
ACCESS TO QUALITY HEALTH SERVICES IN RURAL AREAS— EMERGENCY MEDICAL SERVICES: A LITERATURE REVIEW

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SCOPE OF PROBLEM

- Access to emergency medical services was identified as a major rural health concern among state offices of rural health.³¹
- Emergency medical services are a major factor in assuring “access to health care,” one of the 10 “leading health indicators” selected through a process led by an interagency workgroup within the U.S. Department of Health and Human Services.³²

GOALS AND OBJECTIVES

One Healthy People 2010 goal is to improve access to comprehensive, high-quality health care services.¹ Emergency medical services (EMS) is the umbrella term for a continuum of health services including pre-hospital medical services, emergency services provided at the hospital or health center, and the trauma system that often serves as the network of coordinated trauma care. These services are often the gateway to health care for a large number of individuals.

The following Healthy People 2010¹ objectives are among those addressed in the discussion of emergency medical services.

- 1-10. Reduce the proportion of persons who delay or have difficulty in getting emergency medical care.
- 1-11. Increase the proportion of persons who have access to rapidly responding pre-hospital emergency medical services.
- 1-13. Increase the number of Tribes, States, and the District of Columbia with trauma care systems that maximize survival and functional outcomes of trauma patients and help prevent injuries from occurring.
- 1-14. Increase the number of States and the District of Columbia that have implemented guidelines for pre-hospital and hospital pediatric care.

Specifically, these objectives address the pre-hospital emergency services and trauma system components of the emergency medical services system. Of particular concern in Healthy People 2010 objectives relating to EMS is the ability of the trauma system to respond to the needs of pediatric patients.

Pertinent to this discussion are the following terms:

- *Pre-hospital Services* is defined as a network of first responders serving as a vital extension of emergency care from the community to the hospital emergency room (ER). This service is further defined as that service from the initial 911 call to arrival at the hospital emergency department.
- *First Responders* is defined as the network composed of individuals providing emergency medical care as the patient’s first point of contact after injury or emergency illness. These include, but are not limited to, volunteers, emergency medical technicians (EMTs), and paramedics.
- *Emergency Medical Services* is defined as the personnel, vehicles, equipment, and facilities used to deliver medical care to those with an unpredicted immediate need outside a hospital and continued care once in an emergency facility.³³
- *Tertiary Level Services* is defined as services including, but not limited to, trauma, pediatric, neuro- and cardio-surgery, and services provided by state-designated trauma centers.³⁴
- *Trauma* is defined as a physical or psychological wound or injury, resulting from external forces.³⁵

- *Trauma System* is defined as an organized and coordinated effort in a defined geographic area to deliver the full spectrum of care to injured patients.¹

There is a wide disparity in the delivery of emergency medical services between rural and urban areas. This disparity is attributable to factors such as availability of professional and paraprofessional service providers, geographic barriers, and resource constraints. Such

factors pose challenges for the provision of adequate care and treatment to patients from first response through initial stabilization and subsequent emergency treatment.⁶

In rural areas, trauma patients who have a greater likelihood of needing advanced life support care are less likely to receive it.

IDENTIFIED BY PEOPLE LIVING IN RURAL AREAS AS A HIGH PRIORITY HEALTH ISSUE FOR THEM

In a preliminary survey of state and national rural experts conducted by Rural Healthy People 2010 (RHP2010), emergency medical response was frequently named specifically as a major rural health problem. According to a subsequent, more expansive RHP2010 survey, access to quality health services (which includes access to emergency medical services) rated as the top ranking rural health priority. Approximately three-quarters of the respondents named access as a priority.² It was the most often selected priority among all four types of state and local rural health respondents in the survey and across all four geographic areas. Nine out of 10 leaders of state health organizations nominated access as a priority, while about two-thirds of the public health agencies, rural health clinics, or hospitals did the same—a statistically significant difference among the groups. No significant differences across regions appeared, as access nominations appeared uniformly high across four geographic regions of the country.³⁶

PREVALENCE AND DISPARITIES IN RURAL AREAS

Pre-hospital Services

EMS is the vital extension of emergency care from the community to the hospital emergency room. Rural EMS is provided through of a variety of service delivery components and methods across the United States (e.g., non-transporting volunteer first responder organizations, volunteer ambulance corps, or county ground and air ambulance services). In rural areas where paid city or county services are not in place, the EMS task may fall upon volunteer community members who are trained and organized to provide such services.⁴ An estimated 90 percent of emergency medical service personnel in rural frontier areas are volunteers.⁴

Injuries in rural areas occur as frequently or less frequently than in urban areas. However, many of the injuries sustained in rural areas are greater in severity and may be of different types than in an urban setting.⁴ Because many rural areas rely only on basic EMTs, trauma patients who have a greater likelihood of needing advanced life support care are less likely to receive it. Low call volumes and longer transport times result in less frequent in-the-field use of potentially life-saving interventions such as artificial airways and intravenous fluids.^{3, 17} The frequent and effective utilization of such procedures can be instrumental in saving the lives of many patients.

Though only one-third of all motor vehicle accidents occur in rural areas, two-thirds of the deaths attributed to these accidents occur on rural roads⁷—a situation suggesting the critical importance of minimizing the length of time from call to arrival on the accident scene.³⁷ This discrepancy may be due to a number of factors, such as higher speeds and different types of vehicles driven in these areas.³⁸

Many rural communities are faced with a host of challenges in the delivery of adequate emergency medical services, including:

- a high reliance on increasingly hard-to-find volunteer staff;⁴
- inadequate financial resources;⁶
- aging or inadequate equipment;
- difficulty maintaining skills due to the low call volume;³
- lack of training opportunities close to home; lack of proper medical direction, particularly from individuals trained in emergency medicine; and
- gaps in telecommunications.³⁹

Emergency Medical Services (Hospital)

Hospital emergency departments in rural areas encounter many challenges. These difficulties affect those involved in the operation of the facilities and those who require the use of them, as well.

ER staffing difficulties are a significant challenge in rural areas. Many of the ER directors are not specialists in emergency medicine, and for those who are specialized, the low volume of patients is not conducive to maintaining those skills.^{4,8} Providing 24-hour ER staff coverage is also a problem, creating a reliance on nurses' availability until the physician arrives.⁹ Financial constraints in a low-population community make it difficult for many facilities to maintain tertiary-level services.⁴ Rural ERs often use contract physicians in the form of local primary care physicians, or temporary or traveling physicians-for-hire.^{23, 40}

Trauma System

Trauma systems primarily function as a statewide or regional triage system, connecting multiple health-care components in an effort to ensure timely response and transport times of injured patients to facilities that can provide an appropriate level of treatment.¹⁰ Within such systems, hospitals are designated as a specific level of trauma center, ranging from I through V, with Level I being the highest. Level I centers provide a full range of services along with research and medical education. Level II centers also provide a full range of services

but do not have the research and the education components. A general surgeon, and orthopedic, neurosurgical, and emergency services specialists must be available to be on call 24 hours a day, seven days a week at a Level III center. A surgeon must be available for emergency services for a Level IV center. A Level V center is a clinic staffed by non-physicians.⁴¹

Statewide trauma systems have been shown to reduce preventable trauma deaths in urban areas from 21 percent to 30 percent of deaths to less than 5 percent.⁴² Similar effects of such systems on rural areas are now being discovered.¹¹ A study comparing transfer practices before and after statewide trauma system implementation found that a greater number of rural patients were redistributed to a higher-level trauma hospital with greater resources after implementation.⁴³ However, a comparison of mortality rates of those patients severely injured in rural areas in Vermont before and after trauma system implementation revealed no significant improvement.⁴⁴ Nonetheless, when the processes of care delivered to patients for both pre- and post-system implementation were compared in Level III and IV centers, significant improvement was found.⁴⁵

Pediatrics and Trauma Care

Children account for 25 percent of injury victims, approximately 10 percent of emergency response transports, and one-third of emergency department visits.^{12, 13} A rural Wisconsin study reports that falls, recreational activities, and motor vehicle crashes account for over one-half of all pediatric injuries.¹⁴ A California pediatric injury study found that traumatic injury was the most frequent reason for calling EMS in rural areas, accounting for 64 percent of the calls made. Medical problems accounted for the remaining 36 percent.¹³ Rural areas appear to have a greater number of pediatric calls due to neck and back injuries than urban areas. For children under the age of two, medical problems were the reason for the majority of the calls in both areas. For those age two through 18 in urban areas and six through 18 in rural areas, vehicular injury was the most common reason for calls made to EMS.¹³

A number of care limitations for rural children were noted in the same California study. For both rural and urban areas, infants and young children were less likely to receive advanced life support (ALS) procedures than older victims. Vital signs were measured less frequently, while drugs, IVs, defibrillation or intubation were used in only approximately 12 percent of the calls. The most frequent procedures used, such as spinal immobilization and the use of an oxygen mask, are those that can be performed by a basic life support (BLS) provider.¹³

IMPACT OF THE CONDITION ON MORTALITY

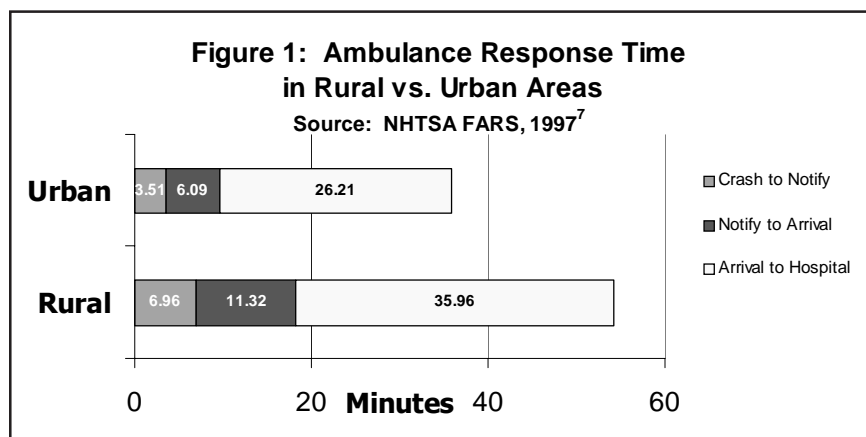
Pre-hospital Services

Death and serious injury accidents account for 60 percent of total rural accidents versus only 48 percent of urban.¹⁷ A 1987 study also revealed that vehicle-crash mortality was inversely related to population density.⁴⁶ One reason for this increased rate of morbidity and mortality is that in rural areas, prolonged delays can occur between a crash, the call for EMS, and the arrival of an EMS provider. Many of these delays are related to increased travel distances in rural areas and personnel distribution across the response area. National average response times from motor vehicle accident to EMS arrival in rural areas was 18 minutes, or eight minutes greater than in urban areas.¹⁸

The time elapsed from the initial call until the treatment of the patient in the hospital may be critical to survival. The ‘golden hour’ refers to the critical first hour from incident to hospital treatment during which, if treatment is received, the patient’s likelihood of survival is greatly increased.¹⁶ Thus, delayed and prolonged response times in rural areas may contribute to additional mortalities.

The National Highway Transportation Administration’s (NHTSA) Federal Accident Reporting Systems (FARS) collects motor vehicle

accident reports that can be used as a measure of the impact of the condition or problem on mortality. Disparities are evident in the rural and urban average response times to fatal motor vehicle collisions.⁷ A significant difference of 98 percent (3.45 minutes) exists in rural areas compared to urban areas between the time of accident occurrence and the initial notification of emergency response services, as outlined below in Figure 1.



In a study of five counties in Washington State, the mean response times for EMS to urban and rural incidents were 7.0 and 13.6, respectively. Urban victims had a response time of less than 10 minutes 84 percent of the time, compared to only 43 percent of rural victims experiencing such a short response time.¹⁷ For those victims in rural areas, death risks were seven times higher if the EMS response time was longer than 30 minutes. After the initial response, transport times also were longer for rural areas at 17.2 minutes on average, versus 8.2 minutes in urban areas.¹⁷ Unfortunately, because of the greater distances involved, such longer response times may be unavoidable in rural areas.

Emergency Medical Services (Hospital)

The relationship between the rural ER and mortality is complex. Among the determining factors are severity of injury or illness, time between acute event and arrival, level of ER staff expertise, and availability of equipment, drugs, and procedures.

The majority of deaths occurring from incidents in rural areas appear to occur at the scene rather than in the admitting hospital. In a five-year study by Trevillyan and associates,¹⁵ 72 percent of trauma deaths in a rural Arkansas county occurred at the scene, re-emphasizing the critical nature of the first hour following the actual incident. Eighteen percent of the deaths occurred after arrival to the hospital, with one-half being attributed to thoracic trauma. One of the reasons behind the low “in-hospital” death total for this particular hospital is that 49 percent of those patients who had sustained major injuries were referred to other higher-level trauma centers.

The majority of deaths occurring from incidents in rural areas appear to occur at the scene rather than in the admitting hospital.

Trauma System

The effect of trauma systems on mortality rates in rural areas has yet to be clearly determined. Many studies have been performed comparing those patients who were stabilized in an outlying hospital before being transferred to a higher-level facility to those who were directly admitted to the latter facility. One such study by Rogers, et al.⁴⁴ found no difference in the mortality rates between those two types of patients.

Several other studies show indirect support for the advantages of trauma system implementation. Two separate studies by West^{19, 20} show a reduction from 15 preventable deaths out of 21 before trauma system implementation, to six out of 29, with four of those six deaths having not received trauma system care following implementation. A comparable reduction is seen in another study’s results reporting a drop from 20 preventable deaths out of 58, to nine out of 60, with seven of those nine not receiving trauma system care.⁴² Another study attributes its rural hospital’s low “in-hospital” trauma death rate

to low minimum criteria for transporting patients to higher-level trauma centers.¹⁵

There is also evidence supporting negative consequences with the transportation of patients to other facilities after stabilization. Excluding patients who died in the first 24 hours, one study found an increased incidence of unexpected death in transferred patients. Seventy-five percent of those in the transferred group experienced an “unexpected” death following that time period as opposed to only 21 percent of those directly admitted.²¹ Overall, 62 percent of the deaths in the transferred group had probabilities of survival greater than 50 percent as opposed to only 22 percent in the direct group, demonstrating an increased incidence of unexpected death in those having been transferred.

Pediatrics and Trauma Care

Unintentional injuries are the most frequent cause of death for children and adolescents one to 14 years old nationwide, with motor vehicle crashes and drowning being the top two categories.⁴⁷ In a study of Vermont and New York City, pediatric trauma death rates were twice as high in the rural area as in the urban area. Of the child trauma deaths in Vermont, 87 percent of children died before accessing adequate trauma care.⁴⁸

Mortality rates have also been compared between pediatric and non-pediatric trauma centers. Trauma centers in Pennsylvania were categorized as urban pediatric, urban non-pediatric, or rural non-pediatric. The centers specifically designed for pediatrics received more pedestrian injuries and falls, while rural non-pediatric centers received more motor vehicle passengers. Death rates were the greatest for these rural non-pediatric centers, at 6.2 percent. Both pediatric and non-pediatric centers in urban areas had similar death rates yet were significantly lower than their rural counterparts.¹²

According to the same Pennsylvania-focused study, the youngest age group (zero to four years) experienced the highest mortality rates among all of the pediatric patients. For all of the pediatric patients, gunshot wounds were the leading cause of

death, contributing to 22.2 percent of the deaths, followed by pedestrian injuries at 8.6 percent, and motor vehicle accidents with 8.5 percent. Pedestrian injuries were the most common cause of death in the rural centers at 15 percent.¹²

KNOWN CAUSES OF THE CONDITION OR PROBLEM SO EFFECTIVE INTERVENTIONS OR SOLUTIONS CAN BE IDENTIFIED

Pre-hospital Services

First responders in rural areas face many challenges in providing adequate and timely service to each surrounding area. Providers of these services are often volunteers who have received only the most basic of training. Depending on the specific location, anywhere from 57 to 90 percent are completely staffed by volunteers.^{3,4} Heavy reliance upon volunteers results in a delay in response times to the accidents since they must often report to their unit before actually traveling to the scene.¹⁷ This contributes to longer response times and, therefore, a greater potential for higher mortality rates.

Lack of funding for expensive, state-of-the-art equipment is also a major factor. Of the non-paramedic level services in Wisconsin, approximately 84 percent operate without a defibrillator. With each defibrillator costing anywhere from \$3,000 to \$5,000, the likelihood of a small rural organization being able to afford one is small.³ Even with defibrillator usage, however, one study found increased survival rates for patients in ventricular fibrillation to be seen only in those communities with greater than 15,000 people. For these communities, greater resources are likely to be available, allowing for a more comprehensive and efficient emergency care structure to be in place. This, in addition to the use of a defibrillator, are the key factors believed to result in the benefits being seen in larger communities.²²

Emergency Medical Services (Hospital)

Physician recruitment and retention are two major problems rural hospitals face. General and family practitioners are frequently relied upon to provide

hospital-based emergency care in rural areas, while many are not adequately trained or certified to do so. Training programs are typically established in urban areas, attracting the majority of graduates to larger communities. A variety of factors result in this unequal distribution. Rural areas tend to lack access to the most current technology, higher trauma-level hospital facilities, collegial support, regular work hours, and competitive salaries and benefits.⁶

Many rural hospitals rely on emergency department contracting to provide adequate services to their communities. However, this carries a great cost. Nearly two-thirds of the reporting rural hospitals in one study report contracting for at least some of their emergency room coverage.⁴⁰ This is consistent with a previous study reporting that 86 percent of rural hospitals in Washington state contract for emergency department coverage, with 59 percent being obtained from non-local physicians.²³ This study also reports a typical cost for the hospital at \$100 per patient visit. This is a heavy financial burden for a rural emergency department that might receive only eight emergency patients per day at most.²³

Physician recruitment and retention are two major problems rural hospitals face.

Trauma System

As mentioned previously, inadequacies of trauma systems in rural areas can be attributed to factors like those affecting rural EMS. Logistical difficulties, longer transport distances, economic hardships of practicing medicine in a small town, the lack of sophisticated emergency-care delivery systems and the critical nature of managing common, blunt-trauma injuries all make creating an effective system for rural areas difficult. In relation to the funds received for the treatment of diseases such as cancer, cardiovascular disease, and blood-borne illnesses, trauma care is also severely under-funded.⁵

Pediatrics and Trauma Care

A number of state studies have compared rural/urban differences in the availability of pre-hospital care services to pediatric patients. In a Kentucky study, although rural areas experience higher traumatic pediatric death rates, those areas that provide 24-hour emergency care and/or the availability of ALS pre-hospital care record significantly lower rates.²⁸ This finding is significant given 71 percent of urban areas provide ALS, compared to only 61 percent of rural.²⁹ A North Carolina study reports an association between increased ALS usage and decreased pediatric mortality rates.⁴⁹ These studies all suggest that with increased training for those individuals providing pre-hospital care, pediatric trauma outcomes can be improved.

PROPOSED SOLUTIONS OR INTERVENTIONS THAT ARE FEASIBLE IN RURAL COMMUNITIES

Pre-hospital Services

The Rural Hospital Flexibility Program (RHFP), passed in 1997 as part of the Balanced Budget Act, is intended to provide financial relief to America's smallest and most vulnerable rural hospitals. While one paragraph of the legislation enables states to establish Critical Access Hospitals (CAHs) and improve rural health networks, a second, parallel paragraph permits states to use RHFP funds to improve their rural EMS systems.⁵⁰

Geographic information systems (GIS) can be utilized in a number of ways in an effort to improve pre-hospital services in rural areas. One study analyzed GIS use to determine preferred mode of ground versus air transport, depending on the location of the accident. Patients in 'air zones' transported by helicopter arrived 13 minutes sooner than those traveling by ground. Likewise, those patients located in the 'ground zones' arrived 36 minutes sooner when transported by ambulance.²⁴ GIS can also assist in 911 dispatching. It is currently being used in Raleigh County, West Virginia, in locating the caller's position. As a call is received, the GIS screen determines the quickest route.²⁵ Thus,

the use of GIS may decrease response time and time for arrival at the hospital, the two longest segments of emergency response shown in Figure 1, and in doing so may increase survival.

Emergency Medical Services (Hospital)

For in-hospital emergency care, telemedicine offers rural facilities the opportunity to take advantage of the skills and knowledge of those in other locations. Various forms of telemedicine are available for use including telephone calls, radio, and faxes. The use of computers allows for new interactive technology in several ways. The 'store and forward' method allows for video and audio clips to be sent through e-mail, and 'real time' telemedicine allows for the interaction between the patients and those treating them with others at other facilities.⁵¹

It is often not practical to keep an experienced surgeon on site 24 hours a day, seven days a week in a rural emergency department. However, with telemedicine, access to a surgeon is possible. A team approach is typically used in trauma, leaving the leader, or surgeon, to direct the activities of the other members rather than having hands-on contact.²⁶ One system takes advantage of this approach, along with the technology, by allowing the trauma surgeon to observe the treatment of a particular patient from his/her own home. Two cameras are set up in the trauma room, one at eye level and one mounted on the ceiling, for the surgeon to switch between at his discretion. Microphones mounted on the ceiling allow the surgeon to hear everything that is going on in the room as well. Results from a study using this system report that over 80 percent of referring providers believed that the telemedicine consults improved patient care, with over one-half believing that the consult could not have been performed over the phone.²⁶ A similar technology could provide access to specialized surgeons in urban locations for assistance with emergency operations in rural areas.

Another form of telemedicine allows an emergency nurse to examine a patient with the telemedicine workstation while the physician watches remotely. The workstation includes a document reader, a digital stethoscope, otoscope, and dermascope. The

patient's breathing and heart sounds can be monitored, and the tympanic membrane and pharynx can be seen along with skin lesions. No patients from the experimental group required additional care or a diagnosis change in one study using this approach. Overall, both patients and physicians had a positive opinion of their experience.⁵¹

This innovation does not come without drawbacks, namely cost. The equipment used to allow the trauma surgeon to observe the trauma treatment costs approximately \$10,000 in addition to hiring technical support personnel and telecommunication costs. Insurance, licensure, and credentialing issues also are important points to consider.²⁶ Barriers aside, telemedicine may provide an option for low-staffed rural hospitals to take advantage of qualified emergency physicians in other locations along with potentially improving patient treatment times during high-volume periods.⁵¹

Trauma System

The U.S Trauma Care Systems Planning and Development Act, P.L. 101-590 enacted in November 1990, among other aspects, allows for the provision of grants for rural EMS. These grants are intended to result in the improvement of quality and availability of EMS and trauma care to rural areas.⁵²

Trauma systems, when implemented in rural areas, should incorporate other services in addition to making tertiary care available at Level I or II trauma centers. Trauma prevention must be promoted; pre-hospital providers must have adequate mobilization provided for, and small hospitals must provide adequate stabilization and treatment along with or in lieu of transferring patients.²⁷ A sense of shared responsibility among all participants of the referring and accepting institutions can be achieved through a rural trauma coalition. And finally, referral patterns should be bi-directional. Those patients who could be more appropriately cared for in a smaller facility should be allowed to do so. Cooperation at each of these levels can help achieve a goal of having the Level I and II centers contribute to the development of the Level III centers.²⁷

Pediatrics and Trauma Care

Implementing a statewide surveillance system is one suggestion by some to help in providing effective and efficient emergency medical services to children. This system would incorporate morbidity data from pre-hospital, emergency department, and hospital levels. Comparisons of injury severity among different environments could then be made, which would allow for the identification of preventable deaths and injury rate data.²⁸ By identifying area-specific injury patterns, prevention programs can be developed that focus on those injuries for which a particular area is at a higher risk.

It is also suggested that initiatives be taken to educate pre-hospital providers in care required for pediatric patients. Proper procedures for assessment and stabilization should be taught to both advanced and basic life support providers.²⁹ Area pediatricians can assist in this by sharing their expertise with their area EMS providers. Remaining aware of how their local EMS system functions, pediatricians can provide additional training and education for EMS providers that can be most beneficial for the population they serve.³⁰

COMMUNITY MODELS KNOWN TO WORK

In Georgia, some counties are using regionalization of EMS systems through the consolidation of two or more systems to pool resources as a method to provide more comprehensive coverage of a larger geographic area.⁵⁰

In Texas, attempts are underway to increase the state's EMS capacity through emergency medical technician education. Though not funded by the state legislature, this program aims to utilize distance education technologies to provide training in the rural communities.

Other states, as well as Texas, are promoting training through local training scholarships through which communities contract with an individual volunteer for their services in the local EMS system.⁵⁰

See the Models for Practice section in Volume 1 for a catalog of models.

SUMMARY AND CONCLUSIONS

Access to rural emergency medical services encompasses several elements, including pre-hospital care, emergency room care, trauma systems, and pediatric care. Through close interaction, these elements constitute emergency medical care as a whole, but they must be analyzed individually for the entire system to be understood. Each component possesses its own unique challenges and issues, and it is only by taking all aspects of the problem into account that progress will be made.

Addressing the special situations and needs of rural emergency care in legislation, policy, and funding may help to eliminate some of the rural-urban disparities. However, given that some sources of these disparities, such as large geographic distances and low population density, are by their very nature, intrinsic to rurality and unmodifiable, it may never be possible to completely eliminate the rural-urban disparities in EMS.

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