Journal of Thrombosis and Thrombolysis 1998;6:19–46

Access to Timely and Optimal Care of Patients with Acute Coronary Syndromes — Community Planning Considerations: A Report by the National Heart Attack Alert Program

National Heart Attack Alert Program Coordinating Committee,
Access to Care Subcommittee,
National Heart, Lung, and Blood Institute,
National Institutes of Health, Bethesda, MD

Abstract. **Age-adjusted mortality due to cardiovascular disease (CVD) has declined by more than 50% over the past three decades; however, CVD continues to be the leading cause of death in the United States. In 1994, 1.25 million people experienced an acute myocardial infarction (AMI). Nearly 500,000 Americans died from CVD, and more than half of these deaths occurred suddenly, within 1 hour of symptom onset, outside the hospital setting. The National Heart Attack Alert Program (NHAAP) endorses the view of the American Heart Association that the community should be recognized as the "ultimate coronary care unit." Rapid identification and early treatment are supported by research that demonstrates time is a fundamental factor in reducing morbidity and mortality from AMI and cardiac arrest. A dramatic relationship has been shown between the onset of AMI symptoms, reperfusion treatment, and outcome for patients treated within the first hour after the onset of symptoms. The *golden hour* has become a widely recognized term in the trauma field, and communities and states are encouraged to develop and implement regional and statewide plans to ensure that trauma patients receive appropriate care within 1 hour of injury. The primary premise of this report — that planning by communities for rapid recognition and triage of patients with symptoms and signs of acute coronary syndromes will result in better outcomes for patients with AMI, including sudden cardiac arrest — is largely based on experience with trauma patients, a population that is benefitting from similar community planning efforts. This NHAAP report reviews community planning considerations and the essential components of an effective community plan (i.e., action plans and protocols, equipment and resources, education and training, and continuous quality improvement evaluation and research) and provides recommendations for each component. The report also presents strategies to guide communities in developing community cardiac emergency action plans.**

Key Words. **angina, unstable angina, community health planning, health services accessibility, myocardial infarction.**

Overview

In 1994, 1.25 million people experienced an acute myocardial infarction (AMI) and nearly 500,000 died [1]. Over half of these deaths occurred suddenly — within an hour of symptom onset — and outside of a hospital, at a time when available technology and early intervention have proven to save lives.

The American Heart Association first described the *community as the ultimate coronary care unit* in 1980 [2]. With that description in mind, this article is designed to be a blueprint for communities in planning for access to timely care for these patients. In addition, it is hoped that the article will serve as a resource for communities as they shape their specific plans for emergency cardiac care.

Current research strongly supports the importance of *time* as a fundamental factor in reducing morbidity and mortality for patients with AMI and cardiac arrest. Therefore, the chain of survival concept — early access to the emergency medical services (EMS) system; early cardiopulmonary resuscitation; early defibrillation by first responders, emergency medical technicians, or paramedics; and early advanced cardiac life support (ACLS) — needs to be applied to individuals presenting with AMI as well as those with cardiac arrest. The chain of survival for patients with AMI encompasses early recognition by patients, their family members, and other bystanders; early and appropriate action; early ACLS; and early identification (i.e., diagnosis) and treatment [3]. This model can also be used for other medical problems, such as acute stroke, for which early intervention (e.g., with thrombolysis) improves outcome [4].

Despite laudable intentions by many individuals, groups, and communities, delays in receiving treatment occur at a number of points from the time the patient initially experiences symptoms and signs of an AMI until treatment is initiated in the emergency department. The National Heart, Lung, and Blood Insti-

Address for correspondence: Mary Hand, M.S.P.H., R.N., Coordinator, National Heart Attack Alert Program, Office of Prevention, Education, and Control, National Heart, Lung, and Blood Institute, 31 Center Drive MSC 2480 Building 31, Room 4A18 Bethesda, MD 20892-2480. E-mail: handm@gwgate.nhlbi.nih.gov

tute (NHLBI) launched the National Heart Attack Alert Program (NHAAP) in 1991 as a national education effort to promote the rapid identification and treatment of individuals with symptoms and signs of an AMI, with the overriding goal of reducing mortality and morbidity from AMI, including sudden cardiac arrest.

As part of its initial educational activities, the NHAAP has prepared papers highlighting delays in recognition and treatment in the hospital emergency department setting [5]; prehospital issues that potentially affect timely identification and treatment of patients with AMI and sudden cardiac arrest (specifically staffing and equipping of EMS systems, emergency medical dispatching standards, and 9-1-1 implementation) [6–8]; and patient/bystander factors associated with early access to care [3]. The program has recently expanded its mission to include patients with symptoms and signs of acute coronary syndromes, encompassing patients with unstable angina as well as AMI (both non–Q-wave and Q-wave myocardial infarction) and sudden cardiac arrest [9].

Meeting an overall goal of ensuring timely and optimal care for patients with manifestations of possible acute coronary syndromes requires the concerted community effort of a number of individuals and groups in a three-phase approach, as conceptualized by the NHAAP. In phase I, *patient/bystander recognition and action*, the patient (or those in his or her environment to whom the patient presents) must recognize the symptoms and signs of a possible heart attack or ischemia and seek emergency evaluation and treatment without hesitation. In phase II, *prehospital action*, the EMS staff must be dispatched appropriately and must respond in the shortest time possible, transporting the patient and providing life-sustaining measures if needed. In phase III, *hospital action*, the emergency department staff of the hospital receiving the patient must be prepared to identify the problem rapidly and treat appropriately.

This article addresses community planning considerations that are necessary to develop an effective action plan to respond to the needs of the patient with suspected acute coronary syndromes. It describes several available community planning models and then identifies the essential components of community planning for ensuring timely and optimal access to care. Finally, it offers community planning strategies based on the essential components for the rapid identification and disposition of these individuals.

A comprehensive plan in communities across the United States for patients who experience symptoms and signs of acute coronary syndromes will result in improved outcomes. This statement embraces the major premise of this article. This concept has not been previously proven or introduced to communities, although the concept represents the collective wisdom and consensus of the NHAAP Coordinating Committee representatives and experts.

Introduction

Despite remarkable declines in mortality over the last 30 years, cardiovascular disease (CVD) remains the number one health threat to most adults in America. People worry about the rise of crime and violence in their neighborhoods, but this silent killer — cardiovascular disease — is by far a greater threat to their lives. Other pressing health problems in our nation today take second place to CVD, even the reemergence of infectious diseases such as tuberculosis.

In terms of the burden of cardiovascular disease for communities, in 1994, 1.25 million people experienced an AMI and nearly 500,000 died [1]. Further, approximately 7 million Americans have coronary heart disease, about 3 million have cerebrovascular disease, and about 2 million have peripheral vascular disease and are at high risk for a future AMI. Approximately 4.9 million patients present to emergency departments with chest pain annually [10]. By the year 2020, the Harvard School of Public Health and the World Health Organization project that "ischemic heart disease" will be the leading cause of death and disability for all regions of the world [11]. For specific information, refer to the Scientific Basis section of Appendix A.*

Community Alert: The Importance of Time to Treatment

Because heart attacks occur at home, at work, and in the community, and because people die without potentially lifesaving care, identification and treatment of patients with AMI and sudden death in particular, as well as acute coronary syndromes in general should be primary community concerns. Therefore, it is critical that communities develop an action plan to ensure a consistent, appropriate, and coordinated response.

In recent years, strides have been made in the identification and treatment of AMI with the development of an armamentarium of powerful technologies and drugs. Thrombolytic agents, angioplasty [12–15] and coronary artery bypass surgery can reestablish blood flow to the infarcting areas. Controlled trials of thrombolytic agents have shown significant and substantial reductions in acute mortality, with benefit markedly outweighing risk [16–21]. Thrombolytic therapy for patients with AMI has significantly greater benefit for those treated within the first or second hour after the onset of symptoms than for those treated in the third to sixth hours [22]. There is modest but significant benefit for patients treated between 6 and 12 hours after the onset of symptoms as opposed to those treated beyond that time [23]. Given the rapid decline in benefit, the potential for myocardial salvage with

*Appendix A provides the detailed background rationale for this article, including the scientific basis and sources of delay for emergency care of patients with acute coronary syndromes.

thrombolytic therapy is substantially greater for patients who present within the first 1–2 hours after symptom onset, with 60 minutes or less being the optimal time to treatment.

Time is, therefore, a critical factor in the identification and treatment of patients with AMI and has resulted in a new paradigm for management of these patients: the possibility of interrupting the infarction process in its early stages [5].

Witnessed cardiac arrest victims have a significantly better survival rate than those who suffer unwitnessed cardiac arrest. Therefore, most survivors of cardiac arrest are from the group of patients whose collapse is witnessed by a bystander, who receive cardiopulmonary resuscitation (CPR) within 4–5 minutes, and who receive; advanced cardiac life support ACLS (e.g., defibrillation, intubation, drug therapy) within the first 10 minutes [24]. *Time*, once again, is a critical determinant in the outcome of cardiac arrest victims. The earlier the victim is defibrillated, the greater the chance of survival [25–51].

However, delays in treatment initiation and lack of implementation of these time-dependent therapies pose major barriers to effective management. These delays are attributable to a variety of factors: patient/bystander, prehospital, and hospital related. For example, studies have reported median ranges in delay time from onset of symptoms of a heart attack to treatment from just under 2 hours to 6.5 hours; 26–44% of patients delay more than 4 hours before seeking care [3].

Use of 9-1-1 (or a seven-digit emergency number) to access EMS has been shown to decrease time to reperfusion with thrombolytic therapy by as much as 60 minutes for individuals with an AMI, compared with patients who transport themselves [52]. Significantly, only 50% of patients with symptoms of a heart attack use the EMS system [53,54]. Once a patient arrives at an emergency department, any delays may compromise the effectiveness of reperfusion therapy for eligible patients [5].

Community Awareness: The Chain of Survival

The American Heart Association (AHA) Committee on CPR and Emergency Cardiac Care first highlighted the community nature of the sudden cardiac arrest problem in 1980 by stating that "since 60 percent to 70 percent of sudden deaths by cardiac arrest occur before hospitalization, it is clear that the *community* deserves to be recognized as the ultimate coronary care unit" [2].

The AHA has also proposed the concept of a chain of survival for victims of cardiac arrest [36]. The chain of survival has four components:

1. Early access to the EMS system
2. Early CPR, either by bystanders or first-responder rescuers
3. Early defibrillation by first responders, emergency medical technicians (EMTs), paramedics
4. Early ACLS

Each link in the chain must be strong to ensure maximal survival rates for those who experience out-of-hospital cardiac arrest. The chain of survival also can be applied to individuals with symptoms and signs of an AMI [8] or other acute coronary syndromes, as well as cardiac arrest.

Community Planning: General Considerations

The purpose of a community plan is to provide an optimal chain of care for patients with symptoms and signs of acute coronary syndromes. The community's goal must be to minimize or eliminate impediments that delay or restrict access to care. From the community perspective, the key times are the time from event (i.e., cardiac arrest) to defibrillation for the cardiac arrest victim, and the time from event (i.e., symptom onset) to open artery for the AMI victim. At times the *best care* and the *shortest time* may be in conflict; therefore, the plan must weigh the choices and decide in favor of the best interest of the patient in terms of clinical outcome.

Other community intervention efforts have been undertaken on a large-scale basis to prevent, reduce, and control cardiovascular disease [55,56]. These efforts to prevent and control cardiovascular disease should continue, given the prevalence of cardiovascular disease risk factors in the population [57], with the ideal goal of *preventing* heart attacks and sudden death. However, given the burden of the CVD problem, communities should be prepared to ensure that the patients who will inevitably present with acute coronary syndromes have access to timely and optimal care.

In general, the goals of a community plan for patients with acute coronary syndromes are that

- Most individuals who are eligible for reperfusion by thrombolytic, angioplasty, or coronary artery bypass grafting receive the therapy.
- Candidates undergo the intervention (e.g. thrombolysis) within 1 hour of symptom onset.
- With patient/bystander median delays of 3–4 hours, a coordinated effort by the community needs to target this obstacle.
- Patients with sudden cardiac arrest receive immediate bystander response with CPR, to access early EMS through 9-1-1 or the seven-digit emergency number, and early defibrillation [58].

Although research is needed (and is under way [59]) to determine the best ways to improve out-of-hospital recognition and response for patients with AMI, and

although resource deficiencies exist, the major immediate need is for organization of existing resources by communities. The fundamental considerations for developing a community plan are listed below followed by a more complete description of each point:

- The plan must try to achieve the most appropriate medical care in the *shortest time* possible.
- All of the important individuals and groups involved in policy setting, transportation, or direct care related to the acute cardiac patient should be involved in the planning process.
- Plans should be tailored to the unique problems faced by urban, suburban, and rural systems.
- The tendency for patients to use alternative modes of entry into the healthcare system needs to be anticipated.
- The plan should adjust for advances in technology that can be brought to bear on facilitating early access to optimal care for patients with symptoms and signs of acute coronary syndromes (e.g., telemedicine).
- Communities should consider utilizing existing community planning models.
- A plan for a coordinated community education program for the general public, high-risk patients, and community providers should be addressed.
- Communities, as part of their planning, should conduct a community assessment.

The plan must try to achieve the most appropriate medical care in the shortest time possible. Ideally, the patient with symptoms and signs suggestive of an AMI should be treated within 1 hour of the onset of symptoms [5]. Earlier treatment would be even better; however, major logistical problems exist. "Sixty minutes to treatment" is a goal that is potentially achievable for the majority of patients. To achieve this goal, several ideal actions or steps need to be accomplished (Figure 1). The patient must recognize the significance of the symptoms very early. Early symptom recognition will require patient education by healthcare providers (and eventually public education).

Because many patients ask family, friends, and/or healthcare providers for advice, those giving advice need to be educated to recognize the significance of the symptoms quickly and the need to access the EMS system for optimal care. Ideally, EMS would be accessed through enhanced 9-1-1 [6]. The person answering the 9-1-1 call would immediately transfer the call to the (trained) emergency medical dispatcher, who gives prearrival instructions to the patient or bystander and rapidly dispatches the appropriate first responders and ambulances [7]. The ambulance should have ACLS capability. The ambulance personnel may be requested to obtain certain data (e.g., historical data, vital signs, 12-lead electrocardiogram [ECG]) en route that will minimize emergency department time.

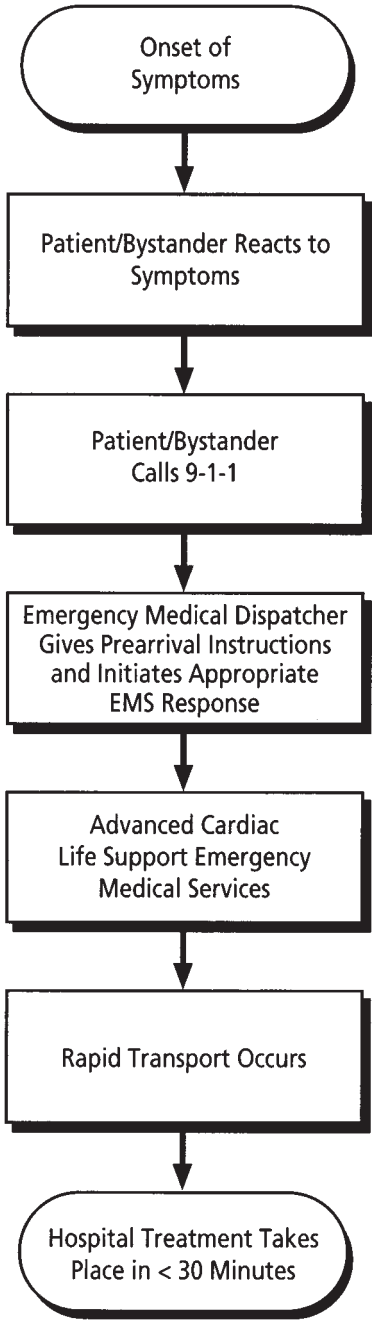

Fig. 1. *Ideal scenario for rapid identification and treatment of the patient with symptoms and signs of a heart attack.*

First responders or EMT/paramedics should be trained and permitted to operate an automated external defibrillator in the event a patient suffers a cardiac arrest. Rapid transport to an appropriate hospital is then required [8].

An appropriate hospital has an emergency department capable of taking care of a cardiac emergency, preferably one with the capacity to match the patient's acuity level. The emergency department at the hospi-

tal should handle the patient efficiently so that the time from arrival at the hospital until definitive treatment, is less than 30 minutes for the majority of the patients [5]. Thus, it must be recognized that many skilled individuals and subsystems are involved in the early identification, triage, transport, and treatment of the patient. The entire "system" must also act appropriately and be extremely well coordinated and organized to minimize delays. Only an effective community plan can take into account each of these considerations. Thus, it is important that individuals who are eligible for reperfusion by thrombolytic, angioplasty, or coronary artery bypass grafting receive the appropriate reperfusion therapy as soon as possible, ideally within 1 hour from the onset of symptoms.

All of the important individuals and groups involved in the policy setting, transportation, or direct care related to the acute cardiac patient should be involved in the planning process. In general, this includes system managers, primary care providers, prehospital care providers, hospital providers, and third-party payors/insurers. Specifically, it includes physician groups such as primary care physicians (both family practitioners and internists), in addition to cardiologists and emergency physicians; managed care organizations; nurses in managed care and emergency care settings; hospital administrators; the Public Safety Answering Point (PSAP) operators, who provide entry into the 9-1-1 system; emergency medical dispatchers; and all portions of the EMS system. This includes all appropriate first-responder organizations (e.g., EMS, fire, and police agencies, etc.), EMS administrators and supervisors, and the on-line and off-line medical control for the EMS system. Consideration should be given to including representatives from local and/or state and federal governmental groups, other regional planning groups, and interested organizations, such as the AHA and the American Red Cross. The process should be inclusive and should have representatives of the community, such as consumers, public information officers, and legislators. A lead agency/group leader is a prerequisite to the planning, implementation, operations, and evaluation processes.

Plans should be tailored to the unique problems faced by urban, suburban, and rural systems. Urban systems have multiple hospitals, and triage among the hospitals is a primary concern. The major emphasis in the rural system may be training appropriate personnel and upgrading systems to provide care. For the urban setting EMS personnel may take responsibility for appropriate triage, whereas in a suburban or rural setting the patient may first be taken to a facility with less than an optimal level of care and then secondarily transported to an appropriate level after being stabilized. Each locale should develop the best possible plan to direct appropriate triage among hospitals to ensure the best outcome for patients with AMI. (See the American Medical Association categorization scheme in Appendix C.)

The tendency for patients to use alternative modes of entry into the healthcare system needs to be anticipated. Patients with heart disease may not be certain of the significance of their symptoms and may typically consult with a family member, friend, coworker, healthcare provider, or even a stranger [3]. Even if the patient recognizes a potential cardiac problem, he or she may elect one or more courses of action (Figure 2). The dynamics in the patient's mind, as well as between patients and bystanders, are complex and often lead to significant delay in receiving care. In terms of the healthcare provider, patients may seek a medical opinion by calling a physician or the physician's office staff, the managed care plan, or the hospital or by walking into the physician's office, the urgent care facility, or the clinic. Recognizing this tendency, each of these settings must have an appropriate triage plan to move the patient into the EMS system as quickly as possible. (See the section, Health Care Sites under Strategies for Community Planning Based on the Essential Components of an Emergency Cardiac Care Plan.)

The plan should adjust for advances in technology that can be brought to bear on facilitating early access to care for patients with symptoms and signs of acute coronary syndromes. Improvements in technology (e.g., telemedicine) may require rethinking of major portions of the plan. If a new technique becomes available that is significantly better but that technique is only available at one location, the entire plan may have to be reconsidered.

Communities should consider utilizing existing community planning models. There are a number of models that communities may wish to consider in planning for the timely access to care and treatment of individuals with acute coronary syndromes. These models each provide a framework that describes the relationships among the community partners, as well as an approach to community planning (see Appendix B).

A plan for a coordinated community education program for the general public, high-risk patients, and community providers should be addressed. Communities will need to educate these groups, including bystanders, because they coexist in community settings and they have a potentially synergistic effect in reducing delays. Research is under way to examine the effect of community-wide intervention on delay time [59].

Communities, as part of their planning, should conduct a community assessment. This assessment should include a description of demographics and resources. For example, the incidence of AMI increases with age [60], so communities can gain information about the potential burden of cardiovascular disease in the community by quantifying the number of older citizens. Resources also include numbers and kinds of

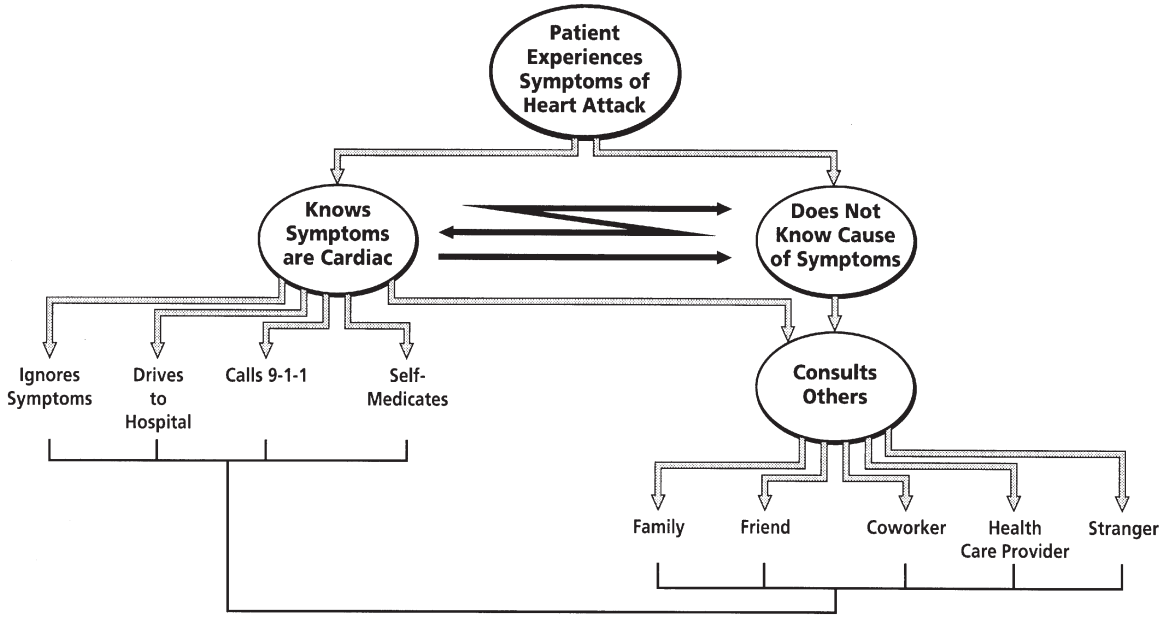

Fig. 2. *Typical scenario for patient response to the symptoms of a heart attack.*

EMS systems, hospitals, and healthcare delivery networks.

Trauma plan analogy

An analysis of the sequence of community response involved in the recognition, transport, and treatment of trauma patients versus patients with potential acute coronary syndromes and sudden cardiac arrest (Figure 3) reveals that the important difference lies in the category of patient recognition. In trauma, recognition of the patient is generally straightforward and accomplished by bystanders in the community. In the cardiac arena, the onus is on patients (or those around them) to recognize their symptoms and to act. However, patients may not be certain of the significance of their symptoms. Typically they may consult with a family

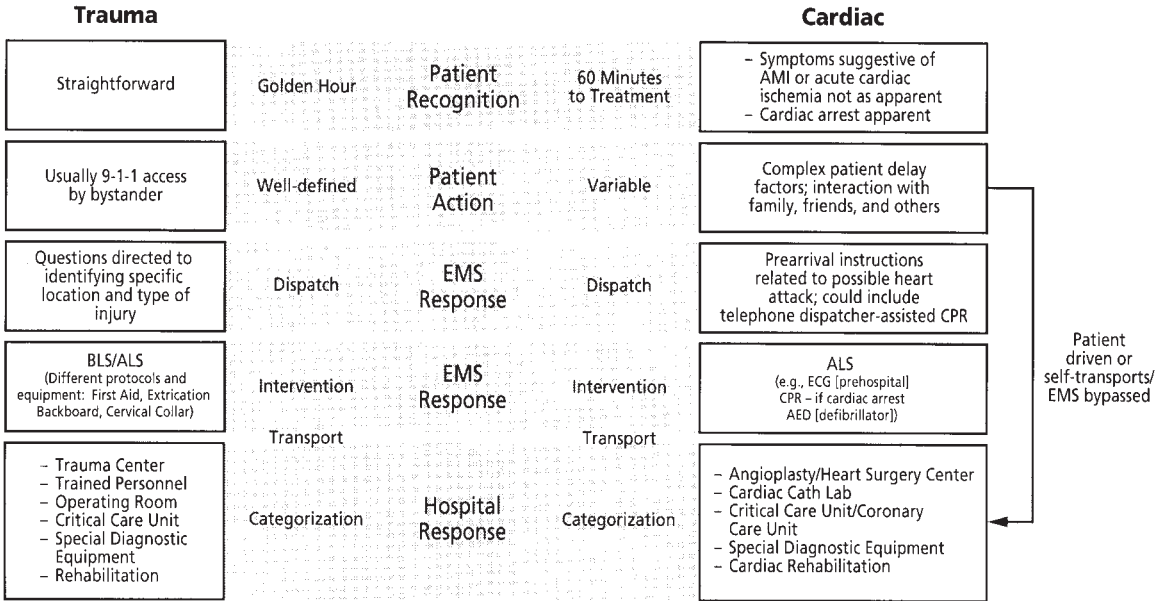

Fig. 3. *Conceptual comparison of patient recognition, transport, and treatment for acute trauma versus acute cardiac patients.*

member, friend, coworker, healthcare provider, or even a stranger.

Even if the patient recognizes a potential cardiac problem, he or she may elect one or more courses of action (see Figure 3). With witnessed cardiac arrest, the sequence of actions leading to treatment closely resembles those for trauma patients. Unlike trauma, about half (or less) of patients with AMI symptoms will bypass EMS (i.e., drive themselves or be driven to the hospital) [61,62]. For the patient who accesses EMS, the processes for EMS and hospital care generally should be similar to those for trauma, although delays for AMI patients have been documented in the emergency department, after arrival [5].

As with the "golden hour" in trauma, patients with acute coronary syndromes have a narrow window of time either to reperfusion therapy in the event of an AMI or to defibrillation for cardiac arrest. Just as communities develop trauma systems to provide the best resources for a patient [63,64], they should also develop a coordinated plan to reduce barriers, and thus time to treatment, for the acute cardiac patient.

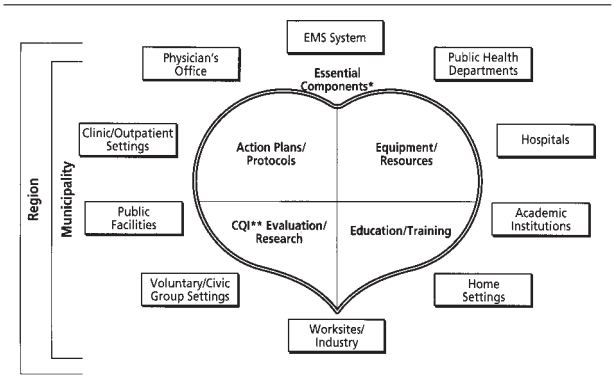

Fig. 4. *Ensuring access to timely and optimal care for patients with acute coronary syndromes. * Essential components of a community plan for ensuring access to timely and optimal care for patients with acute coronary syndromes. ** CQI = Continuous Quality Improvement/Research.*

Essential Components of a Community Emergency Cardiac Care Plan

The essential components of an emergency cardiac care plan that are proposed as fundamental to planning for an acute cardiac contingency in any community setting are **action plans and protocols, equipment and resources, education and training, and continuous quality improvement (CQI) evaluation and research** (Figure 4).

Action plans and protocols entail specific and approved steps that should be implemented when certain conditions are present, such as an emergency cardiac action or contingency plan formulated for high-risk patients and family members, protocols employed by the emergency medical dispatchers for assessing and responding to phone calls by cardiac patients and their families, triage and transport protocols for prehospital providers, telephone protocols by physician's offices and managed care settings for handling phone calls from patients with potential acute coronary syndromes [65], and standing protocols for identification and management of patients with chest pain in the emergency department or chest pain center [5].

Equipment and resources as essential components of an emergency community plan for acute cardiac patients include ambulances, rescue vehicles, 12-lead electrocardiographs, automated external defibrillators, and any other equipment integral to implementing the chain of survival. Resources related to early recognition of and response to individuals with manifestations of acute coronary syndromes or sudden death might include consultation with experts as well as educational materials for health professionals, patients, and the public.

Education and training pertain to the lay public, patients and their family members or significant others, all levels of prehospital providers, and health professionals of all types and settings. Education embraces informal one-to-one counseling, such as by a nurse with a patient, to continuing education of physicians, nurses, and prehospital providers, as well as education done as part of formal training programs. Education also includes teaching the public about heart attack symptoms and appropriate actions. Training encompasses skill in CPR, use of an automated external defibrillator, ACLS, standardized prearrival instructions by emergency medical dispatchers, emergency department triage, and evaluation of chest pain patients—anything associated with implementing and strengthening the chain of survival.

CQI evaluation and research are also essential components of an emergency cardiac community plan. The plan should incorporate a mechanism for ongoing system review and updating, and should have an evaluation component to look at ways to improve the system. Tools should be developed to evaluate each portion of the system as well as overall performance.

The important considerations for *evaluation* of the community plan are

- Measurement of system performance
  - — Were patients'/family members' needs met by system resources, resulting in the best possible outcomes for patients/family members?
- Continuous quality improvement
  - — Timely recognition and response?
  - — Resources available and utilized?
  - — Appropriate medical intervention?
  - — Personnel expertise?

- System data collection
  - — Prehospital
  - — Hospital
  - — Discharge
  - — Follow-up

CQI is important in the many settings in the community where patients present with symptoms and signs of acute coronary syndromes. CQI ensures that processes and systems of care that are in place for identifying and treating these patients are assessed and evaluated on a regular basis by a team of relevant stakeholders (i.e., a CQI system has improved systems, such as in-hospital "door to drug" times [5]).

Research into new and expeditious treatments, tests, and technologies [66], and in educational/behavioral strategies to reduce patient/bystander delay, must continue to expand the number of patients who receive care in the first hour. Such research may contribute to the reduction of patient and system delays.

Strategies for Community Planning Based on the Essential Components of an Emergency Cardiac Care Plan

Strategies for implementing plans for timely access to care for patients with acute coronary syndromes should be based on the essential components of emergency cardiac care. As noted, these components are generic to any community setting confronted with a need to respond to these patients.

Community/regional

Although communities and states have been encouraged to develop regional and statewide trauma plans [67], there has not been a similar comprehensive approach to community planning for the management of patients with acute coronary syndromes. The scientific support for recommending community planning to improve outcomes for patients with acute coronary syndromes comes largely from the trauma literature. In trauma, improved outcomes have been achieved with early treatment (i.e., the golden hour).

In addition, in the trauma area, institutions' capabilities and experience influence outcomes in trauma patients when taken to trauma centers. Survival rates for major trauma improved when victims were transported to a single trauma center as opposed to the closest receiving hospital [70]. Further, implementation of a regional system of trauma care with designated trauma centers and immediately available trauma teams reduces the number of preventable deaths [71]. In Orange County, California, implementation of such a system decreased the percentage of preventable trauma deaths from 71% to 9% [63,72].

Thus, the concept of transporting patients with acute coronary syndromes to the most appropriate facility — and not necessarily to the nearest hospital — to potentially improve patient outcome is relatively new. Ideally, a community/regional plan for ensuring expeditious care of these patients involves planning. Coordination and standardization of care depend on representatives from various settings in the community coming together to create these plans.

In terms of action plans and protocols, the regional plan should include categorization of facilities to guide the community about appropriate resources for patients with acute coronary syndromes, similar to the categorization of facilities for the care of trauma patients. The American College of Surgeons has said that categorization is essential [73]. According to the American Medical Association's Commission on Emergency Medical Services, it is a local responsibility to scrutinize the facilities and resources available, and to make determinations concerning the best means to optimize the use of facilities [74].

Triage of cardiac emergencies has become more complicated because of the availability of primary angioplasty. The range of services that patients may need for an acute cardiac emergency includes an emergency department, an intensive care unit, and/or a cardiac catheterization lab with or without angioplasty or surgical backup. For example, in patients with ST-segment elevation AMI without bleeding risk, a contraindication to thrombolysis, an emergency department or cardiac care unit may suffice; in patients with contraindications, primary angioplasty is necessary. However, hospitals may not always have all services immediately available. For this reason, regional planning can direct the EMS personnel to a location that has the appropriate services available. A portion of the regional/community planning process should provide for patient preference, address medical care coverage plans, and ideally include standard protocols for equal reimbursement for emergency patients if the plan and nonplan facility are a significant distance apart.

For initial care, a number of factors influence the choice of facility for patients with potential acute coronary syndromes. Anecdotal reports identify factors such as patient preference, prior physician–patient relationship, preexisting cardiovascular disease, present physical condition, proximity to various hospitals, EMS system protocols, ambulance service policies and protocols, emergency department/hospital's patient capacity, perceived and actual ability to care for the AMI patient, and patient's insurance plan or lack of healthcare coverage.

In terms of equipment and resources, equipment upgrades and purchases for the EMS system need to be identified and planned for. Further, the plan must determine how to best utilize the resources of the local community and region. In some cases this may require upgrading the local system or integrating the local system into a regional system when the local area lacks key resources. This plan may recommend changes to some of the local providers of care. For example, first

responders may need automated external defibrillators.

In terms of one essential component — education and training at the community/regional level — those involved in some aspect of early care of the acute cardiac patient may wish to sponsor continuing educational symposia for hospital and prehospital personnel about delay issues, current treatments, and provider roles in expediting care. Mass training in CPR at a community gathering might be another strategy to broaden the pool of trained bystanders. In communities such as Seattle, mass CPR training has been successful [24,75].

The public is a vital part of the community/regional plan. Public education about the problem of acute coronary syndromes should be provided by the regional health agencies, volunteer health agencies (AHA, American Red Cross, etc.), and healthcare providers. The training should include recognition of the symptoms and signs of acute heart disease, first aid for the victim (i.e., CPR), and how to utilize the EMS system. These groups can also help in educating managed care providers and individual practitioners at healthcare sites and at worksites. Research is pending on the best ways to reduce delay time in seeking care for symptoms and signs of an AMI through community intervention and public education methods. Planners will need to work in partnership with the media at some level to disseminate information and to increase public awareness.

Public education campaigns are another strategy at the regional level for addressing the essential components of education and training [53]. Educational interventions for providers, patients, and the public need to be developed for various target groups and settings, such as high-risk patients and their families [65] and worksite and primary care settings.

At the regional level, CQI must be applied to regional/community plans for triage and transport of patients. Hospital mergers and closures in some communities change the system environment. Research into patient outcomes by insurance status, prehospital triage and care, and type of facility is urgently needed to ensure that community/regional planning is based on sound data.

Emergency department/hospital

Hospitals and emergency departments need to focus on plans to minimize delays from the time the AMI patient arrives at the door of the facility to the time a drug is administered or angioplasty is performed [5]. A goal should be to reduce the time from emergency department arrival to treatment of eligible AMI patients with thrombolytic therapy to less than 30 minutes in the majority of cases [5].

In many cases, the preferred immediate treatment may be catheterization/angioplasty [9]. Decreasing the time from arrival to the catheterization laboratory may need to be a goal [76]. Emergency department strategies related to these components include:

- Having AMI standing protocols that can be initiated by the emergency department nurse or nurse practitioner
- Ensuring the 12-lead ECG machine is available within 5 minutes of the call, ideally by keeping it in the emergency department
- Conducting in-service training about the problem and sources of delay
- Determining that the thrombolytic drugs are stored in the emergency department
- Implementing a system of assessing the processes of patient care once the patient arrives at the emergency department
- Monitoring the time intervals associated with delivery of this care

Recommendations for decreasing delays in the emergency department have been previously published [5].

Prehospital

At the prehospital level, to ensure a seamless response to the acute cardiac patient, the essential components of a community plan are the same as for an emergency department/hospital. Protocols for management of the AMI patient in the field and in the transport vehicle need to be ready. Protocols could include a checklist to evaluate patients with ischemic-type chest discomfort, 12-lead ECG transmission to a facility, defibrillation capability, and determination of eligibility for thrombolytic therapy as well as possible field initiation of this drug [77]. In a planned system, the EMS providers, potentially in conjunction with emergency department physicians, would determine the hospital most appropriate for the patient's condition.

Prehospital equipment and resource issues include properly equipped ambulances (preferably with paramedics on board), a dispatch system, the 9-1-1 staff, the agency or agencies providing first responders, and the ambulance system. A manual or automated external defibrillator should be available on emergency vehicles. Automated external defibrillators now permit basic-level EMTs and first responders, as well as the traditional ACLS (paramedic) providers, to defibrillate the victim [8].

Prehospital providers need education and training about management of AMI and the problem of delays. Curricula for prehospital providers at all levels should include objectives for management of sudden cardiac arrest patients as well as objectives for handling injury and trauma patients. For the cardiac arrest patient, trained emergency medical dispatchers are needed to give telephone instructions to bystanders for CPR [78]. First responders need training in the use of automated external defibrillators (if these providers are able to respond more quickly than ambulances). In terms of

CQI, recommendations for improving prehospital systems and preparation of personnel have been previously published [6–8].

Healthcare sites

Managed care settings. The payors of medical care must be educated regarding the planning and management of care for patients with acute coronary syndromes. These patients provide a unique challenge for various payor systems trying to provide a high level of quality medical care *and* to limit costs, for example, the movement toward integrated healthcare systems [79].

In the area of action plans and protocols for managed care settings, telephone triage and contact with patients experiencing symptoms of acute coronary syndromes are an important consideration. The policymaking committee in a managed care setting should provide clear instruction and training for staff members. When a patient who has symptoms that may indicate an acute coronary syndrome either phones or walks into the office and seeks advice, office staff must not waste time contacting a physician. Instead, they need the authority and the training to triage these patients to EMS and the emergency department immediately. If a managed care organization has an authorization line, it must have a protocol for staff members to use to identify patients who need emergency referral and quick access to the EMS system.

Equipment and resource issues are the same as in other healthcare facilities, including the need for onsite defibrillators and 12-lead ECG machines to accommodate walk-in patients who present with chest pain.

In terms of education and training, managed care settings should design education programs for enrollees about cardiac emergencies. Health plans should give patients an information card that explains the steps to take in an emergency, particularly the common symptoms of a heart attack: chest pain or shortness of breath. For example, patients with known coronary heart disease (who are at high risk for a future cardiac event) might be given an instruction sheet telling them that if the chest pain is new, different, or unrelieved by usual therapy within 15 minutes, they should call 9-1-1 or dial (in those areas where 9-1-1 is not available) the seven-digit telephone number to access EMS [65].

Staff members need to have ongoing CPR instruction and training in use of onsite defibrillators. They need to be educated about the essentials of early recognition and response to patients who call or walk in with symptoms of AMI or acute ischemia. In this regard, office staff should be given the training and authority to triage these patients to EMS and the emergency department immediately. If a managed care organization has an authorization line, it must have a protocol for staff members to use in identifying which patients need emergency referral, including how to quickly access the EMS system. The plan hotline should have the training and authority to triange these patients to EMS and the emergency department. Finally, they should be educated in counseling strategies with high-risk patients and their families.

A continuous approach for improving quality should be part of any office- or clinic-based triage system wherein information is collected about triage and referral processes (e.g., using a log sheet for telephone calls for chest pain). The policymaking committee in a managed care setting and/or the physician/staff can review these data and modify procedures when the data indicate potential problems. Also for CQI purposes, various payors should carefully plan the manner of handling these patients and continuously evaluate their system to reduce the delay in those patients with acute coronary syndromes.

The plan should track the time from patient symptom onset to the first call from the patient or family to the administration of thrombolytic therapy or other acute intervention, if indicated, to learn where the delays are occurring and to reduce them where possible. Plans must be assessed to understand how they fit into the overall regional plan. Criteria for measuring quality and outcomes of care for the acute cardiac patient need to be developed and adopted by managed care organizations [80]. Research is needed to identify and develop reliable methods for risk stratification of patients with acute coronary syndromes that examine both short-term and long-term outcomes.

In managed care settings, requirements for patients to contact their primary care physician or an authorization service before proceeding to the emergency department may contribute to delay. However, delays that are associated with managed care have not been systematically compared with those associated with fee-for-service [65].

Other healthcare facilities/clinics. Other healthcare facilities need to plan as well for patients who may present with symptoms and signs of acute coronary syndromes. Continuous assessment and improvement of the four essential components are as important here as in the hospital setting. Patients should be educated about accessing emergency cardiac care in a timely and appropriate manner. This is especially important for patients with heart disease or at significant risk of heart disease. The staff in this setting also need instruction on the early recognition and management of patients with AMI, the problem of delays in treatment, and effective counseling strategies. The same expeditious telephone triage system as described under Managed Care Settings needs to be in place. Protocols for handling walk-in patients need to be posted along with emergency telephone numbers.

If there is insufficient volume of patients at the facility to warrant a defibrillator, an action plan for immediate identification and triage should be developed and posted so that the EMS system is activated immediately. Staff members in these settings must know how to quickly move the patient to the appropriate

facility. In large urgent care centers, the staff needs to have ongoing CPR instruction and training in use of automated external defibrillators. Again, the staff need to know how to recognize and respond to patients who call or walk in with possible acute ischemia, and how to access the EMS system and minimize delays. Providing thrombolytic therapy at the site might be considered.

Healthcare providers need to be aware of community resources for optimal care of patients with acute coronary syndromes. They may wish to become involved in efforts to improve regional planning efforts. Their technical input and leadership can contribute greatly to the improvement of healthcare delivery systems that are regional in scope.

Worksite/industry

Each worksite/industry should have an action plan and protocols, and every worker should know how to activate that plan and how to access the EMS system. This may mean calling 9-1-1 or the appropriate seven-digit emergency number directly. In some cases, the call should be to a response team at the worksite with a secondary call to 9-1-1. In other cases, the call should be first to 9-1-1, then to a special response team. Whatever the plan, all the employees need to know it. A sticker on the telephone is a good reminder of the correct number to call. If the worksite has its own telephone answering point, personnel need to know the triage protocols and the appropriate use of the facilities. The policies should be posted. Everyone should know how to access the EMS system. If available, the emergency number at the worksite should be posted and answered promptly by personnel trained to handle the call. The plan should take into consideration the distance to the appropriate hospital and determine what procedures should be done on site and what procedures should be transported.

If the worksite provides emergency equipment, the location and upkeep of that emergency equipment should be addressed in company policies. As far as education and training are concerned, personnel at worksites/businesses should be trained to provide CPR and automated external defibrillation if appropriate. Large worksites/businesses may elect to have trained first responders, possibly with automated external defibrillators, to augment the system. If the facility has its own health unit, then that unit should be trained to handle the patient promptly and move the patient to the appropriate facility expeditiously.

Other public settings

Representatives of public facilities, academic institutions, and voluntary and civic group organizations can best contribute at the regional level through involvement with experts to ascertain the essential components of an optimal community plan for emergency cardiac care and to assess their own community's status. They can contribute greatly as advocates of optimal healthcare delivery systems for AMI patients. In general, public facilities need to be handled in the same way as worksites. There are similar considerations for planning purposes. Academic institutions with health science centers may be able to conduct or synthesize relevant research for community application.

Home settings

For patients and their family members/significant others, essential components include an action plan (equivalent to a protocol), and education and training. High-risk patients and their families should learn appropriate responses to acute situations. The physician (or nurse with physician collaboration) should work out in advance an action plan for the patient. This plan should be familiar to the patient and the patient's family [65]. The appropriate healthcare provider needs to discuss with the patient and family how to recognize acute coronary syndromes and what actions to take. Identification of an appropriate facility should be made for a variety of circumstances, that is, at home, at work, on vacation, and other contingencies. The action plan should include a review of the health insurance coverage and instructions. Preidentified actions may shorten the decision time by the patients and the family, and thereby hasten the initiation of therapy [65].

Conclusions

Because patients usually begin to experience acute coronary syndromes outside of the hospital and present to a variety of people and settings, it is important that every community develop a plan for enhancing access to timely and optimal care. The public, EMS, and healthcare systems and personnel must work together to achieve early recognition of all patients with acute coronary syndromes, including sudden cardiac arrest, and must be prepared to give rapid, safe transport to the nearest facility suited to a patient's needs.

Community planning by individuals, groups, and organizations involved in facilitating access to timely and optimal care of these individuals requires attention to a number of general considerations: community assessment and planning models, and the four essential components of action plans and protocols, equipment and resources, education and training, and CQI and research (Table 1).

Implementing the community plan involves the relevant community partners and groups assessing the essential components in a number of settings and developing implementation strategies. This includes:

- Planning at the regional level;
- Addressing such issues as hospital categorization and triage in the prehospital setting;
- Defining an emergency plan in physicians' offices for

Table 1. *Examples of community planning strategies for ensuring access to care for patients with acute coronary syndromes (or journal equivalent) based on the recommended essential components of community planning*

Essential components of community planning	Community planning strategies			
	Community/regional	**Hospital**	**Prehospital/EMS system**	**Healthcare sites**
Action plans and protocols	• Categorization of hospitals • Triage and transport protocols • Ensuring payor reimbursement	• AMI management protocols	• Prearrival instructions • AMI management protocols	• Telephone triage protocols • Office protocols for walk-ins
Equipment and resources	• Emergency communications systems—enhanced 9-1-1 • Hospitals with Level I–III capabilities • New technologies (e.g., telemedicine)	• 12-lead ECG • Thrombolytic therapy • Defibrillator • Other relevant medications	• Automated external defibrillators[a] • Prehospital 12-lead ECG • ASA and thrombolytic therapy[a]	• Possibly automated external defibrillator (depending on volume) • Nearest most appropriate hospital • Emergency phone number (EMS) posted widely (decals) • Nearest hospital designated
Education and training	• Continuing education symposia on AMI care for health professionals • CPR training	• Essentials of triage in the ED • Sources of delay in the ED • CPR/ACLS training • Use of defibrillator	• Importance of time to treatment • Use of automated external defibrillators[a] • 12-lead ECG transmission • CPR • ACLS	• CPR training of staff • Early recognition of symptoms and problem of delay • Telephone query techniques
Continuous quality improvement and research	• Designated by regional planning coalition	• CQI to examine sources of delay in ED	• Transport times • Other	• CQI of office/clinic-based triage system (log sheet for collecting information about the office's explicit patient triage and referral processes, e.g., percent of calls answered by third or fourth ring, percent of calls abandoned, review of call content and outcome for adherence to protocols)

[a]Local considerations.

ACI-acute cardiac ischemia; ACLs = advanced cardiac life support; AMI = acute myocardial infarction; ASA = acetylsalicylic acid; CPR = cardiopulmonary resuscitation; CQI = continous quality improvement; ECG = electrocardiogram; ED = emergency department; EMS = emergency medical services.

Table 1 (continued). *Examples of community planning strategies for ensuring access to care for patients with acute coronary syndromes (or journal equivalent) based on the recommended essential components of community planning*

	Community planning strategies			
Essential components	**Worksites**	**Other public settings**	**Patients families**	**General public**
Action plans and protocol	• Emergency protocols for triage and access of EMS for patients with cardiac arrest or ACI	• Emergency protocols for triage and access of EMS for patients with cardiac arrest or acute cardiac ischemia	• Emergency action plan predetermined with physician and posted on refrigerator	• See public facilities
Equipment and resources	• Automated external defibrillators • ASA onsite • Emergency phone number (EMS) posted widely (decals) • Nearest hospital designated	• Automated external defibrillators • ASA onsite • Emergency phone number posted widely • Nearest hospital designated	• Nitroglycerin (fresh) for high-risk patients previously prescribed • ASA • Medical history information on person, so readily available to hospital personnel (MD's name, insurance type, medications, allergies, past medical history)	• Automated external defibrillators[a] • See public facilities
Education and training	• First-responder staff training in CPR and early symptom recognition • Automated external defibrillators[a] used by relevant personnel	• CPR training by volunteers • Automated external defibrillator use[a] by relevant personnel • Targeted education	• Training of patient/family member in early recognition of ACI and appropriate steps • CPR training of family members of high-risk patients	• Public education about early recognition of symptoms of ACI/AMI; need for action plan • How to use EMS system • CPR training • Automated external defibrillator training[a]
Continuous quality improvement evaluation and research	• Ongoing assessment of events and improvement in essential components	• Ongoing assessment of events and improvement in essential components	• Primary care physician/ nurse assess plan with patient at regular intervals	• See regional/community planning

[a]Local considerations.

ACI-acute cardiac ischemia; ACLs = advanced cardiac life support; AMI = acute myocardial infarction; ASA = acetylsalicylic acid; CPR = cardiopulmonary resuscitation; CQI = continous quality improvement; ECG = electrocardiogram; ED = emergency department; EMS = emergency medical services.

the patient who calls or walks in with symptoms of acute ischemia;
- Advising high-risk patients to make their own plans for a personal cardiac emergency; and
- Having emergency equipment and action plans in public facilities.

Such planning will not only improve the quality of care for patients with acute coronary syndromes, including sudden cardiac death, but also may improve the overall cost effectiveness of the system by reducing redundancies, although this information has not been demonstrated scientifically.

Finally, the CVD morbidity and mortality problem is too large and complex, and resources too limited, for any *one* group to solve. Partnerships and leadership are necessary to make proposed community planning efforts work. Leadership is required to coalesce these divergent and multidisciplinary groups into a comprehensive approach to community planning for reducing CVD morbidity and mortality. Only then can the community truly become *the ultimate coronary care unit.*

Glossary of Terms

Acute coronary syndromes. as used in this paper encompass patients with acute myocardial infarction (MI) (non–Q-wave MI [nontransmural] or ST-segment elevation/Q-wave MI [transmural]), unstable angina, including sudden cardiac arrest.

Acute myocardial infarction (AMI). heart attack, the necrosis or death of heart tissue due to the blockage of coronary arteries in the heart, resulting in inadequate oxygenation to the heart muscle itself.

Advanced cardiac life support (ACLS). attempts at restoration of spontaneous circulation using basic CPR plus advanced airway management, endotracheal intubation, defibrillation, and intravenous medications.

Angina pectoris. chest pain, the presenting symptom in most patients with AMI. The pain is frequently severe, but there may be minimal or, on occasion, no discomfort. The discomfort is usually substernal and may radiate to the epigastric region, jaw, shoulders, elbows, or forearms. Usually described as a heaviness, tightness, or constriction, but occasionally as indigestion or a burning sensation (see also Stable angina pectoris and Unstable angina pectoris).

Angioplasty. percutaneous transluminal coronary angioplasty (PTCA), a nonoperative procedure that uses a balloon catheter to increase the luminal diameter of obstructed coronary arteries and to improve coronary blood flow.

Automated external defibrillator (AED). small, portable device capable of automatically detecting and treating ventricular fibrillation, a major cause of sudden cardiac arrest.

Basic life support (BLS). includes recognition of cardiac arrest, access to the EMS system, and basic CPR.

Cardiac arrest. the cessation of cardiac mechanical activity, confirmed by the absence of a detectable pulse, unresponsiveness, and apnea.

Cardiac catheterization. an invasive procedure used to visualize the heart's chambers, valves, great vessels, and coronary arteries.

Cardiopulmonary resuscitation (CPR). a series of external chest compressions and rescue breaths to provide lifesaving cerebral and coronary blood flow during cardiac arrest.

Chain of survival. the American Heart Association's concept has four components: early access to the EMS system, early CPR by bystanders or first-responder rescuers, early defibrillation, and early ACLS.

Community planning. the development of a plan by individuals, groups, and organizations utilizing community assessment and planning to facilitate access to timely and optimal care for patients with acute coronary syndromes.

Congestive heart failure. a complex clinical syndrome that results from the heart's inability to increase cardiac output sufficiently to meet the body's metabolic demands.

Coronary artery bypass graft surgery (CABG). a revascularization procedure to increase coronary blood flow by taking veins from other parts of the body and grafting them onto the diseased coronary artery above and below the blockage.

Coronary artery disease. a disorder of the coronary arteries that ultimately leads to obstructed blood flow to the myocardium as a result of atherosclerosis or thrombus formation inside the vessel lumina.

Defibrillation. the delivery of an electrical current to the heart by means of conducting paddles placed on the intact chest or directly on the heart when the chest is opened, to restore a cardiac rhythm for effective circulation.

Emergency medical dispatcher (EMD). a trained public safety telecommunicator with the additional training and specific emergency medical knowledge essential for the efficient management of processing 9-1-1 calls and other emergency medical communications.

Emergency medical services (EMS). aid delivered by a person who responds to medical emergencies in an official capacity as an emergency or EMS provider, usually an EMS responder and an EMS dispatcher.

Emergency medical technicians (EMTs). emergency personnel trained in BLS.

First responder. the first person to arrive at the scene of a cardiac arrest and intervene, either trained emergency personnel, firefighters, police officers, or bystanders knowledgeable in BLS.

Golden hour. the window of opportunity, defined in

trauma literature as 60 minutes for response and intervention for trauma victims.

Patient/bystander. a layperson citizen who witnesses or comes across a patient in sudden cardiac arrest.

Reperfusion. the reestablishment of blood flow to the heart by thrombolytic therapy and/or angioplasty.

Revascularization. the restoration of blood supply by means of a vascular graft or prosthesis.

Stable angina pectoris. angina characterized by effort-induced chest discomfort, with or without radiation, lasting from a few seconds to 15 minutes. It is generally relieved by rest, removal of provoking factors, or sublingual vasodilators.

Sudden cardiac arrest (sudden cardiac death). the sudden cessation of circulation, usually due to irregular ventricular rhythms, most notably ventricular fibrillation.

Tissue plasminogen activator (t-PA). a thrombolytic therapy agent that binds specifically to fibrin in the thrombus and converts entrapped plasminogen to plasmin, initiating local thrombolysis.

Thrombolytic therapy. the infusion of agents that stimulate the conversion of plasminogen to plasmin by various mechanisms acting directly to lyse formed thrombi.

Unstable angina pectoris. angina characterized by pain that lasts longer than stable angina, occurs more frequently, and may be precipitated by factors other than effort or activities.

Ventricular fibrillation. severe derangement of the heartbeat that usually terminates fatally within 3–5 minutes unless it is promptly stopped.

Appendix A
Background Rationale for Timely and Optimal Care of Patients with Acute Coronary Syndromes

Scientific basis

The following section contains background information pertaining to the science base for the early identification and treatment of patients with AMI, including sudden cardiac arrest. This science base provides important rationale for communities to develop a plan to ensure timely response and triage.

Cardiac arrest/sudden cardiac death. Witnessed cardiac arrest victims have a significantly better survival rate than those who suffer an unwitnessed cardiac arrest. Therefore, most survivors of cardiac arrest are from the group of patients whose collapse is witnessed by a bystander, who receive CPR within 4–5 minutes, and who receive ACLS care (e.g., defibrillation, intubation, drug therapy) within the first 10 minutes [24]. *Time* is a critical determinant in the outcome of cardiac arrest victims. The earlier the victim is defibrillated, the greater the chance of survival [36].

The importance of early defibrillation has been emphasized in a number of recent publications [25–35,37–51]. Systems designed to reduce the time to defibrillation, CPR, and the arrival of ACLS-certified paramedics have been shown to be beneficial (Figure 5). BLS defibrillation has been shown to reduce the relative risk of death for out-of-hospital cardiac arrest victims in ventricular fibrillation [81]. However, other research [82] has shown that in a fast-response urban EMS system served by paramedics, the impact of adding first-responder defibrillation appears to be small, and that early defibrillation alone cannot overcome a community's low rates of bystander CPR.

Widespread use of automated external defibrillators in public places holds promise to decrease the time interval from cardiac arrest to defibrillation [83]. Yet studies of community use of automated external defibrillators suggest that identification of a target group is important, skill retention is an issue for those trained in its use, and automated external defibrillators need to be applied as part of a system [48,84–88].

Acute myocardial infarction. In recent years, immense strides have been made in the identification and treatment of AMI with the development of an armamentarium of powerful technologies and drugs. Thrombolytic agents, angioplasty [9,12–15], and coronary artery bypass surgery can reestablish blood flow to the infarcting areas. As a consequence, significant reductions in mortality and morbidity are now possible.

Controlled trials of thrombolytic agents have shown significant and substantial reductions in acute mortality, with benefit markedly outweighing risk [16–18, 20,21]. Thrombolytic therapy for patients with AMI has significantly greater benefit for those treated within the first or second hours after the onset of symp-

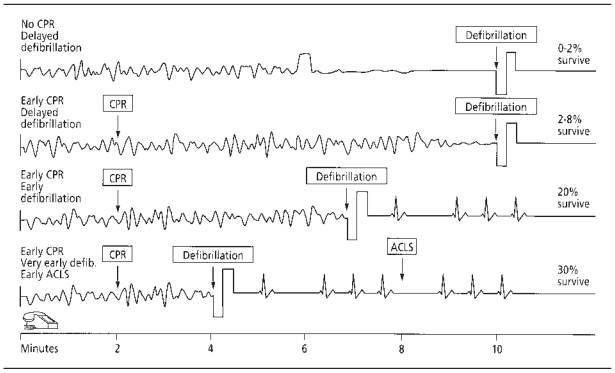

Fig. 5. *Survival rates are estimates of probability of survival to hospital discharge for patients with witnessed collapse and with ventricular fibrillation as initial rhythm. Estimates are based on a large number of published studies, which are collectively reviewed in references 75 and 89. (Reproduced with permission from* Textbook of Advanced Cardiac Life Support, *2nd ed. 1994. Chapter 20, Automated external defibrillation [26]. Copyright American Heart Association.)*

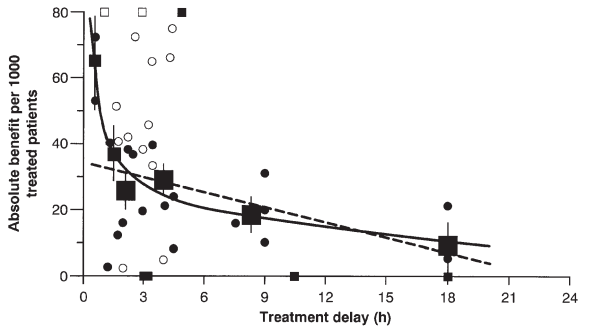

Fig. 6. *Absolute 35-day mortality reduction versus treatment delay. Closed circles indicate information from trials included in FTT analysis. Open circles indicate information from additional trials. Small squares indicate data beyond scale of x/y cross. The linear (34.7 − 1.6x) and nonlinear (19.4 − 0.6x + 29.3x^{-1}) regression lines are fitted within these data, weighted by inverse of the variance of the absolute benefit in each datapoint. Large black squares indicate average effects in six time-to-treatment groups (areas of squares inversely proportional to variance of absolute benefit described). (From Boersma E, Maas ACP, Deckers JW, Simoons ML. Early thrombolytic treatment in acute myocardial infarction: Reappraisal of the golden hour.* Lancet *1996;348:771–775 [22]. by the* Lancet, *1996. Reproduced with permission.)*

toms than those treated in the third to sixth hours [22] (Figure 6). There is modest but significant benefit for patients treated between 6 and 12 hours after the onset of symptoms as opposed to those treated beyond that time [23]. Given the rapid decline in benefit, the potential for myocardial salvage is substantially greater for patients who present within the first 1–2 hours after symptom onset, with 60 minutes or less being the optimal time to treatment (Figure 7).

Time is, therefore, a critical factor in the identification and treatment of patients with AMI and has resulted in a new paradigm for the management of these patients: the possibility of interrupting the infarction process in its early stages [5]. Investigators in Seattle showed that eligible patients with AMI, treated with thrombolytic therapy within 70 minutes of symptom onset, have a very low mortality and very little muscle loss with an event [52] (Figure 8). However, the time to treatment in many areas is 3–4 hours from symptom onset [90].

Sources of delay

As therapies have become increasingly more effective, delays in treatment initiation and lack of the implementation of these therapies pose major barriers to effective management. Thus far, efforts to provide appropriate access to timely and optimal care to patients presenting with acute coronary syndromes are generally not organized into a unified, cohesive system in communities across the United States. Following are ways that delays can occur, as described in the literature and highlighted by the National Heart Attack Alert Program.

Patient/bystander factors. Onset of symptoms of acute coronary syndromes almost always occurs when the patient is in the community outside of a hospital setting. Studies have reported median ranges in delay time from just under 2 hours to 6.5 hours; 26–44% of patients delay more than 4 hours before seeking care [3].

Researchers have identified sociodemographic factors, clinical characteristics, and patient activities that predict long prehospital delay times. Knowledge of these characteristics and activities is important for communities to perform their initial assessment of

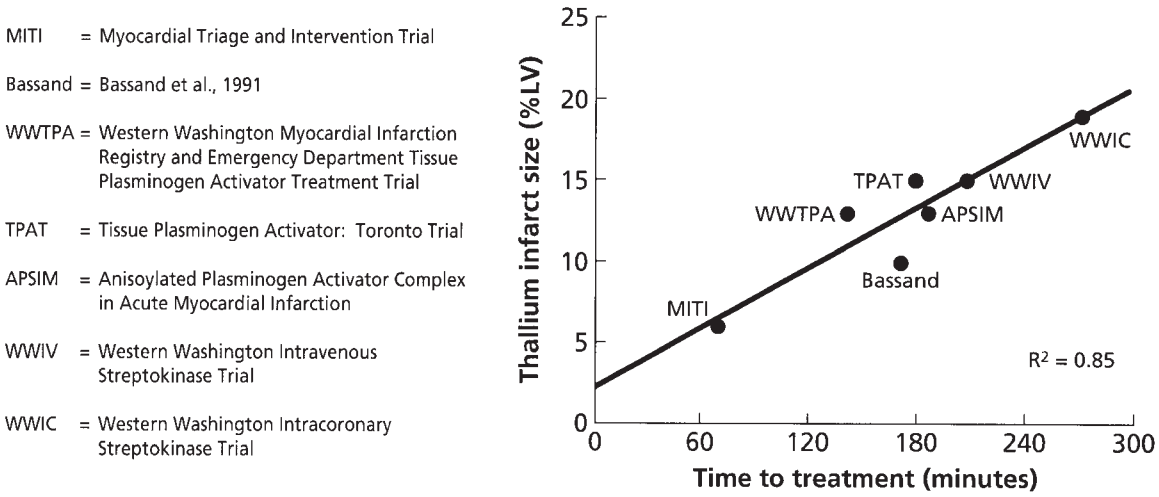

Fig. 7. *Infarct size versus time to treatment. (From Every NR, Weaver WD. Prehospital treatment of myocardial infarction.* Curr Probl Cardiol *1995;J:7–50 [15]. Reproduced with permission.)*

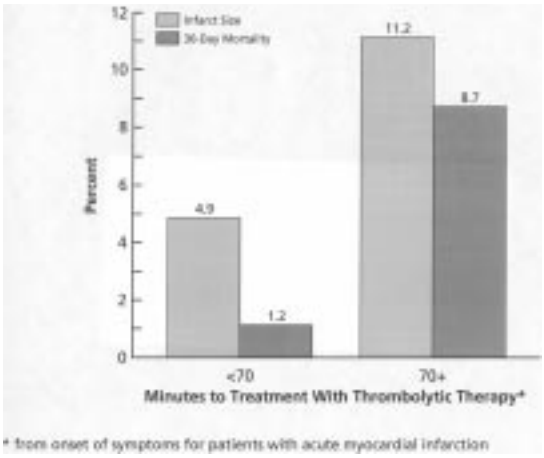

Fig. 8. *MITI: Effect of time to treatment <70 minutes versus ≥70 minutes on infarct size and 30-day mortality. * From onset of symptoms for patients with acute myocardial infarction. (From Weaver ED, Cerqueria M, Hallstrom AP, et al. Prehospital-initiated vs hospital-initiated thrombolytic therapy. The Myocardial Infarction Triage and Intervention Trial [52]. JAMA 1993;270:1211-1216. ©1993, American Medical Association. Reproduced with permission.)*

their sociodemographic profile, and they have already been described in detail [3,62].

Of particular interest to communities is this fact: the person to whom a patient presents can either facilitate entry into the care system or inhibit it [3]. Researchers have considered the role of physicians, family, and friends in helping patients make a decision to go to an emergency department. Before calling 9-1-1 or taking any transportation to the hospital, the majority of patients consult someone — either a layperson or a physician [91,92].

Paradoxically, if patients call a physician, delays are significantly increased [91,93–96]. Physicians may not be readily available at the time of the call (leading to delays while office or telephone service staff try to reach them) or they may give advice that increases the delay to treatment. If patients consult a friend, coworker, or stranger, they come to the emergency department more quickly than if they consult a family member [91,97]. Patient interviews [91] have suggested that family members are more easily dissuaded by the patient from calling 9-1-1 than are nonrelatives, particularly workmates and strangers.

EMS-associated access to care issues. The prehospital action phase in most communities only adds an average delay time of 7–22 minutes [94,98–100]. Use of 9-1-1 (or a seven-digit emergency number) to access EMS has been shown to decrease time to reperfusion with thrombolytic therapy by as much as 60 minutes for individuals with symptoms and signs of an AMI, as compared with patients who transport themselves [52]. Significantly, only 50% of patients with symptoms of a heart attack use the EMS system [53,54]. Gurwitz et al. [62] reported that only 42% of 2409 persons hospitalized for acute myocardial infarction between October 1992 and July 1993 in Minnesota used EMS. Very rural areas may have longer delays [98,99].

Hospital-related access to care issues. AMI patients have been reported to have variable outcomes depending on various qualities of the institution to which they are taken [101–104]. Such reports have implications for where patients with possible AMI/acute coronary syndromes should be taken when (ideally) being transported by EMS.

Other triage issues are unique to patients with AMI or sudden cardiac arrest. Hospitals in communities may have different capabilities, such as cardiac catheterization and primary angioplasty. There have been some reports of a relation between higher volume of angioplasty and outcome for patients [9,105]. Patients with an AMI complicated by cardiogenic shock may need a full-service cardiac center. On the other hand, patients in cardiopulmonary arrest require the resources of the closest facility available, given the importance of immediate reversal and stabilization of this condition.

Once a patient arrives at an emergency department, any delays may compromise the effectiveness of reperfusion therapy if the patient is eligible [5]. Elapsed time from hospital presentation to starting thrombolytic therapy was a median of 57 minutes in a large registry of 1073 U.S. hospitals during 1990 through 1993 [105]. Ultimately, for public education and prehospital management to be effective, treatment facilities must approach the capabilities that current knowledge and technology allow.

Other factors. There are a paucity of data that examine the role of financial barriers in the access to timely and optimal care of individuals with acute coronary syndromes. Outcome studies examining different healthcare delivery systems and access to timely and optimal care for AMI patients are needed.

Appendix B
Community Planning Models

There are a number of models that communities may wish to consider in planning for the timely access to care and treatment of individuals with acute coronary syndromes. These models each provide a framework that describes the relationship among the community partners, as well as an approach to community planning.

According to community organization theory, the community system includes individuals, subsystems, and the interrelationships among the subsystems. The important subsystems for any community consist of

the following sectors: political, economic, health, education, communications, religious, recreational, the social services, voluntary and civic groups (e.g., health-related agencies, political actions groups, and other grassroots groups), and other groups that may be specific to particular communities. Change in one sector of the community usually stimulates changes in other parts of the system. Also, from a community organization perspective, the target of change is generally the entire community. Making changes at the system level will maximize the rapid dissemination of those changes throughout the various sectors of the system [107].

Brach [107] has suggested that solutions to community problems vary by community. Some models by which to approach the community to mobilize it around an issue or problem are the advisory board, council/panel, coalition, lead agency, informal network, grassroots, or advocacy models.

Two public health models have the health department as the lead agency in assessing the health problems of the community, convening community representatives to prioritize the community health problems, identifying and implementing interventions, and evaluating the effectiveness of the interventions.

The Assessment Protocol for Excellence in Public Health (APEXPH)

The APEXPH model for community health planning emphasizes the role of the local health department in providing leadership on community health issues. This involves assessing and improving its capacity to address community health issues, setting appropriate policies, and shaping programs to address community needs. This model is characterized by three phases: (1) In the *organizational capacity assessment phase*, the health department director and staff examine whether they have the organizational and administrative capacity to collaborate with key community groups on developing a community health plan. (2) In the *community process* phase, representatives of different sectors of the community meet with health department staff to review data on health problems and to identify priorities for action. In this phase, a community advisory committee is established to mobilize community resources and monitor developments regarding local health issues. (3) In the final phase, *completing the cycle*, policies and plans are developed, monitored, and evaluated to ensure that they are implemented effectively [108].

The Planned Approach to Community Health (PATCH)

The primary goal of PATCH is to develop a practical mechanism through which effective community health education can be targeted to address local-level health priorities [109]. This health planning model, developed by the Centers for Disease Control and Prevention [110] and community health organizations, emphasizes community involvement in each phase of the plan (Figure 9). During phase I, the state or local health department or other local/community agency introduces the health promotion idea to the community, members of the community are recruited to form a PATCH community group, and training sessions are held to help the PATCH group identify community health needs. In phase II, data on local health problems are collected, and training sessions are held on interpreting the data and planning the health promotion program. During phase III, the PATCH community group identifies the priority health needs and target populations, and es-

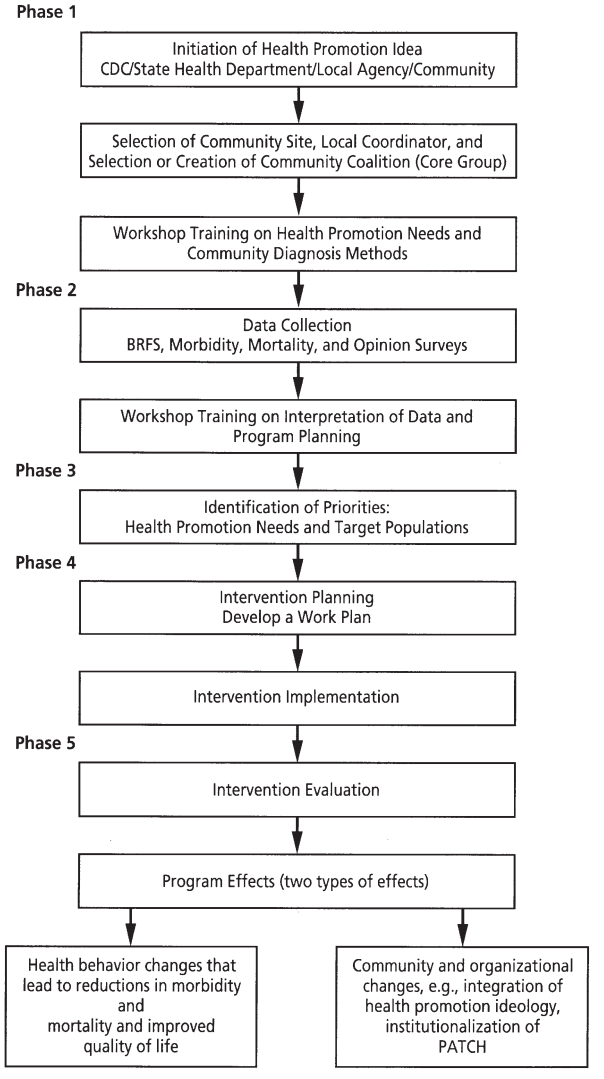

Fig. 9. *The PATCH model. (From Steckler et al. [111]. This figure is reprinted with permission from the* Journal of Health Education, *April 1992, page 176. The Journal of Health Education is a publication of the American Alliance for Health, Physical Education, Recreation and Dance, 1900 Association Drive, Reston, VA 22091.)*

tablishes the objectives for the health promotion effort. During phase IV, a comprehensive health intervention strategy is developed and implemented, and in phase V, the intervention strategy is monitored, assessed, and evaluated. The PATCH model can be adapted so that communities can address specific health needs or specific populations.

Regardless of what model communities select to address their community health priorities, integral steps in community planning include:

- Building a coalition with relevant stakeholders
- Using community data to identify problems and causes
- Developing and testing solutions and interventions based on consensus
- Implementing interventions
- Evaluating the intervention process and outcomes using coalition-generated targets

Local health departments can potentially contribute a great deal by bringing the issue of community planning into the focus of EMS offices and cardiovascular disease community programs.

EMS offices in the state and local health departments have traditionally focused on improving EMS systems for victims of trauma, while cardiovascular disease programs have been concerned with cardiovascular prevention, treatment, and control. Community planning for the acute cardiac patient bridges both sectors (Figure 10). Prehospital care and transport of the acute cardiac patient should be an important issue for EMS offices. Early recognition and response should be part of community education programs for individuals with diagnosed heart disease and with other risk factors or the general public. The application of the PATCH or APEXPH models can assist with this intersection of priorities to the mutual benefit of both entities.

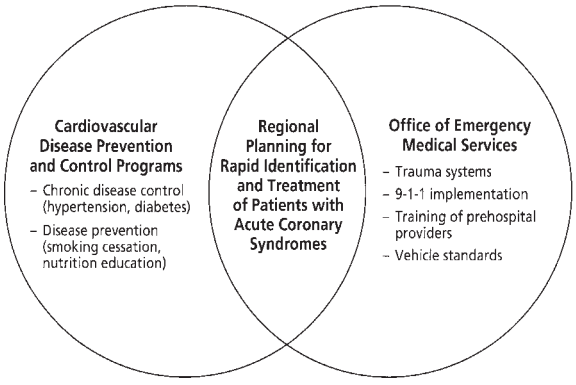

Fig. 10. *Regional planning for patients with acute coronary syndromes. State (or district or local health department) health department as lead agency.*

Appendix C
*Guidelines for the Categorization of Hospital Emergency Capabilities**

The optimal care of adult patients with acute cardiovascular diseases depends on the clinical characteristics of the patient's presentation. Patients with cardiac arrest must receive basic and ACLS, including definitive care, within minutes for any chance of recovery. Thus, because the rapidity of treatment is the paramount consideration, patients should be cared for at the nearest facility that can deliver such care. Less unstable cardiac patients should be transported to facilities that have at least intensive care capabilities. Even more complicated cardiac patients should be taken to facilities with cardiac catheterization and open heart surgery capabilities. Each locale should develop the best possible plan for achieving these goals. It is a local responsibility to scrutinize the facilities and resources available and to make determinations concerning the best means to optimize the use of facilities. The advent of helicopter and fixed-wing airplane transport should permit most areas to have access to a higher level of care in less than 60 minutes. In most instances, transport for this duration can be accomplished safely if a prospective plan for safe transport has been developed and appropriate resources committed. For the urban setting EMS personnel may be responsible for appropriate triage, whereas in a suburban or rural setting the patient may be taken first to a facility with less than an optimal level of care and then secondarily transported to an appropriate level after being stabilized.

Types of facilities

Level I — Tertiary cardiac care facility. Tertiary cardiac care facilities must have the equipment and staff necessary to provide intensive care, open heart surgery, cardiac catheterization, coronary angiography, and coronary angioplasty. Physician, nurse, and technical staffing should be sufficient to provide rapid and quality care. The presence of appropriate subspecialists is mandatory. Cardiac patients in shock, with refractory recurrent ventricular tachycardia, or with chest pain with pulmonary edema should be preferentially brought to tertiary care facilities as soon as possible.

Level II — Secondary cardiac care facility. A secondary cardiac care facility should have an intensive care unit for the treatment of cardiovascular patients. Physicians and nurses caring for such patients must be trained in basic life support and ACLS. They

*Source: Guidelines for the Categorization of Hospital Emergency Capabilities, American Medical Association, copyright 1989 [74]. (Reproduced with permission.)

should know how to utilize monitoring equipment, including that necessary for the monitoring of hemodynamics. A secondary cardiac care facility should be able to administer thrombolytic agents and to insert Swan-Ganz catheters and transvenous pacemakers when indicated. The facility should be able to diagnose, treat, and care for patients with myocardial infarction, unstable angina pectoris, congestive heart failure, cardiac arrhythmias, pericarditis, cardiomyopathy, and other routine cardiac problems, both emergently and thereafter. Adequate staffing and continuing education should be available to ensure that longer term care can be provided for the majority of these patients in the secondary cardiac care facility. These capabilities should permit the efficient care of nearly 85% of all cardiac emergencies. It is the responsibility of the secondary facility to have a plan to ensure that patients requiring cardiac catheterization, open heart surgery, or angioplasty can be expeditiously transferred to an appropriate tertiary care facility.

Level III — Primary cardiac care facility. The purpose of a primary cardiac care facility should be to stabilize cardiac patients for transfer to a higher level of care. The primary care facility should have an emergency department staffed 24 hours per day by physicians and nurses capable of resuscitating or stabilizing cardiovascular patients. Personnel should be trained in basic life support and ACLS. In areas where a higher level of care is available within a reasonable transport time, the EMS system should transport all cardiac patients, except for those with cardiac arrest, to the appropriate higher level of care. Hence, the primary care facility should only care for walk-in cardiac patients and those who are severely unstable, including those in cardiac arrest. In more rural settings, where a larger number of unstable patients may be brought to the primary care facility, facilitated arrangements for transfer to a more appropriate facility should be in place. It is acknowledged that in some areas even unstable cardiac patients might receive continuing care at a primary facility if transfer is not feasible. These facilities should be upgraded to a secondary level of cardiac care as soon as possible.

Patient triage

Patients with cardiac arrest should be brought to the closest facility capable of handling cardiac arrests. If there is a choice of hospitals with less than 2–5 minutes difference in transport time, the higher level of care is preferred. If a cardiac arrest patient is resuscitated at a primary care facility, the patient should be transferred as soon as logistically possible. Patients may be transferred to a secondary or tertiary facility unless the clinical care of the patient requires facilities unique to the tertiary center.

Cardiac patients should preferentially be brought to secondary or tertiary care facilities. Patients with chest pain, congestive heart failure, or arrhythmias should be taken to secondary or tertiary facilities wherever possible. Patients should have the opportunity to choose the hospital to which they are taken directly or transferred, when and wherever logistically possible, to ensure their right to choose their own physician and to facilitate continuity of care. The stable cardiac patient should be transported to the hospital of his or her choice, when and wherever possible logistically; the local area should develop a plan that determines under what conditions patient choice can be met considering time and distance variables. This may require extra staffing and prolong the periods needed for transport, stabilization, and subsequent transfer.

Patients with shock, recurrent or refractory ventricular tachycardia, or chest pain with pulmonary edema should preferentially be taken to a tertiary care facility whenever possible because these patients are more likely to need catheterization or open heart surgery. All secondary care facilities should develop arrangements for the rapid transfer of patients to a tertiary care facility for patients needing catheterization and/or surgery.

	Levels		
	I Tertiary	II Secondary	III Primary
A. Hospitalization Organization			
1. Medical departments/divisions/services (each staffed by qualified specialists)			
Anesthesia	E	D	
Cardiac surgery	E		
Cardiology	E	D	
Critical care (or cardiology)	E	E	D
Emergency medicine	E	E	E
Family practice	E	E	D
Internal medicine	E	E	D
Psychiatry	E	D	
Radiology	E	E	E
Social/rehab	E	E	

	Levels		
	I Tertiary	II Secondary	III Primary
2. Specialty availability This requirement may be fulfilled by in-house house physicians with special competence in the care of patients with cardiac emergencies as judged by the chief of the respective service and who are capable of initiating measures directed toward stabilizing the patient and beginning the patient management process. Staff specialists are to be on call and promptly available for consultation and on-site supervision.			
In-hospital			
Emergency medicine	E	E	E
24-hour in-house coverage	E	E	
24-hour in-house coverage with Swan-Ganz, arterial line, and pacemaker abilities	E	< 30 min	
On-call and promptly available outside hospital			
Anesthesiology	E		
Cardiac surgery	E		
Cardiology	E	D	
Hematology	E	D	
Nephrology	E	D	
Neurology	E	D	
Pulmonary	E	D	
Radiology	E	D	
B. Special facilities/resources/capabilities			
1. Emergency Department			
a. Personnel			
(1) Designated Medical Director	E	E	E
(2) Physician(s) with special competence in care of patients with cardiac emergencies on duty in Emergency Room 24 hours a day (*in rural areas where there is inadequate volume of patients, simultaneous arrival is acceptable)	E	E	E*
(3) Adequate nursing staffing	E	E	E
(4) Physician and nurse training equivalent to BLS and ACLS	E	E	E
b. Equipment — for resuscitation and to provide life support for the critically or seriously injured shall include but not be limited to:			
(1) Airway control and ventilation equipment, including laryngoscopes and endotracheal tubes of all sizes, bag-mask resuscitator, sources of supplemental oxygen, and mechanical ventilator	E	E	E
(2) Suction devices	E	E	E
(3) Electrocardiograph-oscilloscope defibrillator	E	E	E
(4) All standard intravenous fluids and administration devices, including peripheral and central intravenous catheters and cannulation	E	E	E

	Levels		
	I Tertiary	II Secondary	III Primary
(5) Drugs and supplies necessary for emergency care	E	E	E
(6) Pacemaking equipment	E	E	D
(7) X-ray capability, 24-hour coverage by technicians	E	E	E
(8) Communication system to notify hospital of impending arrival of emergency cardiac case	E	E	E
(9) Immediate access to clinical laboratory services	E	E	E
(10) Ability to administer thrombolytic agents	E	E	D
2. Intensive Care Units (ICU) — for cardiac patients, ICUs may be separate specialty units			
a. Designated Medical Director	E	E	
b. Physician on duty in ICU 24 hours a day or immediately available in-hospital	E	E	
c. Adequate nurse staffing	E	E	
d. Adequate clinical social work coverage	E	E	
e. Immediate access to clinical laboratory services	E	E	
f. Equipment			
(1) Airway control/ventilation devices	E	E	
(2) Supplemental oxygen source with concentration controls	E	E	
(3) Cardiac emergency cart	E	E	
(4) Temporary transvenous pacemaker	E	E	
(5) Electrocardiograph-oscilloscope defibrillator	E	E	
(6) Swan-Ganz monitoring	E	E	
(7) Arterial pressure monitoring	E	E	
(8) Mechanical ventilator-respirator	E	E	
(9) Patient weighing devices	E	E	
(10) Pulmonary function measuring devices	E	D	
(11) Temperature control devices	E	E	
(12) Drugs, intravenous fluids, supplies	E	E	
(13) Intravenous infusion pumps	E	E	
(14) Intraaortic balloon counter pulsation	E	E	
g. Respiratory care capability	E	E	E
3. Postanesthetic Recovery (PAR) (surgical intensive care room is acceptable)			
a. Registered nurses and other essential personnel 24 hours a day	E		
b. Physician (usually anesthesiologist) supervision in-hospital 24 hours a day	E		
c. Appropriate monitoring and resuscitation equipment	E		
4. Hemodialysis capability	E	D	
5. Radiological special capabilities			
a. Angiography of all types	E	E	D
b. Sonography	E	D	
c. Nuclear scanning	E	D	
d. Computed tomography	E	D	

	Levels		
	I Tertiary	II Secondary	III Primary
6. Rehabilitation medicine	E	E	
7. Echocardiography (2D and M mode)	E	E	
8. Cardiac catheterization laboratory meeting national standards	E		
9. Thrombolytic therapy	E	E	D
10. Angioplasty	E		
C. Operating suite requirements/ equipment/instrumentation			
1. Operating room adequately staffed and available 24 hours a day	E		
2. Cardiopulmonary bypass pump oxygenator	E		
3. Thermal control equipment for patient and blood	E		
4. X-ray capability	E		
5. Monitoring equipment	E		
6. Intraaortic balloon counterpulsation availability	E		
D. Clinical laboratory services available 24 hours a day			
1. Standard analysis of blood, urine, and other body fluids	E	E	E
2. Coagulation studies	E	E	D
3. Comprehensive blood bank or access to a community central blood bank, adequate hospital storage facilities, blood typing, and crossmatching	E	E	D
4. Blood gases and pH determinations	E	E	E
5. Microbiology	E	E	D
E. Programs for quality assurance			
1. Medical care evaluation, including:			
a. Special audits for cardiac deaths	E	E	E
b. Morbidity and mortality review	E	E	E
c. Multidisciplinary medical conference	E	E	D
d. Medical nursing audit	E	E	E
e. Utilization review	E	E	E
f. Medical record review audit	E	E	D
2. Outreach program: telephone and on-site consultations with physicians of the community and outlying areas	E	D	
3. Public education: basic life support, problems confronting public/medical profession and hospitals regarding optimal care for patients with cardiac disease, prudent heart living, risk factor identification, and modification of lifestyles	E	E	
4. Qualification of cardiac care personnel	E	E	E
F. Cardiac research program May be satisfied by clinical and/or laboratory research	D		
G. Continuing education programs			
1. Formal programs in continuing education provided by hospital for:			
a. Attending staff physicians	E	E	D
b. Nurses	E	E	D
c. Allied health personnel	E	E	D
d. Community physicians, nurses, and allied health personnel	D	D	D

E = essential; D = desirable.

Acknowledgments

National Heart, Lung, and Blood Institute
National Heart Attack Alert Program
Access to Care Subcommittee Members

Angelo A. Alonzo, Ph.D. (Advisor) Associate Professor of Sociology, The Ohio State University, Columbus, Ohio

James M. Atkins, M.D., F.A.C.C. — Chair Medical Director, Emergency Medicine, Education Professor of Internal Medicine, University of Texas Southwestern, Medical Center at Dallas Dallas, Texas

Allan Braslow, Ph.D. (Advisor) President, Braslow and Associates, Alexandria, Virginia

Heddy Hubbard, R.N., M.P.H. Health Scientist Administrator, Center for Outcomes and Effectiveness Research, Agency for Health Care Policy and Research, Rockville, Maryland

Mark B. Johnson, M.D., M.P.H. Director, Jefferson County Department of Health and Environment, Golden, Colorado

Lawrence D. Jones, M.D., Consulting Physicians Network Summit, Mississippi

Bruce MacLeod, M.D., F.A.C.E.P. Clinical Assistant Professor of Medicine, University of Pittsburgh Chair, Department of Emergency Medicine, Mercy Hospital, Pittsburgh, Pennsylvania

Jay Merchant, M.H.A. Professional Relations Advisor, Office of Professional Relations, Health Care Financing Administration, Washington, D.C.

Mary Beth Michos, R.N. Chief Prince William County Department of Fire and Rescue, Prince William, Virginia

Jimm Murray Director, Emergency Medical Services Program, Wyoming Department of Health, Cheyenne, Wyoming

Joseph Ornato, M.D., Professor of Medicine and Cardiology, Medical College of Virginia, Richmond, Virginia

Roger B. Rodriguez, M.D., M.P.H. Vice Chairman/Program Director, Department of Family and Community Medicine, Medical Center of Delaware, Wilmington, Delaware

Susan Ryan, M.Sc. Chief Emergency Medical Services Division, National Highway Traffic Safety Administration, Department of Transportation, Washington, D.C.

William J. Schneiderman Executive Director, Metropolitan Boston Emergency Medical Services Council, Burlington, Massachusetts

Harry P. Selker, M.D., M.S.P.H. Chief, Division of Clinical Care Research, New England Medical Center, Associate Professor of Medicine, Tufts University School of Medicine, Boston, Massachusetts

Bruce Shade Commissioner, Cleveland Emergency Medical Service, Cleveland, Ohio

Joanne Wilkinson, M.D. (Advisor) Physician Coordinator Emergency Services and Urgent Care Utilization Health Centers, Division Office of the President and Medical Director, Harvard Pilgrim Health Plan, Brookline, Massachusetts

National Heart, Lung, and Blood Institute

Mary M. Hand, M.S.P.H., R.N. Coordinator, National Heart Attack Alert Program, Office of Prevention, Education, and Control, National Heart, Lung, and Blood Institute, National Institutes of Health, Bethesda, Maryland

Michael J. Horan, M.D., Sc.M. Director, Division of Heart and Vascular Diseases, National Heart, Lung, and Blood Institute, National Institutes of Health, Bethesda, Maryland

Gregory J. Morosco, Ph.D., M.P.H. Director, Office of Prevention, Education, and Control, National Heart, Lung, and Blood Institute, National Institutes of Health, Bethesda, Maryland

Contract Staff

John Clinton Bradley, M.S. R.O.W. Sciences, Inc., Rockville, Maryland

Pamela A. Christian, R.N., M.P.A. R.O.W. Sciences, Inc., Rockville, Maryland

National Heart Attack Alert Program Coordinating Committee Member Organizations

Agency for Health Care Policy and Research
American Academy of Family Physicians
American Academy of Insurance Medicine
American Association for Clinical Chemistry, Inc.
American Association of Critical Care Nurses
American Association of Occupational Health Nurses
American College of Cardiology
American College of Chest Physicians
American College of Emergency Physicians
American College of Occupational and Environmental Medicine
American College of Physicians
American College of Preventive Medicine
American Heart Association
American Hospital Association
American Medical Association
American Nurses Association
American Pharmaceutical Association
American Public Health Association
American Red Cross
Association of Black Cardiologists
Centers for Disease Control and Prevention
Department of Defense, Health Affairs
Department of Veterans Affairs
Emergency Nurses Association
Federal Emergency Management Agency
Food and Drug Administration
Health Care Financing Administration
Health Resources and Services Administration

International Association of Fire Chiefs
National Association of Emergency Medical Technicians
National Association of EMS Physicians
National Association of State Emergency Medical Services Directors
National Black Nurses Association, Inc.
National Center for Health Statistics
National Heart, Lung, and Blood Institute
National Highway Traffic Safety Administration
National Medical Association
NHLBI Ad Hoc Committee on Minority Populations
Society for Academic Emergency Medicine
Society of General Internal Medicine

References

1. National Heart, Lung, and Blood Institute. *Morbidity and Mortality. Chartbook on Cardiovascular, Lung, and Blood Diseases*. Bethesda, MD: Public Health Service, National Institutes of Health, National Heart, Lung, and Blood Institute, May 1996.
2. McIntyre KM. Cardiopulmonary resuscitation and the ultimate coronary care unit. *JAMA* 1980;244:510–511.
3. Dracup K, Moser DK, Eisenberg M, Meischke H, Alonzo AA, Braslow A. Causes of delay in seeking treatment for heart attack symptoms. *Soc Sci Med* 1995;40:379–392.
4. National Institute of Neurological Disorders and Stroke rt-PA Stroke Study Group. Tissue plasminogen activator for acute ischemic stroke. *N Engl J Med* 1995;333:1581–1587.
5. National Heart Attack Alert Program Coordinating Committee, 60 Minutes to Treatment Working Group. Emergency department: Rapid identification and treatment of patients with acute myocardial infarction. *Ann Emerg Med* 1994;23:311–329.
6. National Heart Attack Alert Program Coordinating Committee, Access to Care Subcommittee. 9-1-1: Rapid identification and treatment of acute myocardial infarction. *Am J Emerg Med* 1995;13:188–195.
7. National Heart Attack Alert Program Coordinating Committee, Access to Care Subcommittee. Emergency medical dispatching: Rapid identification and treatment of acute myocardial infarction. *Am J Emerg Med* 1995;13:67–73.
8. National Heart Attack Alert Program Coordinating Committee, Access to Care Subcommittee. Staffing and equipping emergency medical services systems: Rapid identification and treatment of acute myocardial infarction. *Am J Emerg Med* 1995;13:58–66.
9. The Global Use of Strategies to Open Occluded Coronary Arteries in Acute Coronary Syndrome's (GUSTO IIb) Angioplasty Substudy Investigators. A clinical trial comparing primary coronary angioplasty with tissue plasminogen activator for acute myocardial infarction. *N Engl J Med* 1997;336:1621–1628.
10. Stussman BJ. *National Hospital Ambulatory Medical Care Survey: 1995. Emergency Department Summary. Advance Data from Vital and Health Statistics*. No. 285 Hyattsville, MD: National Center for Health Statistics, 1997.
11. World Health Organization. Murray CJ, Lopez AD, eds. *The Global Burden of Disease: A Comprehensive Assessment of Mortality and Disability from Diseases, Injuries and Risk Factors in 1990 and Projected to 2020*. Cambridge, MA: Harvard University Press, 1996.
12. Grines CL, Browne KF, Marco J, et al. A comparison of immediate angioplasty with thrombolytic therapy for acute myocardial infarction. *N Engl J Med* 1993;328:673–679.
13. Ziljstra F, de Boer MJ, Hoorntje JCA, Reiffers S, Reiber JHC, Suryapranata H. A comparison of immediate coronary angioplasty with intravenous streptokinase in acute myocardial infarction. *N Engl J Med* 1993;328:680–684.
14. Gibbons RJ, Holmes DR, Reeder GS, Bailey KR, Hopfenspirger MR, Gersh BJ. Immediate angioplasty compared with the administration of a thrombolytic agent followed by conservative treatment for myocardial infarction. *N Engl J Med* 1993;328:685–691.
15. Every NR, Weaver WD. Prehospital treatment of myocardial infarction. *Curr Probl Cardiol* 1995;20:7–50.
16. AIMS Trial Study Group. Effect of intravenous APSAC on mortality after acute myocardial infarction: Preliminary report of a placebo-controlled clinical trial. *Lancet* 1988; 1:545–549.
17. Gruppo Italiano per lo Studio della Streptochinasi nell'Infarto Miocardico (GISSI). Long-term effects of intravenous thrombolysis in acute myocardial infarction: Final report of the GISSI study. *Lancet* 1987;2:871–874.
18. Hackworthy RA, Sorensen SG, Fitzpatrick PG, et al. Effect of reperfusion on electrocardiographic and enzymatic infarct size: Results of a randomized multicenter study of intravenous anisoylated plasminogen streptokinase activator complex (APSAC) versus intracoronary streptokinase in acute myocardial infarction. *Am Heart J* 1988;116: 903–914.
19. Second International Study of Infarct Survival Collaborative Group (ISIS-2). Randomized trial of intravenous streptokinase, oral aspirin, both, or neither among 17,187 cases of suspected acute myocardial infarction: ISIS-2. *J Am Coll Cardiol* 1988;12(Suppl. A):3A–13A.
20. de Bono DP. The European Cooperative Study Group trial of intravenous recombinant tissue-type plasminogen activator (rt-PA) and conservative therapy versus rt-PA and immediate coronary angioplasty. *J Am Coll Cardiol* 1988;12 (Suppl. A):20A–23A.
21. Wilcox RG, von der Lippe G, Olsson CG, Jensen G, Skene AM, Hampton JR (for the ASSET Study Group). Trial of tissue plasminogen activator for mortality reduction in acute myocarcial infarction: Anglo-Scandinavian Study of Early Thrombolysis (ASSET). *Lancet* 1988;2:525–530.
22. Boersma E, Maas ACP, Deckers JW, Simoons ML. Early thrombolytic treatment in acute myocardial infarction: Reappraisal of the golden hour. *Lancet* 1996;348:771–775.
23. Betts JH. Late assessment of thrombolytic efficacy with altiplase (rt-PA) six–24 hours after onset of acute myocardial infarction. *Aust N Z J Med* 1993;23:745–748.
24. Weaver WD, Cobb LA, Hallstrom AP, Fahrenbruch C, Copass MK, Ray R. Factors influencing survival after out-of-hospital cardiac arrest. *J Am Coll Cardiol* 1986;7:752–757.
25. American Heart Association. Standards and guidelines for cardiopulmonary resuscitation and emergency cardiac care. *JAMA* 1986;255:2841–3044.
26. American Heart Association. Automated external defibrillation. In: *Textbook of Advanced Cardiac Life Support, 2nd ed.* Dallas, TX: American Heart Association, 1990, Chapter 20. ACLS Task Force on Early Defibrillation.
27. Atkins JM. Emergency medical service system in acute cardiac care: State of the art. *Circulation* 1986;74(Suppl.): IV4–IV8.

28. Atkins JM, Murphy D, Allison EJ Jr., Graves JR. Toward earlier defibrillation. *J Emerg Med Serv* 1986;11:70.
29. Bachman JW, McDonald GS, O'Brien PC. A study of out-of-hospital cardiac arrests in northeastern Minnesota. *JAMA* 1986;256:477–483.
30. Chapman PJC, Chamberlain DA. Death in the clouds [letter to the editor]. *Br Med J (Clin Res Ed)* 1987;294:181.
31. Cummins RO. EMT — defibrillation: National guidelines for implementation [editorial]. *Am J Emerg Med* 1987; 5:254–257.
32. Cummins RO, Eisenberg MS, Bergner L, Hallstrom A, Hearne T, Murray JA. Automated external defibrillation: Evaluations of its role in the home and in emergency medical services. *Ann Emerg Med* 1984;13:798–801.
33. Cummins RO, Eisenberg M, Bergner L, Murray JA. Sensitivity, accuracy, and safety of an automated external defibrillator: Report of a field evaluation. *Lancet* 1984;11: 318–320.
34. Cummins RO, Eisenberg MS, Moore JE, et al. Automated external defibrillators: Clinical, training, psychological, and public health issues. *Ann Emerg Med* 1985;14:755–760.
35. Cummins RO, Eisenberg MS, Stults KR. Automated external defibrillators: Clinical issues for cardiology. *Circulation* 1986;73:381–385.
36. Cummins RO, Ornato JP, Thies WH, Pepe PE. Improving survival from sudden cardiac arrest: The chain of survival concept. *Circulation* 1991;83:1832–1847.
37. Eisenberg MS, Copass MK, Hallstrom AP, et al. Treatment of out-of-hospital cardiac arrests with rapid defibrillation by emergency medical technicians. *N Engl J Med* 1980;302: 1379–1383.
38. Eisenberg MS, Hallstrom AP, Copass MK, Bergner L, Short F, Pierce J. Treatment of ventricular fibrillation: Emergency medical technician defibrillation and paramedic services. *JAMA* 1984;251:1723–1726.
39. Eisenberg MS, Cummins RO. Defibrillation performed by the emergency medical technician. *Circulation* 1986;74 (Suppl. 4):IV9–IV12.
40. Gentile D, Auerbach P, Gaffron J, Foon G, Phillips J Jr. Prehospital defibrillation by emergency medical technicians: Results of a pilot study in Tennessee. *J Tenn Med Assoc* 1988;81:144–148.
41. Newman M. National EMT-D study: Who's doing what where? *J Emerg Med Serv* 1986;11:70–72.
42. Newman M. The survival advantage: Early defibrillation programs in the fire service. *J Emerg Med Serv* 1987; 12:40–46.
43. Olson DW, LaRochelle J, Fark D, Aprahamian C, Aufderheide TP, Mateer JR, Hargarten KM, Stueven HA. EMT-defibrillation: The Wisconsin experience. *Ann Emerg Med* 1989;18:806–811.
44. Ornato JP, McNeill SE, Craren EJ, Nelson NM. Limitation on effectiveness of rapid defibrillation by emergency medical technicians in a rural setting. *Ann Emerg Med* 1984;13: 1096–1099.
45. Ruskin JN. Automated external defibrillators and sudden cardiac death [editorial]. *N Engl J Med* 1988;319:713–715.
46. Stults KR. Planning, implementing, and evaluating a successful EMT-D program. In: *EMT-D: Prehospital Defibrillation*. Bowie MD: Brady Communications, 1985, Chapter 8.
47. Stults KR, Brown DD, Schug VL, Bean JA. Prehospital defibrillation performed by emergency medical technicians in rural communities. *N Engl J Med* 1984;310:219–223.
48. Vukov LF, White RD, Bachman JW, O'Brien PC. New perspectives on rural EMT defibrillation. *Ann Emerg Med* 1988;17:318–321.
49. Weaver WD, Copass MK, Bufi D, Ray R, Hallstrom AP, Cobb LA. Improved neurologic recovery and survival after early defibrillation. *Circulation* 1984;69:943–948.
50. Weaver WD, Sutherland K, Wirkus MJ, Bachman R. Emergency medical care requirements for large public assemblies and a new strategy for managing cardiac arrest in this setting. *Ann Emerg Med* 1989;18:155–160.
51. Weigel A, Atkins JM, Taylor J. Preparing for automated defibrillation; Operation and use of automated defibrillators. In: *Automated Defibrillation*. Englewood, CO: Morton, 1988, Chapters 3 and 4.
52. Weaver WD, Cerqueira M, Hallstrom AP, et al. Prehospital-initiated vs. hospital-initiated thrombolytic therapy. The Myocardial Infarction Triage and Intervention Trial. *JAMA* 1993;270:1211–1216.
53. Ho MT, Eisenberg MS, Litwig PE, Schaeffer SM, Daman SK. Delay between onset of chest pain and seeking medical care: The effect of public education. *Ann Emerg Med* 1989;18:727–731.
54. Weaver WD, Kennedy JW. Myocardial infarction-thrombolytic therapy in the prehospital setting. In: Foster V, Varstraete M, eds. *Thrombosis in Cardiovascular Disorders.* Philadelphia: WB Saunders, 1992:275–287.
55. Farquhar JW, Fortmann SP, Wood PD, Haskell WL. Community studies of cardiovascular disease prevention. In: Kaplan N, Stamler JJ, eds. *Prevention of Coronary Heart Disease*. Philadelphia: WB Saunders, 1983.
56. Gyarfas I. Review of community intervention studies on cardiovascular risk factors. *Clin Exp Hypertens* [A] 1992;14:223–237.
57. CVD Plan Steering Committee. *Preventing Death and Disability From Cardiovascular Disease: A State-Based Plan for Action*. Washington, DC: Association of State and Territorial Health Officials, 1994.
58. Emergency Cardiac Care Committee and Subcommittees, American Heart Association. Guidelines for cardiopulmonary resuscitation and emergency cardiac care, I: Introduction. *JAMA* 1992;268:2172–2183.
59. National Heart, Lung, and Blood Institute. NIH Guide. *Community Intervention to Reduce Myocardial Infarction Delay*. RFA: HL-93-16-P. Bethesda, MD: National Heart, Lung, and Blood Institute, 1993.
60. Wei JY. Age and the cardiovascular system. *N Engl J Med* 1992;327:1735–1739.
61. Ho MT. Delays in the treatment of acute myocardial infarction: An overview. *Heart Lung* 1991;20:566–569.
62. Gurwitz JH, McLaughlin TJ, Willison DJ, Guadagnoli E, Hauptman PJ, Xiaoming G, Soumerai SB. Delayed hospital presentation in patients who have had acute myocardial infarction. *Ann Intern Med* 1997;126:593–599.
63. West JG, Cales RH, Gazzaniga AB. Impact of regionalization. The Orange County experience. *Arch Surg* 1983; 118:740–744.
64. Shackford S, Hollingsworth-Fridlund P, Cooper G, Eastman AB. The effect of regionalization upon quality of trauma care as assessed by concurrent audit before and after institution of a trauma system: A preliminary report. *J Trauma* 1986;26:812–820.
65. National Heart Attack Alert Program. The physician's role in minimizing prehospital delay in patients at high risk for acute myocardial infarction: Recommendations from the Na-

tional Heart Attack Alert Program. *Ann Intern Med* 1997;126:645–651.
66. Selker HP, Zalenski RJ, Antman EM, et al. An evaluation of technologies for identifying acute cardiac ischemia in the emergency department: A report from a National Heart Attack Alert Program Working Group. *Ann Emerg Med* 1997;29:13–87.
67. Trauma Care Systems Planning and Development Act of 1990. U.S. Public Law 101–590.
68. National Highway Traffic Safety Administration. *Development of Trauma Systems (DOTS): A State and Community Guide*. Washington, DC: U.S. Department of Transportation, 1989.
69. Bureau of Health Services Resources, Division of Trauma and Emergency Medical Services. *Model Trauma Care System Plan*. Rockville, MD: U.S. Department of Health and Human Services, 1992.
70. West JG, Trunkey DD, Lim RC. Systems of trauma care. A study of two counties. *Arch Surg* 1979;114:455–460.
71. Smith JM, Martin LM, Young KW, Maciocie DP. Do trauma centers improve outcome over non-trauma centers: The evaluation of regional trauma care using discharge abstract data and patient management categories. *J Trauma* 1990;30:1533–1538.
72. Mullins RJ. Outcome of hospitalized injured patients after institution of a trauma system in an urban area. *JAMA* 1994;271:1919–1924.
73. Champion HR, Copes WS, Sasso WJ, et al. The Major Trauma Outcome Study: Establishing national norms for trauma care. *J Trauma* 1990;30:1356–1365.
74. American Medical Association Commission on Emergency Medical Services. *Guidelines for the Categorization of Hospital Emergency Capabilities*. December 1989.
75. Eisenberg MS, Horwood BT, Cummins RO, Reynolds-Haertle R, Hearne TR. Cardiac arrest and resuscitation: A tale of 29 cities. *Ann Emerg Med* 1990;19:179–186.
76. Cannon CP, Braunwald E. Time to reperfusion: The critical modulator in thrombolysis and primary angioplasty. *J Thromb Thrombolysis* 1996;3:109–117.
77. Ryan TJ, Anderson JL, Antman EM, et al. ACC/AHA guidelines for management of patients with acute myocardial infarction: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Management of Acute Myocardial Infarction). *J Am Coll Cardiol* 1996;28:1328–1428.
78. National Heart Attack Alert Program Coordinating Committee, Access to Care Subcommittee. Emergency medical dispatching: Rapid identification and treatment of acute myocardial infarction. *Am J Emerg Med* 1995;13:67–73.
79. Pawlson LG. The health care revolution: Change and impact in geriatric medicine. *J Am Geriatr Soc* 1995;43:707–711.
80. National Heart Attack Alert Program Coordinating Committee Meeting. *Exploring the Issues: The Rapid Identification and Treatment of Patients with Acute Myocardial Infarction/Acute Cardiac Ischemia in the Emerging Managed Care Environment*. Executive Summary and Meeting Proceedings. Bethesda, MD: National Heart, Lung, and Blood Institute, National Institutes of Health, December 12, 1995.
81. Auble TE, Menegazzi JJ, Paris PM. Effect of out-of-hospital defibrillation by basic life support providers on cardiac arrest mortality: A meta-analysis. *Ann Emerg Med* 1995; 25:642–648.
82. Kellerman AL, Hackman BB, Somes G, Kreth TK, Nail L, Dohyns P. Impact of first-responder defibrillation in an urban emergency medical services system. *JAMA* 1993;270:1708–1713.
83. Weisfeldt ML, Kerber RE, McGoldrick RP, et al. American Heart Association report on the public access defibrillation conference, December 8–10, 1994. *Circulation* 1995;92: 2740–2747.
84. Mols P, Beaucarne E. Bruyninx J, et al. Early defibrillation of EMT: The Brussels experience. *Resuscitation* 1994;27: 129–136.
85. McKee DR, Wyne G, Evans TR. Student nurses can defibrillate within 90 seconds. An evaluation of a training program for third-year student nurses in the use of an automated external defibrillator. *Resuscitation* 1994;27:35–37.
86. Cummins RO, Schubach JA, Litwin PE, Hearn TR. Training lay persons to use automated external defibrillators: Success of initial training and one-year retention of skills. *Am J Emerg Med* 1989;7:143–149.
87. Eisenberg MS, Moore J, Cummins RO, et al. Use of the automated external defibrillator in homes of out-of hospital ventricular fibrillators. *Am J Cardiol* 1989;63:443–446.
88. Cummins RO, Austin D Jr., Graves JR, Hambly C. An innovative approach to medical control: Semiautomated defibrillators with solid-state memory modules for recording cardiac arrest events. *Ann Emerg Med* 1988;17:818–824.
89. Eisenberg MS, Cummins RO, Damon S, Larsen MP, Hearne TR. Survival rates from out-of-hospital cardiac arrest: Recommendations for uniform definitions and data to report. *Ann Emerg Med* 1990;19:1249–1259.
90. The GUSTO Investigators. An international randomized trial comparing four thrombolytic strategies for acute myocardial infarction. *N Engl J Med* 1993;329:673–682.
91. Alonzo AA. The impact of the family and lay others on care-seeking during life-threatening episodes of suspected coronary artery disease. *Soc Sci Med* 1986;22:1297–311.
92. Reilly A, Dracup K, Dattolo J. Factors influencing prehospital delay in patients experiencing chest pain. *Am J Crit Care* 1994;3:300–306.
93. Simon AB, Feinleib M, Thompson HK Jr. Components of delay in the pre-hospital phase of acute myocardial infarction. *Am J Cardiol* 1972;30:476–482.
94. Schroeder JS, Lamb IH, Hu M. The prehospital course of patients with chest pain: Analysis of the prodromal, symptomatic, decision-making, transportation and emergency room periods. *Am J Med* 1978;64:742–748.
95. Leitch JW, Birbara T, Freedman B, Wilcox I, Harris PJ. Factors influencing the time from onset of chest pain to arrival at hospital. *Med J Aust* 1989;150:6–10.
96. Gray D, Keating NA, Murdock, Skene AM, Haptom JR. Impact of hospital thrombolysis policy on out-of-hospital response to suspected myocardial infarction. *Lancet* 1993; 341:654–657.
97. Hackett TP, Cassem NH. Factors contributing to delay in responding to the signs and symptoms of acute myocardial infarction. *Am J Cardiol* 1969;24:651–658.
98. Gillum RF, Feinleib M, Margolis JR, Fabsitz RR, Brasch RC. Delay in the prehospital phase of acute myocardial infarction: Lack of influence on incidence of sudden death. *Arch Intern Med* 1976;136:649–654.
99. Wielgosz AT, Nolan RP, Earp JA, Biro E, Wielgosz MB. Reasons for patients' delay in response to symptoms of acute myocardial infarction. *Can Med Assoc J* 1988;139: 853–857.
100. Moss AJ, Wynar B, Goldstein S. Delay in hospitalization

during the acute coronary period. *Am J Cariol* 1969;24: 659–665.
101. Keeler EB, Rubenstein LV, Kahn KL, et al. Hospital characteristics and qualify of care, *JAMA* 1992;268:1709–1714.
102. Hartz AJ, Krakauer H, Kuhn EM, et al. Hospital characteristics and mortality rates. *N Engl J Med* 1989;321: 1720–1725.
103. Pashos CL, Normand JL, Garfinkle JB, Newhouse JP, Epstein AM, McNeil BJ. Trends in the use of drug therapies in patients with acute myocardial infarction: 1988 to 1992. *J Am Coll Cardiol* 1994;23:1023–1030.
104. McClellan M, McNeil BJ, Newhouse JP. Does more intensive treatment of acute myocardial infarction in the elderly reduce mortality? Analysis using instrumental variables. *JAMA* 1994;272:859–866.
105. Ritchie JL, Phillips KA, Luft HS. Coronary angioplasty: Statewide experience in California. *Circulation* 1993; 2735–2743.
106. Rogers WJ, Bowlby LJ, Chandra NC, French WJ, et al. for the participants in the National Registry of Myocardial Infarction. Treatment of myocardial infarction in the United States (1990 to 1993). Observations from the National Registry of Myocardial Infarction. *Circulation* 1994;90: 2103–2114.
107. Bracht NF, ed. *Health Promotion at the Community Level*. Newbury Park, CA: Sage, 1990.
108. National Association of County and City Officials. *Assessment Protocol for Excellence in Public Health (APEXPH)*. March 1991.
109. Kreuter MW. PATCH: Its origin, basic concepts, and links to contemporary public health policy. *J Health Educ* 1992;23:135–147.
110. Centers for Disease Control and Prevention. *Planned Approach to Community Health: Guide For the Local Coordinator*. Atlanta; U.S. Department of Health and Human Services, Public Health Service, 1995.
111. Steckler A, Orville K, Eng E, Dawson L. Summary of a formative evaluation of PATCH. *J Health Educ* 1992;23:176.