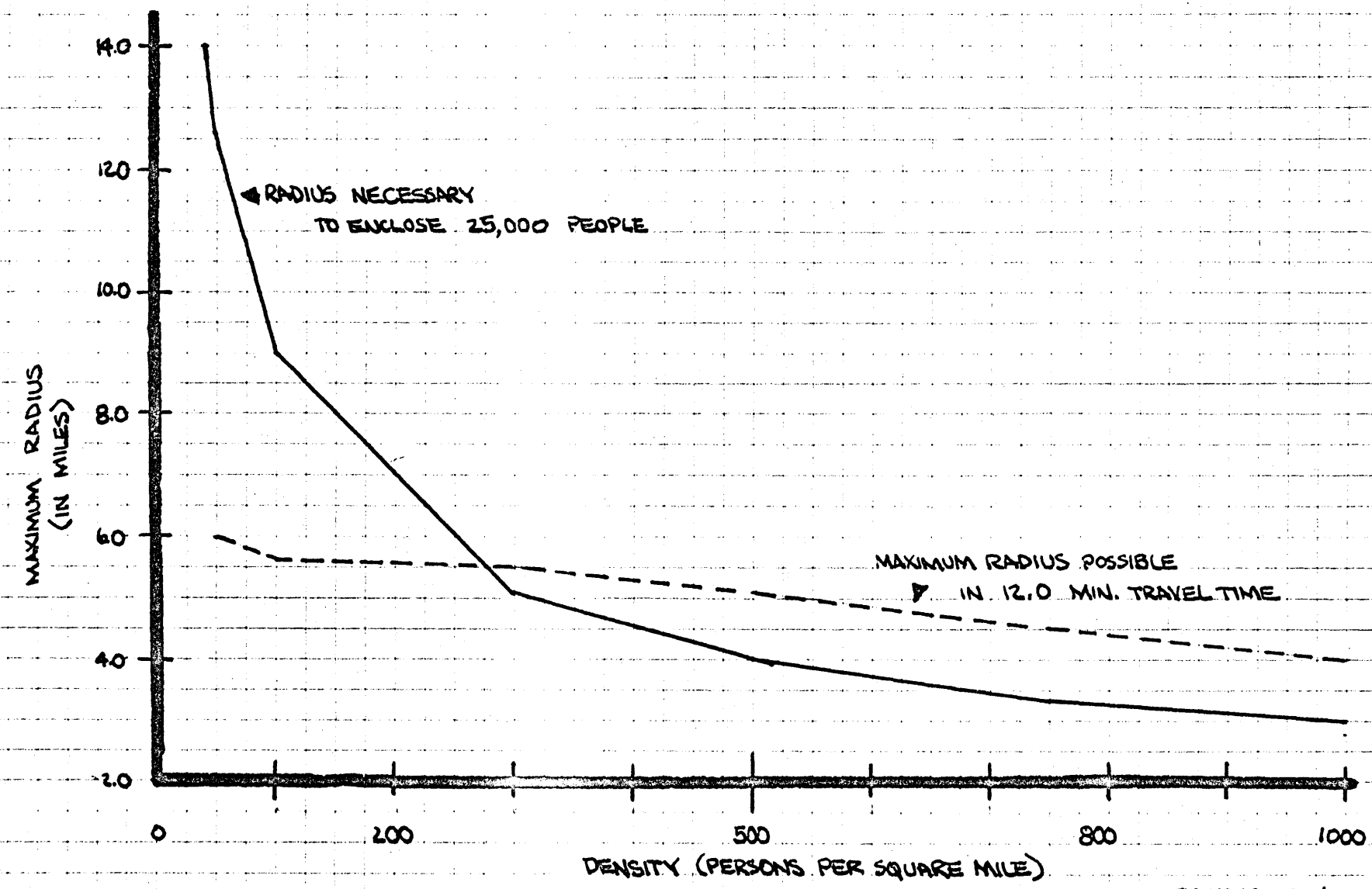

14.0
12.0
10.0
8.0
6.0
4.0
2.0
MAXIMUM RADIUS (IN MILES)
RADIUS NECESSARY TO ENCLOSE 25,000 PEOPLE
MAXIMUM RADIUS POSSIBLE IN 12.0 MIN. TRAVEL TIME
0
200
500
800
1000
DENSITY (PERSONS PER SQUARE MILE)

FIGURE E-1

Appendix F: From Worcester Telegram, November 10, 1971.

Dudley Officer Claims Delay By Ambulance

By HELDON D. BARTH
Telegram Webster Bureau

DUDLEY — Operation of the Dudley ambulance service came under criticism yesterday after an industrial accident that severed the left arm of a 41-year-old Webster man at Stevens Linen Co.

Patrolman Philip J. Ryznal charged that it took 30 minutes for the ambulance to respond when Daniel F. MacQuarrie, 41, of Myrtle Ave., Webster, had his arm severed three inches from the shoulder.

MacQuarrie was taken by Ryznal in a police cruiser to Hubbard Regional Hospital, Webster, where he is listed in satisfactory condition in the intensive care unit.

Ryznal said an ambulance was summoned about 4:30 a.m., minutes after MacQuarrie's arm became caught in a carding machine. When Ryznal saw that MacQuarrie needed immediate attention, he said he took him to the hospital in the cruiser.

Ryznal was asked by a doctor at the hospital to try to bring back MacQuarrie's arm. When Ryznal returned to the mill about 5 a.m., the ambulance was just arriving, he said.

"I'm not blaming the kids in the ambulance," Ryznal said. "But they ought to have someone in that fire station at night, even if they're sleeping, to handle calls like this.

"We were fortunate this time, thanks to two women at the mill who helped save this man's life, but I'd hate to see someone die in an accident because we can't get an ambulance in time.

"The people pay for this ambulance service, and they're entitled to a good one."

Fire Chief Roger D. St. Germain would not comment, except to say that there had never been discussion about a full-time ambulance service.

Asked if he felt the town needed full-time personnel on ambulance duty, he replied: "We don't think so."

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