

Emergency Cardiac and Trauma Care in Rural Areas

Caring for victims of cardiac arrest and trauma represent two of the most common demands of the emergency medical services (EMS) system. In this section, the care of patients with these conditions is used to illustrate the special problems of delivering EMS services in rural areas.

CARDIAC CARE

Cardiovascular disease is the primary cause of death in the United States, accounting for nearly half of all deaths. More than half of cardiovascular disease deaths are caused by coronary heart disease, and most of these deaths occur suddenly (sudden cardiac arrest), usually outside of hospitals (52).¹ Requests for EMS services are more likely to be related to complications of medical conditions such as heart disease than for trauma. In rural Texas, for example, about one in seven calls for EMS services are attributed to heart complications (see table 3-1). Coronary heart disease death rates are 25 percent higher in rural areas but the fact that the rural population has proportionately more older residents may largely explain this difference (table 5-1).

At present, no more than 5 percent of sudden cardiac arrest victims are successfully resuscitated, but the combination of a well-organized EMS system and the application of a relatively new technology—the automated external defibrillator—could raise the proportion of successful resuscitations² to as high as 30 percent (52). Factors that maximize a patient's chances of recovering following cardiac arrest relate to time to care and the skills of the prehospital provider. Providing cardiac EMS care quickly is essential but difficult in many rural areas. In the case of cardiac arrest, cardio pulmonary resuscitation (CPR) must begin within 4 minutes and definitive care within 10 minutes of a cardiac arrest (115). Rural EMS systems are at a disadvantage in treating cardiovascular emergencies because they often lack paramedics, who are much more successful than basic emergency medical technicians (EMT) in treating cases of prehospital cardiac arrest (52). Some evidence suggests that paramedics are as effective as physicians in diagnosing and treating

acute cardiovascular emergencies (52). The skills of the basic EMT can, however, be upgraded so that he or she can use an external defibrillator to improve the outcomes of patients suffering cardiac arrest.

Manual or automatic external defibrillators can be used to deliver electric countershocks to patients in ventricular fibrillations.³ Manual defibrillator require the operator to read an electrocardiogram and to determine if the heart rhythm warrants the use of defibrillation. Automatic or “smart” defibrillators, developed in the early 1980s, perform these functions and deliver a countershock when ventricular fibrillation is detected. The automatic defibrillator allows persons with less medical experience and training to effectively treat critical dysrhythmia (79).

Paramedics and EMTs trained in advanced life support (e.g., intermediate EMTs) can use external defibrillator. In addition, basic EMTs can receive additional training in the use of external defibrillators and be certified as EMT-Ds (EMT-Defibrillators). Basic-level EMTs can be trained to use manual defibrillation in 16 to 20 hours and to use automatic defibrillator in about 4 hours (100). In the future, first responders and other community members may be trained in its use because automatic external defibrillator are so easy to use (52). Family members or fellow workers may defibrillate cardiac arrest victims at home or at work with a recently developed device that is stationed at home or work but is connected to a hospital base station by phone. When a cardiac arrest occurs, the bystander can activate the device to dial the hospital base station automatically, and after getting advice from a physician (based on electrocardiogram readings), a defibrillating shock can be administered by phone (36).

Defibrillator, when used effectively by EMTs, can potentially save one out of five cardiac arrest victims if used soon after a cardiac arrest (52), and some studies have found lower cardiac arrest mortality in communities where EMTs have been trained to defibrillate (102). Not all communities, however, have the resources or the conditions that would

¹Coronary heart disease is caused by changes in the arteries leading to the heart (coronary arteries) that interfere with adequate blood flow.

²A successful resuscitation is one that results in the patient surviving to hospital discharge (52).

³Ventricular fibrillation, the rhythm most often associated with cardiac arrest, is a condition in which the heart muscles twitch in an uncoordinated fashion, interfering with the pumping of blood (115).

Table 5-I—Deaths Attributed to Cardiovascular Disease by MSA/non-MSA Residence, 1986

Cause of death	U.S.		MSA		Non-MSA	
	Number	Crude ^a death rate (per 1,000)	Number	Crude death rate (per 1,000)	Number	Crude death rate (per 1,000)
All causes	2,105,361	8.7	1,533,914	8.3	571,447	10.1
Major cardiovascular diseases ^b	968,240	4.0	696,865	3.8	271,375	4.8
Diseases of the heart ^c	765,490	3.2	554,564	3.0	210,926	3.7
Ischemic heart disease (coronary heart disease) ^d	520,729	2.2	377,888	2.0	142,841	2.5
Other heart disease ^e	215,315	0.9	153,527	10.8	61,788	1.1

^aThe crude death rate is calculated by dividing the number of resident deaths by the area's total population. It is not adjusted to take an area's age distribution into account.

^bICD-390-448.

^cICD 390-398, 402, 404-429.

^dICD 410-414.

^eICD 415-429.

SOURCE: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Center for Health Statistics, Vital Statistics of the United States, 1986, vol. II—Mortality, Part B, table 8-9.

permit effective use of this technique by EMTs. Furthermore, a few States do not permit basic-level EMTs trained as EMT-Ds to operate the defibrillation equipment (74).

EMT-D programs are most cost-effective in communities with more than a thousand people, or those large enough to expect more than one out-of-hospital cardiac arrest each year. The costs of instituting an EMT-D program include training and equipment cost⁴ and the salary of a medical director. In order to institute an EMT-D program, a medical director must assure quality control through supervision of trained EMTs.⁵ In some States, "standing orders" from the medical director permit EMTs to defibrillate, while other States require direct radio contact (telemetry) with the medical director.⁶ Defibrillation, to be effective, must be instituted shortly after the onset of the heart attack. EMT-D programs are therefore most effective where cardiac arrests are witnessed and when CPR is started by bystanders or emergency personnel within 4 minutes of the victim's collapse. In addition, EMT response times must be short—not more than 10 minutes—or the chances of survival are slim (115,130).

If communities are small, community members are not trained in CPR, and response times are 10

minutes or more, a community should direct its resources to improving these conditions before instituting an EMT-D program (115,130). Because most cardiac arrests occur at home, in men over 60 years old, some have recommended that CPR training be targeted to middle-aged women and that physicians encourage the families of cardiac patients to learn CPR (52). Several communities have developed dispatcher CPR programs where an EMS dispatcher offers CPR instruction to bystanders until an EMS crew arrives at the scene (52).

Rural providers may have difficulty maintaining manual defibrillation skills, as some estimates indicate that a rural EMT-D in a small community may manage a cardiac arrest as seldom as once every 8 years (100).⁷ To overcome this problem, practical skills review should occur at least every 3 months (52). Automatic external defibrillator (AEDs) are particularly well suited to the needs of rural areas because they are easier to use than manual defibrillators and do not usually require recertification (100). Basic-level EMTs can quickly learn how to place the defibrillator's paddles and to start the automated system. The AED will defibrillate only in the presence of ventricular fibrillation.⁸

⁴Small automatic defibrillators are available for between \$5,000 to \$9,000, making them affordable for many rural communities.

⁵Detailed, step-by-step information on planning and implementing an EMT-D program was published in a three-part article in the *Journal Of Emergency Medical Services* (33,34,35).

⁶The license of the medical director provides the authority for certified EMTs to diagnose cardiac arrhythmias and to use a defibrillator.

⁷The responsibility for relatively few cardiac arrests (approximately 1 per 1,000 population per year) may be shared by as many as 20 volunteers in a small community (100).

⁸Verification that a patient is actually in cardiac arrest by determination of pulselessness is critical and yet difficult for the untrained. Other conditions such as seizures might confuse medically unskilled operators and potentially, a countershock could be lethal if administered inappropriately (52).

Improving rural response time to cardiac arrest calls can be achieved by stationing defibrillator with one or more on-call EMT-Ds instead of with the ambulance. EMTs carrying defibrillator can proceed directly to the patient while another EMT goes to the station house for the ambulance. Some rural ambulance services are notified by pager or telephone and then respond first to the ambulance garage, then to the patient. Some services require ambulances to remain at the garage until at least two or even three EMTs arrive, which delays response (loo).

Prehospital care providers may become more involved in the treatment of patients with acute myocardial infarction. Thrombolytic agents—drugs to restore blood flow to the heart—are now common emergency room treatments for this type of heart attack. Some evidence suggests that if an adequate diagnosis is made, patients can safely be given thrombolytic treatment in the field and transferred by ambulance (89). This may be a promising intervention in some rural areas where time to emergency room care is long.

TRAUMA CARE

Injury⁹ occurs with about equal frequency in urban and rural areas but tends to be more severe in rural areas (table 3-2). Motor vehicle accidents, for example, occur with equal frequency (see table 3-5) but are more likely to occur at higher speeds in rural areas and result in more serious injuries. Motor vehicle-related mortality is consequently 1.6 times higher in rural than urban areas (table 3-6). From 15 to 30 percent of calls for EMS care in rural areas are related to injuries, but only about one-tenth of these calls would represent severe or critical injuries. When severe injuries do occur, they require immediate medical attention and, sometimes, specialized trauma care that may be far from rural areas. A number of factors may contribute to the severity of injury and higher injury-related mortality seen in rural areas (55):

- there may be long delays between the injury and its discovery by a passerby;
- it may take a long time to get a patient from the scene of an accident to a hospital because of distances between the scene, the ambulance service, and the hospital;

- prehospital care in many rural areas may be performed by volunteers with basic EMT or first aid level training who are unable to provide advanced airway management or volume resuscitation;
- emergency departments in small rural hospitals may be staffed by primary care physicians without the knowledge or skills needed for critical trauma management;
- there may be relatively few trauma cases at the rural hospital, making it difficult for physicians and nurses to maintain their skills;
- rural hospitals may not have 24-hour physician and ancillary staff coverage (e.g., anesthesia, X-ray, and lab); and
- in situations involving multiple victims, delays may occur in the initial stabilization of the patients because there are too few physicians or nurses available.

As many as 50 to 60 percent of critically injured trauma patients die before reaching the hospital (5) and another 20 percent die within the next 4 hours (66). Some estimate that 20 to 45 percent of those who reach the hospital alive but eventually die could be saved if regional systems of trauma care were in place (16,19). Some argue that less than 10 percent of the United States has an effective trauma system in place, but that with additional support, existing technology and expertise could be organized to prevent these avoidable deaths (16, 19). Basic information is lacking, however, on when, where, and why rural injury and injury-related deaths are occurring. Before implementing programs to improve rural trauma outcomes, it would be useful to know more about the causes and consequences of rural trauma, where along the continuum of care deaths are occurring (e.g., during the prehospital or hospital phase), and whether these deaths are potentially preventable. Implementing programs without such information may lead to inefficient use of limited resources (24),

With available information, it is difficult to know where to place limited resources. For example, if the excess motor vehicle-related mortality in rural areas occurs because of delays in discovering victims who have had accidents on infrequently traveled rural roads, improvements in the medical care system will probably not prevent these deaths. Instead, improvements in road safety or communications (e.g.,

⁹Injury and trauma are synonymous terms.

placing more call boxes along the sides of roads) may prove effective. Severity of injury in rural areas may be higher because of a lack of adherence to effective preventive practices. If, for example, rural residents are less likely to use seatbelts, are more likely to exceed speed limits, and drive while drunk, public education campaigns and better enforcement of existing laws to support preventive practices might effectively reduce motor vehicle-related morbidity and mortality.

Because time to emergency care is such a crucial factor in determining the trauma patient's outcome, higher trauma-related mortality might be expected in rural areas due to delays in detection and response times. In some remote rural areas, delays are unavoidable, but response times can be improved in some areas by increasing the number of available ambulances, improving air medical services, or changing the placement of ground or air transport. Reducing delays to emergency care can also be accomplished by shifting the onset of emergency treatment to the prehospital period. If rural EMTs were lacking the training to provide specific types of care that would benefit rural trauma patients, investing in EMT training would clearly be warranted. Training the public in basic emergency care so that accident bystanders are prepared to offer assistance until an emergency vehicle arrives could also extend the "golden hour" needed for trauma patients.

If there were evidence that prehospital care is adequate, but that deaths are occurring in rural hospitals that are ill-equipped to provide trauma care, then resources could be directed to improving hospital resources and the training of hospital-based nurses and physicians. It is possible that some rural trauma patients, needing the specialized services of trauma centers, are not being transferred to these facilities quickly, or at all. If this were the case, improvements in regional systems—specifically, the institution of protocols guiding the transfer of patients from a rural hospital to trauma centers—could be considered. Unfortunately, there is not much quantitative evidence available to help policymakers rationally allocate limited resources. This section reviews the available evidence and professional opinion that lend support to specific interventions aimed at improving the outcomes of trauma occurring in rural areas.

Prevention Education

There is evidence that public education is needed to improve rural residents' preventive health behaviors. Only 25 percent of rural residents report using seatbelts all or most of the time as compared to nearly 40 percent reported by urban residents. Not using seatbelts regularly appears to be a particular problem among young adult males in the rural West. Here, only 16 percent report using seatbelts all or most of the time, as compared to 30 percent among their urban counterparts (table 5-2). Seatbelt use reduces front-seat, passenger vehicle, occupant fatalities by about one-half (24).

The proportion of alcohol drinkers reporting that they had driven a car at least once in the past year when they thought they might have had too much to drink is generally not that much higher in rural than urban areas (18 percent v. 17 percent) but among young adults, especially those in the Midwest, drinking and driving appears to be a serious problem in rural areas. Among rural, Midwestern, young adult males who drink, over one-half report driving after having too much to drink (see table 5-3).

In addition to public education, States could be encouraged to adopt seatbelt laws and drunk driving laws and, where laws exist, actively enforce them. Thirty-four States have safety belt use laws and such laws reduce front-seat, passenger vehicle, occupant fatalities by about 7.5 percent (24).

Prehospital Care

There continues to be considerable controversy surrounding the appropriate level of prehospital care for trauma patients. The majority of EMTs in rural areas are trained to provide basic life support (BLS) prehospital care. Paramedics are trained in advanced life support (ALS) which permits them to initiate treatments including advanced airway management, administration of intravenous (IV) fluids, and decompression of tension pneumothorax. In the urban environment, where level I or II trauma centers are within 20 minutes reach, it may be better to have the trauma patient rapidly transported to the trauma center than to take time to provide ALS in the field (15). Some studies in urban areas suggest that this "scoop and run" approach is preferable because while providing prehospital ALS improves the chances that the trauma patient arrives at the hospital alive, it doesn't seem to improve the trauma patients ultimate outcome (80). There are few controlled

Table 5-2—Percent of Persons 18 Years of Age and Over Who Wore Seatbelts All or Most of the Time When Riding in a Car by Sex, Age, and Residence: United States, 1985

	Both sexes All ages	Total male	18-29 years	30-44 years	45-64 years	65+ years	Total female	18-29 years	30-44 years	45-64 years	65+ years
<i>Total MSA:</i>											
All regions	38.9	36.9	32.5	40.1	38.5	36.5	40.6	39.3	44.2	39.0	38.9
Northeast	48.1	46.4	41.5	49.9	47.8	45.5	49.7	47.2	54.3	49.3	46.5
Midwest	37.9	34.7	31.1	38.0	36.2	32.7	40.6	38.5	45.0	38.5	39.7
South	31.2	30.5	29.0	32.4	31.2	28.0	31.9	31.8	35.0	30.2	28.8
West	40.5	37.7	30.2	41.6	39.6	41.3	43.1	42.6	46.0	39.8	43.8
<i>Total non-MSA:</i>											
All regions	25.5	23.7	19.9	26.9	24.4	22.7	27.2	28.5	27.2	29.2	22.8
Northeast	29.4	27.2	26.0	35.2	23.4	20.7 ^a	31.6	41.6	32.4	30.5	16.7 ^a
Midwest	26.6	24.1	21.4	25.7	24.8	25.1	28.8	26.2	31.7	30.3	26.3
South	22.3	21.2	18.6	22.9	22.4	20.2	23.3	25.6	22.6	25.0	19.2
West	30.2	27.5	15.9	33.8	32.0	26.7	32.8	31.6	29.2	39.3	30.5

^aFigure does not meet standard of reliability or precision.

SOURCE: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Center for Health Statistics, Special Tabulation prepared for OTA from the 1985 Health Promotion and Disease Prevention Survey.

Table 5-3—Percent of Current Drinkers 18 Years and Over Who Had Driven a Car At Least Once in the Past Year When They Thought They Might Have Had Too Much To Drink By Sex, Age, and Residence: United States, 1985

	Both Sexes All ages	Total male	18-29 years	30-44 years	45-64 years	65+ years	Total female	18-29 years	30-44 years	45-64 years	65+ years
<i>Total MSA:</i>											
All regions	16.6	22.4	35.6	23.8	11.4	2.6	9.5	17.2	9.7	2.4	0.5 ^a
Northeast	11.6	16.4	27.4	18.9	7.6	1.5 ^a	5.8	11.4	6.0	1.1 ^a	0.2 ^a
Midwest	22.1	30.3	44.1	33.1	15.8	5.3 ^a	12.9	21.6	12.2	4.5 ^a	—
South	15.5	20.1	31.0	20.7	10.8	1.9 ^a	9.3	16.3	9.3	2.4 ^a	0.7 ^a
West	17.6	23.6	40.8	23.5	12.2	2.2 ^a	10.2	18.8	11.4	1.5 ^a	0.9 ^a
<i>Total Non-MSA:</i>											
All regions	17.9	22.5	40.5	21.0	9.6	2.3 ^a	11.4	19.0	13.1	2.7 ^a	0.2 ^a
Northeast	16.3	20.4	40.9	14.9	11.8 ^a	2.4 ^a	10.8	16.2 ^a	11.9 ^a	5.0 ^a	—
Midwest	22.0	28.5	51.7	27.8	10.1	1.8 ^a	13.7	24.6	16.7	1.6 ^a	—
South	14.0	17.4	32.9	14.5	6.0 ^a	1.4 ^a	8.6	10.7	11.0	3.3 ^a	0.9 ^a
West	18.6	23.4	34.3	27.4	15.3	4.8 ^a	12.4	26.1	11.3 ^a	2.6 ^a	—

^aFigure does not meet standard of reliability or precision.

SOURCE: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Center for Health Statistics, Special Tabulation prepared for OTA from the 1985 Health Promotion and Disease Prevention Survey.

studies of the benefits of prehospital ALS provided in rural areas, but on theoretical grounds, ALS is recommended as both appropriate and beneficial (15,83).

The effectiveness of some of the interventions included in ALS care have been questioned (18). There is no evidence, for example, that the pneumatic antishock garment that is standard equipment on ambulances is effective for victims of penetrating trauma when ALS is provided; there is little evidence that endotracheal intubation is useful when performed outside of the hospital; and there is some evidence that trying to expedite the administration of medication by starting IV lines in the field is ineffective (38).¹⁰ Clearly, the effectiveness of the

components of ALS and ALS care in general need to be further evaluated. Ironically, ALS providers are located principally in urban areas where they are less likely to be needed. If rural EMTs were trained to assume ALS responsibilities, they might have trouble maintaining their skills without continuing education programs accessible in rural areas. Even if ALS care were found to be beneficial in rural areas, many rural areas would find it difficult to compete for, or afford, the limited number of paramedics and intermediate-level EMTs that are available.

Hospital-Based Trauma Care

In rural areas where specialized trauma services are unavailable, the severely injured patient should be evaluated and stabilized expeditiously in the

¹⁰Sometimes IV lines are started so that when the patient arrives at the hospital, IV medication can be given immediately

community hospital, and then triaged to the nearest trauma center (21,54). The quality of trauma care in rural hospitals can be improved by promoting physician and nurse education, instituting a trauma protocol, promoting prompt resuscitation and stabilization of patients before transfer, and implementing a quality assurance program, such as a monthly case review (131). Training opportunities tailored for rural physicians are available through the American College of Surgeons (ACS). A 2-day Advanced Trauma Life Support (ATLS) course was designed by ACS to meet the needs of rural physicians who must occasionally stabilize and transfer trauma victims but who do not see major trauma often enough to develop expertise in this type of care (20). Since training began in January 1980, about 90,000 physicians have been certified.¹ The American College of Emergency Physicians offers a 2-day Basic Trauma Life Support course for basic and advanced EMTs, nurses, and paramedics. The Emergency Nurses Association sponsors the Nursing Core Course, and the National Association of EMTs sponsors a course in trauma life support for prehospital care providers.

When 24-hour physician coverage is unavailable in a rural hospital emergency room, a trauma protocol can be implemented to help ensure that a physician and necessary ancillary personnel will be available by the time a trauma patient arrives, and that until the physician arrives, a well-trained nurse can assume immediate resuscitation and stabilization responsibilities. A rural hospital trauma protocol may begin with communications between prehospital providers at the scene in regard to the nature of the patient's injuries and condition. When notified, the nursing supervisor can call members of an established trauma team that includes physicians, nurses, a laboratory technician, an X-ray technician, an anesthetist, and possibly a social worker and medical records clerk. While waiting for the patient to arrive, the nursing supervisor prepares the needed equipment and alerts the air medical service to prepare for a possible transport. Training rural hospital providers to assume these responsibilities and implementing such a protocol avoids confusion and delays. Case reviews help to assure appropriate

rural hospital response and can include physicians from a regional trauma center (55).

Regionalization of Trauma Care

According to guidelines of the American College of Surgeons' Committee on Trauma:

Each region must structure a trauma system in a manner that ensures the most prompt access to appropriate care and minimizes the risk of delay in diagnosis, delay in surgical intervention, and inadequately focused care, which are responsible for most of the preventable deaths from trauma (4).

The guidelines recognize that in rural areas, an injured patient may be at substantial distances from level I or level II trauma centers (see app. C for ACS criteria for level I, II, and III hospitals) and suggest that such patients should ideally be treated initially at the nearest available hospital facility. It is desirable that,

... such a facility meet the requirements of a Level III trauma center or at least have emergency staff trained in advanced trauma life support. Patients with major injuries should then be secondarily triaged to more distanced Level I or II trauma centers, should local resources prove inadequate for continued care (4). *² An organized regional trauma system that restricts specialized care to designated facilities has been shown to benefit patients with severe injuries (22).

According to the ACS, "In the ideal prehospital care system there is preplanning, ensuring optimal use of resources between communities and regions to minimize inefficiency and excessive cost" (4). Accordingly, among the essential components of a trauma system are the legal authority and a formal process to designate trauma centers, use of ACS standards in designating the trauma centers, use of patient volume or population data to ensure that the number of centers designated for an area are reasonable, presence of written triage criteria that form the basis for bypassing nondesignated hospitals, use of monitoring systems, and statewide coverage (133). A 1987 national survey of State EMS programs indicated that only two States¹³ have

¹ The course and certification are available through the American College of Surgeons. There is no information available on how many of the certified physicians are rural practitioners or the type of physician certified (e.g., family practitioner, emergency physician).

² Revised ACS standards that include a section on "Optimal Care in the Rural Setting" are forthcoming.

¹³ The two States with comprehensive trauma systems are Maryland and Virginia.

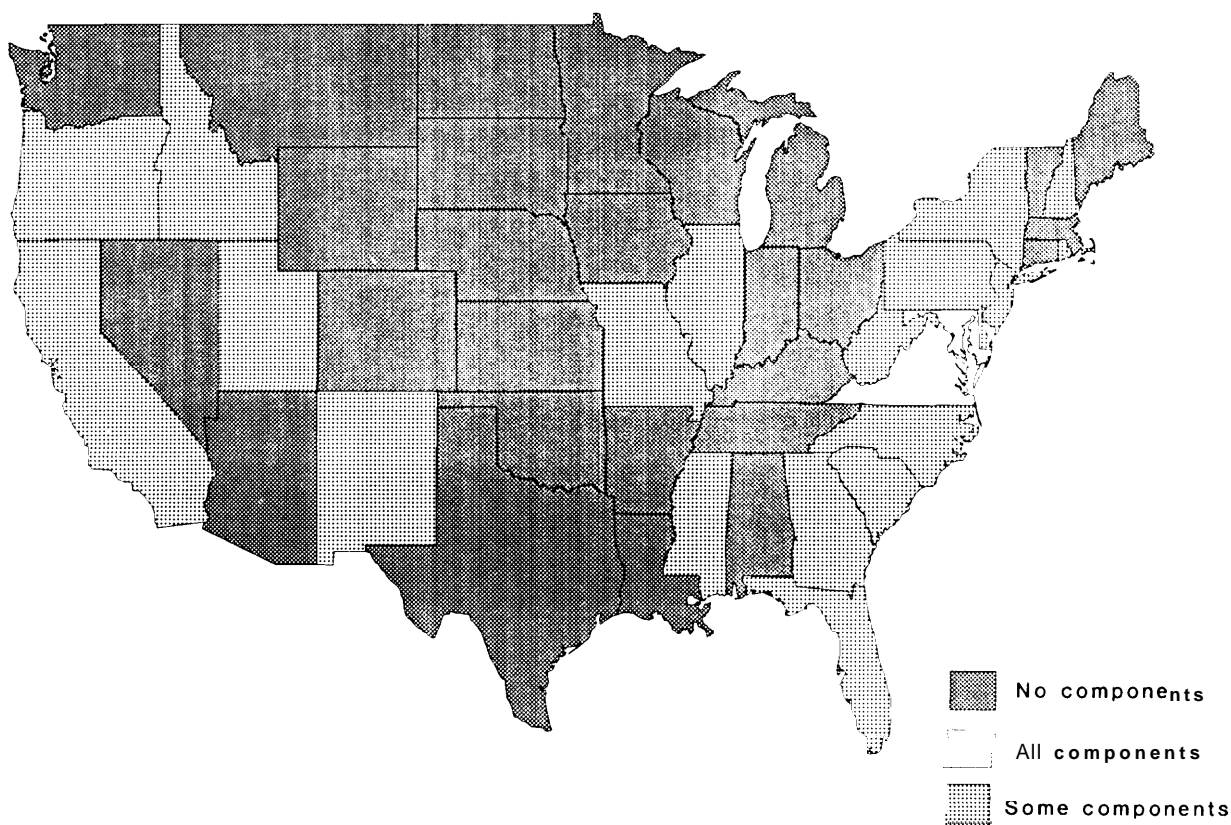
trauma systems that include components deemed essential by the ACS Committee on Trauma (133).

At the time of the ACS survey, 2 States met all criteria, 19 States and the District of Columbia had designated trauma centers, but lacked statewide coverage and/or indicated that triage and quality assurance programs were inadequate, leaving 29 States that had not yet designated trauma centers (see figure 5-1). Somewhat different results were found in a survey of State EMS directors. According to this survey, also conducted in 1987, 14 States were designating trauma centers and another 22 were developing designation programs. An addi-

tional two States had verification programs with Standards. Only 13 States lacked either verification or designation.¹⁴ and 3 of these States had developed standards (see figure 5-2).

Guidelines for trauma care systems have been developed by a number of professional organizations and by the Joint Committee on the Accreditation of Healthcare Organizations (JCAHO). Both the 1987 ACS guidelines and those published by the American College of Emergency Physicians (ACEP) take into account some of the unique features of rural health care. According to ACEP guidelines, some

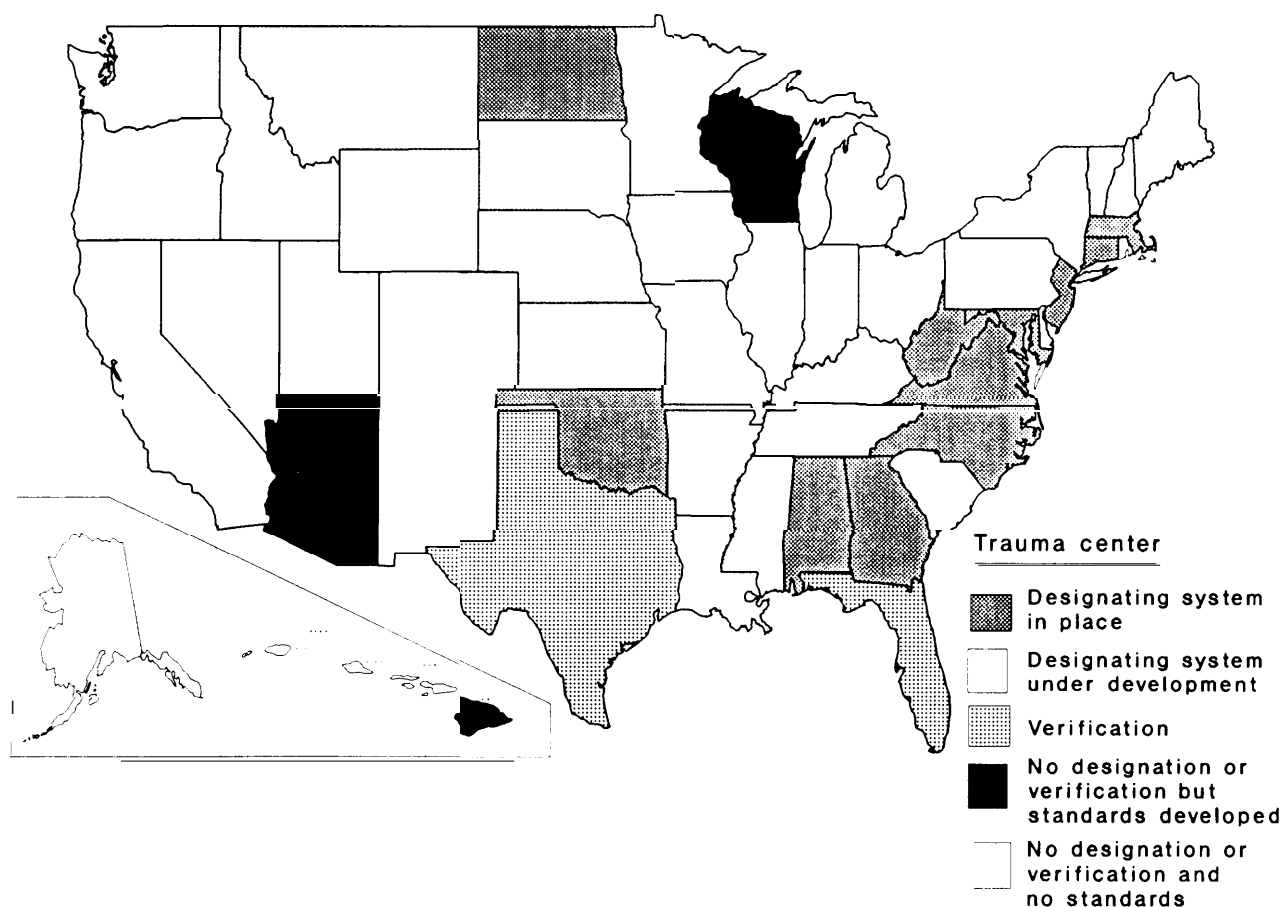
Figure 5-1—States Having All, None, or Some of Eight Essential Components of a Regional Trauma System According to American College of Surgeons' Criteria, 1987



SOURCE. J.G West et al , "Trauma Systems. Arrest Status—Future Challenges," J A M A 259(24) 3597-1445, June 24, 1988

¹⁴ Designation involves identifying a limited number of hospitals meeting specified criteria to serve the trauma needs of the State. In contrast, verification involves certifying any number of hospitals that meet specified criteria (108).

Figure 5-2-State Trauma Center Designation and Verification Practices, 1986-87



SOURCE: National EMS Clearinghouse, "Emergency Medical Services: Transportation Systems and Available Facilities," 1988.

features of a trauma care system deemed "essential" in the urban environment are "desirable" in rural setting (see app. C).¹⁵ Universal access through 911, for example, is essential in urban systems but desirable in rural areas. Few States with hospital trauma verification or designation programs are using the ACS or ACEP guidelines. Less than one-third (9) of the 32 States that reported the type of standards used in their programs reported using the ACS standards, according to the 1987 survey of State EMS directors. Instead, most had adapted ACS

or ACEP guidelines to meet State or regional needs (108).

Some States have too many designated trauma centers. In Missouri, for example, there are 62 designated trauma centers, or 1 per 80,000 residents. This exceeds the recommended ratio of 1 trauma center per 350,000 residents (133).¹⁶ Evidence suggests that some rural areas underutilize available resources. In one region in the Southeast, for example, relatively few life-threatening emergency

¹⁵Eleven components (i.e., medical direction, prevention, communication, training, triage, prehospital care, transportation, hospital care, rehabilitation, public education, and medical evaluation) of system management, prehospital care, hospital facilities and rehabilitation services are described as essential or desirable in urban and rural settings. ACEP defines an urban system as one that encompasses at least one metropolitan area with 250,000 persons. Rural systems are lacking any single population center (3).

¹⁶The recommended ratio is based on the average annual trauma rate of one case per 1,000 people and ACS's recommendation for a minimum of 350 patients per year at a level 1 trauma care facility.

cases were being transferred from rural hospitals to adjacent urban specialty hospitals (93).

Many rural hospitals cannot meet the requirements of an ACS level III hospital, but nonetheless have an important role to play in providing trauma care in rural areas. Specific trauma care guidelines for rural hospitals without level 111 resources might prove helpful to rural providers. Oregon, for example, designates a fourth level of trauma care, specifically to meet the needs of rural hospitals. A level IV hospital requires an ACLS-trained nurse to be in-hospital and immediately available, and an ACLS and ATLS-trained physician to be on call and promptly available (e.g., within the hospital, but not necessarily in the emergency room). (See Oregon hospital criteria in app. D.) The Oregon system ties the resources of the urban level I and II hospitals to

the level 111 and IV hospitals to improve their trauma-related services. Level I and II hospitals must provide training for rural providers, provide feedback on patients referred to their hospitals by the level 111 and IV hospitals, and must provide peer review of trauma cases as part of a regional quality assurance program. Furthermore, Level I hospitals must provide telephone and onsite consultations with physicians of the community and outlying areas as part of an outreach program (25). There would perhaps be less controversy surrounding triage criteria if rural hospitals could establish their role in providing care and formalize beneficial relationships with specialty hospitals. The availability of rapid and aggressive treatment at the local level before and during transport to definitive care will likely improve rural trauma patient outcomes.