

9-1-1:

Rapid
Identification
and Treatment
of Acute
Myocardial
Infarction



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**National Heart Attack
Alert Program (NHAAP)**



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
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Coronary heart disease (CHD) continues to be the leading cause of death in the United States despite a remarkable decline in CHD mortality over the last 30 years. The National Heart, Lung, and Blood Institute (NHLBI) estimates that as many as 1.25 million people will experience an acute myocardial infarction (AMI) in 1993, and nearly 500,000 will die.

The importance of early treatment has been underscored in the last decade with the results from clinical trials of thrombolytic therapy demonstrating mortality reductions with earlier treatment. Out-of-hospital sudden cardiac death is an ever-present threat, further highlighting the importance of early recognition and treatment.

However, a fundamental barrier to timely treatment is delay—at the level of the patient, the emergency medical services (EMS) system, and the emergency department. In June 1991, the NHLBI launched the National Heart Attack Alert Program (NHAAP) with the goal of reducing AMI morbidity and mortality, including sudden cardiac death. The NHAAP Coordinating Committee was formed to help develop, implement, and evaluate the program. This committee is composed of representatives of 39 national scientific, professional, governmental, and voluntary organizations interested in lowering AMI morbidity and mortality through professional, patient, and public education.

Initially, the NHAAP is directing educational efforts toward hospital and prehospital health professionals and high-risk patients. Eventually, the NHAAP plans to develop public educational messages about the symptoms and signs of an AMI and about appropriate actions to take in response to those symptoms and signs. Although the specific messages have not been developed for the public education component of the program, it is anticipated that one of the major messages will be to dial 9-1-1 in response to the symptoms and signs of AMI/sudden cardiac death. These educational messages will be conveyed through various media campaigns, including print advertisements, posters, billboards, and brochures. In its adult basic life support protocol, published in 1992, the American Heart Association has recommended activating the EMS system by calling the local emergency telephone number (9-1-1, if available), after determining a victim's unresponsiveness and prior to initiating the ABC's of cardiopulmonary resuscitation.

This paper reviews 9-1-1's history, key elements/components, implementation status, and existing legislation and standards. It also describes issues and presents recommendations for ensuring a universally available system. Finally, it promotes implementation of a universal and enhanced 9-1-1 system for rapid access to EMS.



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Health Care Financing Administration
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National Highway Traffic Safety Administration
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NHLBI Ad Hoc Committee on Minority Populations
Society for Academic Emergency Medicine
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**NATIONAL HEART
ATTACK ALERT
PROGRAM
COORDINATING
COMMITTEE
MEMBER
ORGANIZATIONS**

The cooperative efforts of the Federal Government and the telephone industry have established 9-1-1 as the national emergency telephone number to facilitate public access to emergency response services (police, fire, and medical). To potentially minimize the time elapsed from the onset of a cardiac (or other) emergency to the arrival of prehospital emergency care and then to the delivery of the patient to an appropriate medical facility, it is necessary to have access to a pervasive, efficient, and coordinated emergency medical services (EMS) communications system that includes 9-1-1. However, the 9-1-1 system function and activities are not as yet universally available.¹

The 9-1-1 system enables persons experiencing or witnessing a medical emergency to access easily and quickly the emergency response system and, where available, to obtain emergency medical dispatcher assistance through prearrival instructions and prompt definitive emergency medical care. Therefore, ideally, 9-1-1 telephone services should be available to all people to facilitate access to EMS. Enhanced 9-1-1, which automatically lists the caller's location and, through a computer-aided dispatch system, the identity of the appropriate response agency, adds efficiency and accuracy to an emergency response system. In the public safety communications literature, numerous studies have documented the benefits of using 9-1-1 versus other emergency telephone numbers. For example, in the Institute of Electrical and Electronics Engineers (IEEE) publication, "IEEE Transactions on Vehicular Technology," Ivy² reported the results of three community surveys showing the efficacy of 9-1-1 services in reducing the uncertainties and delays that citizens experience in reporting emergencies to the proper authorities. In the same publication, Reinke³ discussed the additional costs and benefits of incorporating enhanced features into 9-1-1 services.

In the medical literature, Mayron et al.⁴ reported an increase from 63 to 82 percent of people who successfully activated EMS after the implementation of a 9-1-1 system. Eisenberg et al.⁵ surveyed communities with different activation systems and found that citizens knew the emergency activation number only 36 to 47 percent of the time; in communities with 9-1-1 services, the citizens knew the emergency activation number 85 percent of the time. It was also suggested that people in communities adjacent to 9-1-1 areas called 9-1-1 instead of their seven-digit number and thus experienced delays in activation of EMS. In many areas where people dial 9-1-1 when it is not available, they will get a recording telling them to look up a number in the directory.⁶

In the United States, partially as a result of the availability of 9-1-1 services, EMS responses to medical emergencies are prompt. For example, the national average elapsed time from the time of injury to hospital arrival for persons injured in motor vehicle fatality crashes is 33.9 minutes in urban areas and 51.2 minutes in rural areas.⁷ Other factors exist, however, that substantially increase the delay between the onset of medical emergencies and hospital arrival. For example, Barsan and associates⁸ reported that hospital arrival (from onset of symptoms) was fastest for individuals seeking treatment for acute stroke who used 9-1-1 as their first medical contact (205 minutes) rather than using their personal physician (603 minutes) or transporting themselves to the hospital (414 minutes). These authors concluded that strategies to increase the use of 9-1-1 systems may aid in

recruiting patients into urgent treatment protocols for stroke. Of particular concern for early cardiac care, use of 9-1-1 to access EMS has been shown to decrease time to reperfusion for individuals with symptoms and signs of AMI. Patients with symptoms of AMI who called 9-1-1 in King County, Washington, thereby accessing the EMS system, received the time-dependent thrombolytic (clot-dissolving) treatment 1.9 hours earlier compared with those who transported themselves to the hospital.⁹

Also, the characteristics of individuals who are likely to use 9-1-1 for possible acute cardiac problems deserve more investigation overall. Data from the Myocardial Infarction Triage and Intervention Project showed that patients with symptoms and signs of an AMI who called 9-1-1 were more acutely ill. They had a 50 percent greater mortality than those presenting directly to the emergency department.¹⁰ The existence of 9-1-1 telephone access was significantly associated with survival from out-of-hospital cardiac arrest (9.18 versus 5.35 percent survival for 9-1-1 versus no 9-1-1 groups, respectively) in a report of 1,753 prehospital cardiac arrest patients in Iowa. The authors attributed the association partially to their findings of a significant association of 9-1-1 with a shorter time interval from collapse to the 9-1-1 call for help, decreased time to cardiopulmonary resuscitation, and less time to the first shock (if in ventricular fibrillation).¹¹

The idea of a universal emergency telephone number originated in Europe. The official impetus for the development of a nationwide emergency telephone number in the United States was provided in 1967 by recommendations of the President's Commission on Law Enforcement and the Administration of Justice.¹² The American Telephone and Telegraph Company (AT&T) announced in 1968 that 9-1-1 was available as a single national emergency telephone number for any public safety agency and community group that desired to develop a common public number for access to local emergency services. At that time, the telephone industry offered their "dial operator" service as a backup system to the seven-digit emergency-assistance telephone numbers for police, fire, and medical emergencies. The availability of 9-1-1 through AT&T meant that emergency call handling could be shifted from telephone company operators to public safety agencies. Prior to 9-1-1, seven-digit emergency numbers proliferated and resulted in confusion for the public and in delays trying to make emergency contact with the correct public safety agency.² It was not unusual in many large urban/suburban areas of the United States to find more than 200 seven-digit telephone numbers for public safety agencies.¹³ Thus 9-1-1 was developed to increase public access to public safety agencies for police, fire, and medical emergencies.

Various national professional organizations and task forces on crime and crime-related activities endorsed the 9-1-1 concept. Local governments began implementing basic 9-1-1 in 1968 with assistance from their telephone companies. The first area of the country to implement basic 9-1-1 was Haleyville, Alabama, using an independent telephone company. New York City was among the cities and towns that first offered the service in the ensuing 3 years. The first fully enhanced system was implemented in Orange County, Florida, in the fall of 1980.⁶

The Federal Communications Commission (FCC) concluded in 1972 that 9-1-1 should be implemented nationwide and that the Federal Government should provide a greater leadership role. In 1973, the Office of Telecommunications Policy of the Executive Office of the President issued Bulletin No. 73-1,¹⁴ which addressed a national policy for the 9-1-1 emergency telephone number. This bulletin states that "it is the policy of the Federal Government to encourage local authorities to adopt and establish 9-1-1 emergency telephone systems in all metropolitan areas and throughout the United States. Whenever practicable, efforts should be initiated in both urban and rural areas at the same time."

The concept that 9-1-1 services should be based on individual community initiatives was widely accepted. By 1977, 600 systems were in existence, and approximately 90 new services were being implemented per year. Although this level of development was significant, only about 30 percent of the U.S. population, primarily in urban areas, had access to 9-1-1 services. Reasons for the slow development of 9-1-1 at the time, as cited by Reinke,³ were:

- Lack of strong Federal leadership
- No perception of 9-1-1 as a priority public issue
- Lack of targeted funding
- Lack of State action on 9-1-1

- Intra-agency and interagency jurisdictional conflicts
- Telephone industry passivity regarding 9-1-1 implementation
- Fear of high costs for 9-1-1.

In addition, a fear of loss of control on the part of the departments to be served by 9-1-1 has been cited as another reason for the slow development of 9-1-1. Only one agency can receive the initial 9-1-1 call, and in areas where there is a strong police presence and a strong fire presence, this may create friction.¹⁵

For many years, the Department of Commerce supported an information center, which is now in the National Telecommunications and Information Administration (NTIA). This center monitors progress in 9-1-1 systems development and provides information about existing systems. In addition, other Federal departments and agencies offer technical and financial assistance to State and local governments for 9-1-1 services. The Department of Transportation, for example, authorizes technical and financial support of 9-1-1 system planning and development using existing Federal highway safety grants programs. More recently, Federal funding has also become available for 9-1-1 system development to States and local governments from the U.S. Department of Health and Human Services through the following grants programs:

Agency

Health Resources and Services Administration (HRSA), Bureau of Health Resources Development, Division of Trauma and Emergency Medical Services

HRSA Office of Rural Health Policy

Agency for Health Care Policy and Research (AHCPR)

Program

Trauma Care Systems Planning and Development Act of 1990

Rural Health Outreach Demonstration Grants

Health Services Research on Rural Health

Key Elements/Components

The universal emergency telephone number (9-1-1) concept combines areawide coordination of emergency response resources and a single telephone number. It provides the means for reporting emergencies and summoning assistance. The primary function of 9-1-1 systems is to ensure that the most appropriate response agency (police, fire, or emergency medical services) is notified of the emergency with minimum delay. This function is performed at specialized communications centers called public safety answering points (PSAP's). PSAP's conduct the following activities:

- **Promptly answer telephone calls directed to the PSAP.**
- **Interrogate each caller to determine caller time and identity and the nature, location, extent, and severity of the emergency.** This information must be elicited verbally in both basic and enhanced 9-1-1 systems. In basic 9-1-1 systems, this function also involves determining the telephone number from which the call is being made and the location

of the caller. In enhanced 9-1-1 systems, the process is usually expedited through computerization.

- **Depending upon the nature of the emergency, communicate the information to the appropriate emergency agency for its response.**

Typically, in fully enhanced 9-1-1 systems, the appropriate designated response agency or unit for a particular type of emergency, for a given emergency site, is automatically selected from a computer database. In some enhanced systems, communications links may be established and emergency information automatically relayed through a computerized database and call system.

- **Maintain records on all 9-1-1 calls.**

The U.S. Department of Transportation encourages States and political subdivisions to adopt and to implement the universal emergency telephone number concept (9-1-1) and single emergency telephone number access.¹⁴

Implementation Status

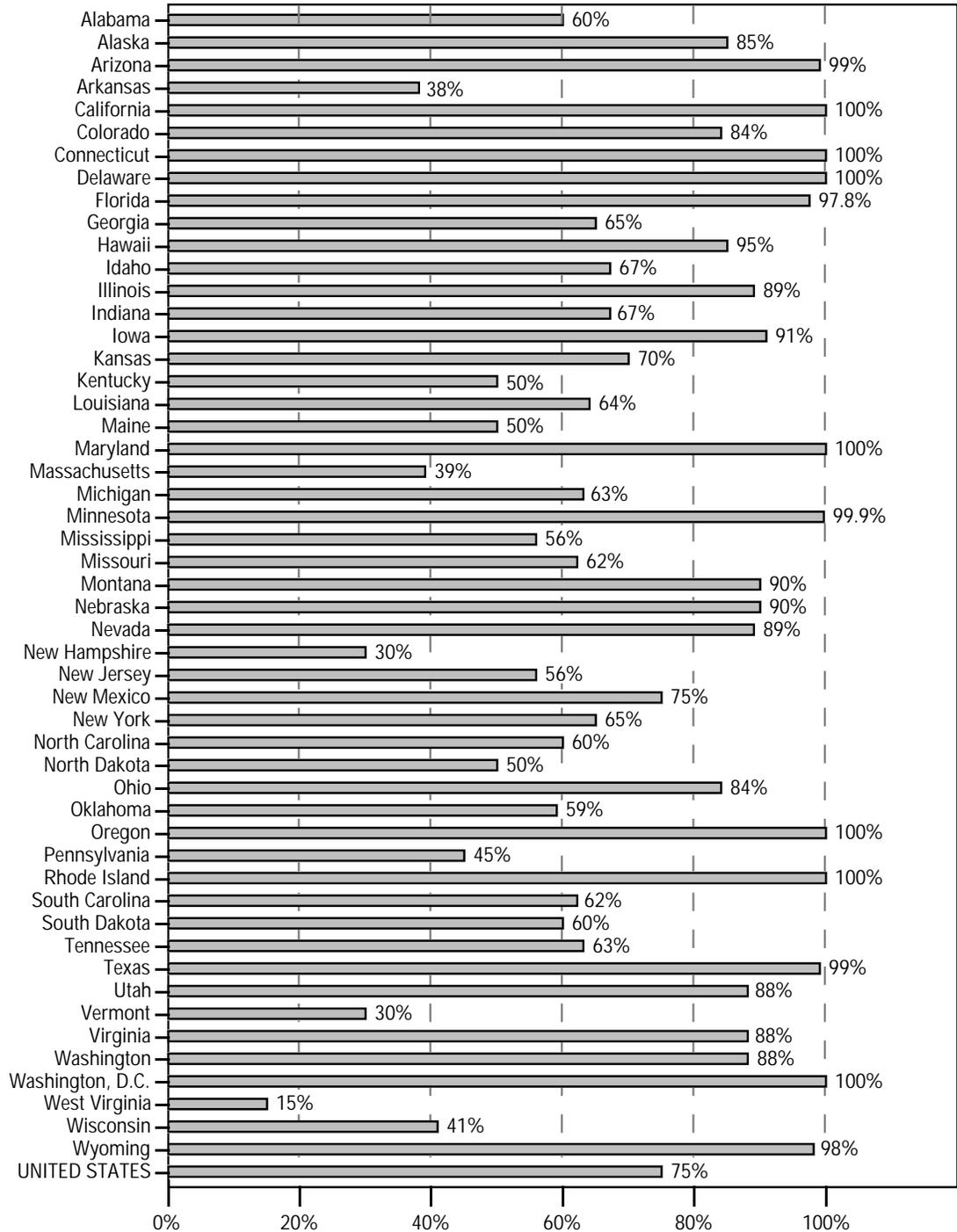
The National Emergency Number Association (NENA) estimates that currently about 75 percent of the U.S. population, mostly in urban areas, has access to public safety services through some type of 9-1-1 system.¹⁶ Figure 1 illustrates the estimated percentage of population with access to 9-1-1 services in each of the States. Many rural households and roadways fall outside the areas covered by existing 9-1-1 systems. However, they may still have access to public safety services through seven-digit dialing.

As of June 1993, nearly 195 U.S. cities with a population over 100,000 have enhanced 9-1-1 service (including four with enhanced 9-1-1 in the planning stages).¹⁶

Ideally, enhanced 9-1-1 coverage should be available for 100 percent of the Nation's population in order to ensure rapid and maximum access to police, fire, and EMS. As already noted, enhanced 9-1-1 systems can determine the telephone number and location from which an emergency call is made. Theoretically this will promote greater access to emergency services for non-English-speaking callers, as well as for those who are too upset or sick to communicate the necessary information. Enhanced 9-1-1 systems also permit automated use of computerized databases listing designated law enforcement, fire, and EMS primary and secondary responders for each location in the 9-1-1 service area. Finally, enhanced 9-1-1 systems can also selectively route calls, resulting in fewer jurisdictional disputes among agencies.¹⁵

Much work has already been done to develop national consensus on guidelines for multitiered (municipal/county/regional/statewide) planning and implementation for 9-1-1 services. Such guidelines are contained in the "Standard Guide for Planning and Developing 9-1-1 Enhanced Telephone Systems," F 1381-92.¹⁷ This ASTM standard guide promotes and facilitates implementation of State legislation on statewide planning and development of enhanced 9-1-1 telephone systems. Such legislation has been enacted and is being implemented in several States—such as California, Connecticut, Delaware, Maryland, and New Jersey—and is pending in others.

Figure 1. Percentage of Population Covered by 9-1-1 in Each State



Source: Minnesota Department of Administration, 1993.¹⁶

Existing State Legislation and Standards

As noted, communities have initiated citizen access to public safety services via the designated national emergency telephone number (9-1-1). Because some of these community-developed systems exclude households located in unincorporated areas between communities and because of other inadequacies of individual community initiatives for 9-1-1 systems, many States have developed 9-1-1 legislation. According to the May 1992 status report of the National Association of State Nine-One-One Administrators,¹⁸ 9-1-1 legislation now exists in 45 States, an increase from 37 States in 1990. The existing legislation has little uniformity, however, and there is a need to develop statewide legislation and standards for 9-1-1 system funding, management, and operations.

Tables 1, 2, and 3 illustrate the variability in scope, system characteristics, and management overview prescribed in existing 9-1-1 legislation. Table 1 shows that 36 States have legislation that addresses the scope of 9-1-1 on a statewide basis; 2 States, regionwide; 6 States, countywide; and 1 State, citywide. Table 2 shows that 12 States have enhanced 9-1-1 systems prescribed in their existing State 9-1-1 legislation, 7 have basic 9-1-1 systems prescribed, and 26 have unspecified system characteristics prescribed. Table 3 depicts the management overview prescribed in the existing 9-1-1 legislation, specifically showing that 14 States have State boards; 27, district boards; 3, county boards; and 1, a city board.

Even more variability exists in 9-1-1 legislation in provisions for approving system implementation. Some of this variability may be due only to differences in legislative language. Approximately 12 different procedures for approving the implementation of 9-1-1 systems have been specified by the 45 States. These provisions are State/county/regional resolution, State/county vote, legislative action, State/regional ordinance, State board of supervisors, county plan, county commissioners, public agency, referendum, board law, and city mandate. In seven of the States such procedures are not specified.¹⁸

Table 1. Scope Prescribed in Existing 9-1-1 Legislation

Scope	Number of States
Statewide	36
Regionwide	2
Countywide	6
Citywide	1

Source: National Association of State Nine-One-One Administrators (compiled by the Texas Advisory Commission on State Emergency Communications), August 1992.¹⁸

Table 2. System Characteristics Prescribed in Existing State 9-1-1 Legislation

System Characteristics	Number of States
Enhanced	12
Basic	7
Not Specified	26

Source: National Association of State Nine-One-One Administrators (compiled by the Texas Advisory Commission on State Emergency Communications), August 1992.¹⁸

Table 3. Management Overview Prescribed in Existing State 9-1-1 Legislation

Management Overview	Number of States
State boards	14
District boards	27
County boards	3
City boards	1

Source: National Association of State Nine-One-One Administrators (compiled by the Texas Advisory Commission on State Emergency Communications), August 1992.¹⁸

Variability in many aspects of State 9-1-1 legislation is a natural byproduct of differences in State constitutions and in evolving relations between State and local governments and is not necessarily undesirable. However, some differences can be classified as apparent oversights that may need to be changed. For example, 29 States do not address the characteristics of 9-1-1 systems, and 7 States do not address procedures for making and approving 9-1-1 system implementation.

Most of the 45 States specify authorized funding mechanisms (sources, payment/collection processes, and amounts) in their 9-1-1 legislation and limitations on the uses of such revenues. Here again, every State is different in some respect. The most widely used funding mechanism is a variable fee for 9-1-1 services (usually not to exceed a specified maximum amount) collected from all telephone service subscribers. Table 4 shows the various 9-1-1 funding mechanisms and the number of States in which they are specified in State 9-1-1 legislation.

In most States, the existing 9-1-1 legislation **permits** rather than **mandates** 9-1-1 system implementation. However, State legislative provisions for 9-1-1 are being regularly changed and updated to address oversights and to ensure:

- Definition of system performance characteristics and standards of reliability for 9-1-1 systems
- Simplification of procedures for approval of 9-1-1 system implementation
- Upgrading of State-specified 9-1-1 system characteristics from basic to enhanced
- Improvement of funding mechanisms
- Quality assurance in 9-1-1 system performance, including call answering and dispatching
- Improvement of guidelines for appropriate citizen use of 9-1-1.

The definition and planning for beneficial changes in State 9-1-1 legislation and in EMS dispatching are supported by ASTM standard guides and practices. These changes are promoted by the National Association of State EMS Directors; the National Emergency Number

Association; the National Association of State Nine-One-One Administrators; the National Association of State Telecommunications Directors; the Associated Public-Safety Communications Officers, Inc.; and the International Municipal Signal Association.

Table 4. 9-1-1 Funding Mechanisms

Mechanism	Number of States
Variable 9-1-1 fee per subscriber (to cover costs) collected monthly by telephone company	16
Fixed 9-1-1 fee per subscriber collected monthly by telephone company	7
Variable percentage of telephone bill (to cover costs) collected monthly by telephone company	5
Fixed percentage of telephone bill collected monthly by telephone company	7
Bond issue	2
Property tax	2
State application (to cover State and local administrative costs)	2
Tax/license fee	1
Telephone company revenue from local directory service charges	1
Not specified	2

Source: National Association of State Nine-One-One Administrators (compiled by the Texas Advisory Commission on State Emergency Communications), August 1992.¹⁸

ISSUES AND RECOMMENDATIONS FOR IMPLEMENTING UNIVERSAL/ ENHANCED 9-1-1

Important issues to consider in working to achieve universal/enhanced 9-1-1 include the following:

- **9-1-1 is not universal.** Some households do not have public telephone services because of financial or logistical reasons, particularly in rural areas. Other households do have public telephone services but may not have 9-1-1 services because there has been no local government initiative to provide such services, it is too expensive for small local governments, or they live outside of local government 9-1-1 system service boundaries.
- **Existing 9-1-1 systems may be inefficient and have low productivity.** Efficiency of 9-1-1 services will be increased by upgrading basic 9-1-1 systems to enhanced 9-1-1 systems. With enhanced 9-1-1, the time required for processing individual 9-1-1 calls may be decreased, because identifying the address and phone number obviates the need to spell words and circumvents communication problems with non-English-speaking callers. This potentially permits processing a greater volume of cases per unit time and in general furthers the goal of decreasing the time to obtain appropriate information. This enables a system to handle the demands of a larger population and a greater volume of emergency calls during “busy hours.”
- **Existing 9-1-1 systems may not be sufficiently coordinated with EMS dispatch services.** One of the greatest potential benefits of 9-1-1 is emergency medical dispatch. A well-coordinated dispatch, as a portion of a 9-1-1- system, may result in fewer instances of inappropriate response (e.g., response agency or unit, emergency response vehicle, location).
Coordination of 9-1-1 and dispatch services may be further enhanced by collocating facilities, by cross-training personnel, or by completely integrating 9-1-1 and dispatch services. Existing PSAP and dispatch communications functions may be performed by the same or by different persons. However, collocating and integrating these services may generate conflict among managers of existing facilities and services, even though consolidation of 9-1-1 can lead to economies of scale, including cost savings. Ideally, emergency medical dispatching should be incorporated into fully developed 9-1-1 centers.
A related problem is that private ambulance services may promote not calling 9-1-1, reflecting variability of control of these operations and competing services.
- **Using 9-1-1 for cardiac emergencies may be perceived as a minor use of 9-1-1.** The estimated composition of 9-1-1 calls is about 85 percent for police response (most of which are crimes against property), 8 percent for medical response, and 7 percent for fire response.¹⁹ Less than 2 percent of all 9-1-1 calls involve cardiac emergencies. Thus a possible perception is that use of 9-1-1 in response to heart attacks is a minor usage of this system. However, although cardiac emergencies are a relatively small percentage of 9-1-1 calls, the potential for lives saved is great. Changes needed to achieve the ideal goal of universal/enhanced 9-1-1, including improved coordination with EMS dispatch

services, may involve relocation and reorganization and thus may be resisted, as noted.

Recommendations on how to meet the challenges of implementing universal/enhanced 9-1-1 systems include the following:

1. **The current physical location for every telephone number must be identified, documented, and updated.** Automatic number identification (ANI) capabilities must be instituted. In addition, an automatic location identification (ALI) computer site must be developed and maintained to identify the location of the telephone corresponding to each telephone number. Updating the ALI database to reflect the frequent changes in telephone subscribers and their locations is a substantial system maintenance effort that is a joint responsibility of telephone service providers and enhanced 9-1-1 system managers. Lack of street numbers and names in rural areas (where rural route and post office box numbers are used) poses further barriers to enhanced 9-1-1.
2. **An oversight on Federal Government actions that may affect 9-1-1 services must be maintained.** Changes to conventional telephone services and cellular radio telephone systems—for example, creation of new types of radio telephone systems such as personal communications systems—may result from changes in FCC rules, congressional communications bills, and Federal court orders. Court orders or regulations may require competitiveness in the communications industry and permit multiple providers for local telephone services. Such Federal actions, if taken with an appropriate concern for maintaining and improving public access to public safety service, may have a beneficial effect on the evolution of 9-1-1 systems. If public safety concerns are ignored in such actions, however, they may have an adverse effect on the continued viability of 9-1-1 concepts.
3. **Reasonable local guidelines to resolve misuse problems should be developed.** Misuse of 9-1-1 (e.g., prank calls) may pose problems to 9-1-1 systems.
4. **Consideration should be given to reconfiguring 9-1-1 systems on the basis of larger political jurisdictions.** The national 9-1-1 program was conceived as an initiative to be planned and implemented through cooperative efforts of local governments (primarily municipalities) and local telephone exchanges. Exclusion of 9-1-1 coverage to households that are outside of municipal boundaries is a problem. Reconfiguration of 9-1-1 systems on the basis of larger political jurisdictions (counties, multicounty regions, or statewide) is a possible solution to avoid exclusion of rural households. Municipal public safety officials may object to their 9-1-1 and dispatch services becoming part of a larger county, regional, or statewide system because they may perceive a loss of control and a decrease in responsiveness of public safety services for their constituents.^{15,17}
5. **Strategies to reach households without telephones need to be developed.** One aspect of 9-1-1 as it relates to access to care for early identification and treatment of individuals with symptoms and signs of AMI/sudden cardiac death is that, nationally, not all households have

telephones. Thus, strategies to reach households without telephones need to be developed. Table 5, which is based on data from the 1990 U.S. Census Bureau, lists the 10 States with the highest percentages of households without telephones.

6. **Each State should have a statewide EMS communications plan that focuses on public access to EMS and two-way voice communications.** A strategy for implementation of universal/enhanced 9-1-1 systems is that each State develop a statewide EMS communications plan that focuses on public access to EMS and two-way voice communications. The plan should emphasize statewide planning and development of enhanced 9-1-1 as described in the ASTM “Standard Guide for Planning and Developing 9-1-1 Enhanced Telephone Systems,”

F 1381-92.¹⁷ Use of this guide will promote uniformity in statewide planning and implementation of enhanced 9-1-1 systems so as to provide prompt access to EMS and other public safety services for the entire population of a State. The plans should also address extending the coverage and upgrading the reliability of EMS communications as described in the ASTM “Standard Guide for Emergency Medical Services Systems Telecommunications,” F 1220-89²¹ and applicable Federal Communication Commission rules for emergency medical radio services.²²

7. **A national awareness must be promoted concerning the feasibility and importance of achieving universal/enhanced 9-1-1.** The need for improvement in 9-1-1 and public safety dispatch communications to achieve objectives for early cardiac care can be a catalyst for change. National, State, and local governments and public safety agencies must become convinced that the benefits of achieving universal/enhanced 9-1-1 implementation override the burdens (increased costs, shifts in management responsibility, and legislative efforts) of needed changes to create pervasive, efficient, and coordinated public access and EMS response for cardiac emergencies.
8. **Key groups that can help effect change should promote 9-1-1 implementation.** Among these key groups are the National Association of State EMS Directors; the National Association of State Telecommunications Directors; the National Association of State Nine-One-One Administrators; the National Emergency Number Association; the 9-1-1 Committee of the Associated Public-Safety Communications Officers, Inc.; and the International Municipal Signal Association. Such groups as these can help effect change and should be involved, as should the National Association of EMS Physicians and associations of fire chiefs,

Table 5. Percentage of Occupied Housing Units Without Telephones (Top 10)

State	Percent
1. Mississippi	12.6
2. New Mexico	12.4
3. Arkansas	10.9
4. West Virginia	10.3
5. Kentucky	10.2
6. South Carolina	9.1
7. Oklahoma	8.8
8. Alabama	8.7
9. Texas	8.6
10. Arizona	8.5

Source: U.S. Census Bureau, 1990.²⁰

sheriffs, chiefs of police, and law enforcement officers. Networking and establishing better links among EMS groups (including private ambulance services), professional communications associations, State regulatory utility commissioners, law enforcement, and fire systems are important factors in achieving universal/enhanced 9-1-1.

9. **Continued monitoring of the status of 9-1-1 systems should be supported.** The National Association of State EMS Directors and the National Association of State Telecommunications Directors have published several reports on national surveys of 9-1-1 services, and the 9-1-1 Committee of the Association for Public-Safety Communications Officers, Inc., has developed an extensive collection of reports on 9-1-1 systems. The National Association of State Nine-One-One Administrators, the National Emergency Number Association, and the International Municipal Signal Association are excellent survey sources as well. Research on barriers to 9-1-1 implementation at the local and State levels, which is concurrent with monitoring the status of 9-1-1 systems implementation, should be fostered.
10. **The ASTM “Standard Guide for Planning and Developing 9-1-1 Enhanced Telephone Systems,” F 1381-92, should be implemented by States.** The ASTM “Standard Guide for Planning and Developing 9-1-1 Enhanced Telephone Systems,” F 1381-92¹⁷ promotes and facilitates the enactment and implementation of statewide enhanced 9-1-1 systems. Thus any recommendations for prehospital early cardiac care should address consideration of the benefits associated with statewide enhanced 9-1-1 systems, although scientific data are lacking that demonstrate improved outcomes with statewide 9-1-1 system administration compared with local control.

Even though cardiac emergencies represent a relatively small percentage of 9-1-1 calls, they constitute a high-risk group of users. Ideally, implementation of

universal and enhanced 9-1-1 will allow ready access to the EMS system, and will include emergency medical dispatching services, for individuals seeking treatment for symptoms and signs of an AMI, as well as sudden cardiac death.

Organizations that seek to promote universal/enhanced 9-1-1 should work with groups involved in enhanced 9-1-1 system planning and development to help achieve that goal as well as promote continuing collaboration to implement improved emergency medical dispatching practices.

The presence of universal 9-1-1 does not itself ensure rapid access to EMS if the patient or bystanders do not employ it appropriately or are unaware of its existence.²³ However, a major assumption of this paper is that universal and, ideally, enhanced 9-1-1 is a fundamental prerequisite to a seamless access to EMS. The 1992 National Conference on CPR and Emergency Cardiac Care recommended that for adult sudden cardiac death victims, the rescuer should **phone first** to activate the EMS system before performing CPR. This is a shift from its 1986 recommendation that rescuers perform CPR for 1 minute on adult victims before calling the EMS system.²⁴ In terms of patients with heart attacks, once 9-1-1 is in place universally, national public education campaigns can promote use of 9-1-1 in response to the symptoms and signs of an AMI in order to facilitate entry into the EMS system and early identification and treatment of AMI. Such education will aim to reduce the greatest source of delay in receiving care for an AMI—that related to the patient.

1. Glass CJ. Implications of 9-1-1 system development and use on the National Heart Attack Alert Program 1991. Report to: Mary McDonald. 1991 June 20. 4 leaves.
2. Ivy SC. Potential for citizen time savings with 911 access. *IEEE Trans Vehicular Technol* 1979;VT-28(4):298-302.
3. Reinke RW. EMS public access through 911: a technological response to political tradition. *IEEE Trans Vehicular Technol* 1979;VT-28(4):267-71.
4. Mayron R, Long RS, Ruiz E. The 911 emergency telephone number: impact on emergency medical systems access in a metropolitan area. *Am J Emerg Med* 1984;2(6):491-3.
5. Eisenberg M, Hallstrom A, Becker L. Community awareness of emergency phone numbers. *Am J Public Health* 1981;71(9):1058-60.
6. Tall RR. (9-1-1 Coordinator, Seminole County, Florida). Letter to: Mary McDonald Hand. 1993 June 29. 3 leaves.
7. U.S. Department of Transportation, National Highway Traffic Safety Administration. Fatal accident reporting system 1991: a review of information on fatal traffic crashes in the United States. Washington, DC: Department of Transportation; March 1993. Report No.: DOT HS 807954.
8. Barsan WG, Brott TG, Broderick JP, Haley EC, Levy DE, Marler JR. Time of hospital presentation in patients with acute stroke. *Arch Intern Med* 1993; 153:2558-61.
9. Weaver WD, Kennedy JW. Myocardial infarction—thrombolytic therapy in the prehospital setting. In: Fuster V, Verstraete M, eds. *Thrombosis in cardiovascular disorders*. Philadelphia: WB Saunders Co., 1992; pp. 275-87.
10. Maynard C, Weaver WD, Litwin PE, Martin JS, Kudenchuk PJ, Dewhurst TA, Eisenberg MS, Hallstrom AP, Chambers J for the MITI Project Investigators. Hospital mortality in acute myocardial infarction in the era of reperfusion therapy (the Myocardial Infarction Triage and Intervention Project). *Am J Cardiol* 1993;72:877-82.
11. Joslyn SA, Pomrehn PR, Brown DD. Survival from out-of-hospital cardiac arrest: effects of patient age and presence of 911 emergency medical services phone access. *Am J Emerg Med* 1993;11(3):200-6.
12. Institute for Defense Analysis. Task Force Report: Science and Technology, President's Commission on Law Enforcement and the Administration of Justice, 1967.
13. Dayharsh TI, Yung TJ, Hunter DK, Ivy SC. Update on the national emergency number 911. *IEEE Trans Vehicular Technol* 1979;VT-28(4): 292-7.
14. U.S. Department of Transportation. Policy on implementation of the universal emergency telephone number (911) concept. Washington, DC: Department of Transportation Order 4540.1. November 23, 1973.

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15. Ehrlich RR. A study of relationships during the establishment of a 9-1-1 system. A thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts in Urban and Regional Studies at Mankato State University, Mankato, Minnesota, 1984.
 16. Beutelspacher J. (9-1-1 Project Manager, Department of Administration, St. Paul, Minnesota). Fascimile transmission to: Mary McDonald Hand. 1994 April 11. 11 leaves.
 17. American Society for Testing and Materials (ASTM). F 1381-92, Standard guide for planning and developing 9-1-1 enhanced telephone systems. In: Annual book of ASTM standards. Vol. 13.01, Medical devices. Philadelphia: ASTM; 1992.
 18. National Association of State Nine-One-One Administrators. Comparison of state 9-1-1 legislation and standards. Compiled by the Texas Advisory Commission on State Emergency Communications, Austin, Texas. August 1992.
 19. Stanton W. (Executive Director, National Emergency Number Association, Columbus, Ohio). Letter to: Mary McDonald Hand. 1993 June 2. 2 leaves.
 20. U.S. Bureau of Census. Summary of social, economic, and housing characteristics. 1990-series CPH-5.
 21. American Society for Testing and Materials (ASTM). F 1220-89, Standard guide for emergency medical services system (EMSS) telecommunications. In: Annual book of ASTM standards. Vol. 13.01, Medical devices. Philadelphia: ASTM; 1992.
 22. Federal Communications Commission PR Docket No. 91-72. Notice of Proposed Rulemaking. Amendment of part 90 of the commission's rules to create the emergency medical radio service. Adopted January 14, 1993.
 23. The Upjohn Company and American College of Emergency Physicians. Americans' preparedness for medical emergencies and understanding of emergency medical procedures [unpublished survey]. New York: Yankelovich Partners, Inc. December 17, 1992.
 24. Montgomery WH, Brown DD, Hazinski MF, Clawsen J, Newell LD, Flint L. Citizen response to cardiopulmonary emergencies. *Ann Emerg Med* 1993;22(part2):428-34.

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