A red emergency medical services (EMS) ambulance is shown from a side-rear perspective. The vehicle features a prominent light bar on the roof with several orange and red lights. A Texas Tech University logo is visible on the side of the ambulance. The background is a solid red color.

An Assessment of Rural West Texas Emergency Medical Services (EMS)



TEXAS TECH UNIVERSITY
HEALTH SCIENCES CENTER™

F. Marie Hall Institute *for*
Rural *and* Community Health

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The Golden Hour

What is an hour? It is sixty minutes of time. An hour is the time it took to write this preface. I could only write these words in short spans of time. Some life experiences evoke such powerful memories that they flood your emotions, feeling as if they just happened, and the awful reality of how close I came to the death of my precious daughter overwhelms me even now. You will read this preface in a few minutes of time, but it took many stops over the hour it was written to relate these events. Keep in mind that an hour is an arbitrary designation, and it can seem far too long or not even close to enough time. An hour can seem like an eternity and an instant all at once, depending on circumstances. I came to understand this on a new level about seven years ago.

My family and I traveled to a church retreat just less than 50 miles from the heart of downtown Houston, Texas. It was a beautiful spring day, and the grounds were on the edge of the Sam Houston National Forest. We followed a two-lane country road to the grounds that were about a mile back in the pine trees. As we moved up that road, a go-cart sped past us and darted away down a dirt trail. I will never forget telling my kids to stay away from that machine and the crazy kid driving it!

The retreat was pleasant enough. There was the usual warm fellowship with people; truthfully, it was very pleasant for the first few hours. The kids went off in groups to do things like fish, explore the woods, and other activities. Three of my kids were there that day, so I was scouting them out at a reasonable distance just to make sure things were as they should be. I was at the fishing pond when a friend rode up on a four-wheeler and said I needed to come quickly as my daughter had been in an accident involving a go-cart. Responding with urgency, with no experience on one of those very deadly four-wheeled crafts, there could have been more than one wreck that day as I raced up the hill and through the woods to come upon an upside down go-cart.

Gasoline was all around the area, and my daughter was hanging there inside the go-cart. My first thought was to cut her from the harness, and as I did, her compound complex fracture was upmost on my mind. She was stunned, but the helmet had protected her brain; would she bleed to death in front of me? These thoughts, questions, and more sped through my mind. Once she was out of the vehicle and in my arms, I began to fight the other enemy in these situations – panic! I was shouting orders, and one was to call EMS. Somewhere in the next moments, her arm was immobilized, I calculated no arteries were severed, and I knew that she might have a chance if we transported her rapidly to a hospital. That is when I was informed that EMS was over an hour away – it was a weekend, and they were busy elsewhere. It gave a new meaning to “spotty coverage”.

In what would become the next most dangerous part of that day, I transported my daughter to the hospital. I became an emergency driver and my wife the emergency attendant as we drove two lane roads at breath-taking speeds. We made it in a record time of 37 minutes, not counting the ground time getting her ready for the trip; from the time of the wreck to the arrival at

the hospital was 67 minutes. It was not the golden hour, but at least pain medicines and intravenous fluids were flowing into her while traumatic shock seemed forestalled. As we waited for transport to Texas Children's Hospital, a place that would seem like home for the next five months of surgeries, I met some of the EMS crews as they came in. They all knew about my family and the incident; they were all solid people, mostly Vietnam medics and others with military training, all about my age. As they praised us for our quick action, they also told me about their old equipment and the little or no pay received for their life-saving work (most were volunteers). Most were very candid that they viewed the golden hour, from incident to definitive care, as nothing more than a myth of government bureaucrats.

You may be reading this and thinking, "But they were only an hour from the fourth largest city in the United States. Why was it an hour for emergency services to arrive? What if this happened to me or my loved-one?" Well, dear reader, read on in this report and you will gain some answers and form even greater questions. That is why this report is a good first step to a candid assessment of the state of Emergency Services in West Texas and beyond. There may be limitations in the way we approached this study but they are not significant, and what we present is a fair and balanced report. We hope it will stimulate discussion, community engagement, more study, and ultimately an improved system.

You never know when events will lead to trauma and the need for emergency services, even in the midst of your best efforts to protect and be careful. I pray that you will never experience what we had to face that day and to this day, as it continues to haunt us. What I do hope is that whatever service is available for your trauma, the immediate need will be met with the best system we can provide in every community and for every citizen of Texas. For the silent trauma of the memories of that day, I will trust my Creator for that grace.

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Overview

According to Rural Health People 2010, “Access to Emergency Medical Care (EMS) is a major rural health concern among state offices of rural health”.¹ EMS is the third most often cited rural health priority based on state and national surveys.

This report is based on the findings of an EMS telephone survey and research conducted by personnel within the F. Marie Hall Institute for Rural and Community Health at Texas Tech University Health Sciences Center (TTUHSC) in Lubbock, Texas. In an effort to address one of the major rural health concerns in the State of Texas and the nation, the survey consisted of questions related to EMS services, needs, and coverage of West Texas.

Emergency Medical Services are the primary providers of pre-hospital medical care and disaster response, as defined by the Centers for Disease Control and Prevention (CDC). They are often the gateway to health for many people. In some rural communities, EMS may be the only care available to the patient.²

Dr. R. Adams Cowley, of the Maryland Institute for Emergency Medical Services, was a leading researcher and proponent of critical trauma care within the first hour after a trauma occurs. His research developed in the late 1950s and led to the term “golden hour”, which emerged based on the importance of speed and skill in emergency response. Dr. Cowley stated in an interview:

There is a golden hour between life and death. If you are critically injured you have less than 60 minutes to survive. You might not die right then; it may be three days or two weeks later—but something has happened in your body that is irreparable.³

From his research, studies found that treatment within the “golden hour” has a significant impact on the patient’s outcome. Based on these findings, initial, immediate treatment can substantially decrease the death rate.

An available, well-trained, and well-equipped EMS service is a vital link in the golden hour goal of malady-to-care disposition.

In a report published in November of 2004 by the Health Resources and Services Administration (HRSA), entitled “Quality Through Collaboration: The Future of Rural and Frontier Emergency Medical Services in the U.S. Health System”, an agenda was set to appropriate needs in rural communities. They were developed to make healthcare safe, patient-centered, timely, and efficient.⁴

¹Rawlinson, C., & Crews, P. (2010). Access to quality health services in rural areas-emergency medical services. *Rural Health People 2010: A Companion Document to Health People 2010*

²(2012). Emergency medical services workers. *Centers for Disease Control and Prevention: Workplace Safety & Health Topics*.
<http://www.cdc.gov/niosh/topics/ems/>

³*The history of the R. Adams Cowley shock trauma center; University of Maryland medical center*. (2013, June).
<http://umm.edu/programs/shock-trauma/about/history>

⁴U.S. Department of Health and Human Services (HRSA), Office of Rural Health Policy (ORHP). *Quality Through Collaboration: The Future of Rural and Frontier Emergency Medical Services in the U.S. Health System* (p.2).
<http://www.nasemso.org/Projects/RuralEMS/documents/QualityThroughCollaboration.pdf>

In the report, EMS was at the forefront of recognition. It was apparent that there was a problem in rural communities with EMS, which is a core component of the healthcare infrastructure. The report stated that there were care issues due to the long distances, shortages of personnel, need for timely care, as well as other factors.

The State of Texas is one of the largest in the United States, and the West Texas region is a large geographical area comprising mostly rural and frontier populations. The Texas Tech University Health Sciences Center (TTUHSC) spans an area of 131,459 square miles with a population of 2,836,499. There are 108 counties in this region with eight major cities; Lubbock, Amarillo, El Paso, San Angelo, Wichita Falls, Midland, Odessa, and Abilene; with the largest being El Paso.⁵ Big Bend National Park and Palo Duro Canyon are two major driving-tourist attractions in the region. Three interstates run through West Texas; I-10, I-20, and I-40.⁶ According to the Department of State Health Services (DSHS), within the TTUHSC region there are 196 Emergency Medical Services (EMS) stations, seven of which are air-service only. (See Figure 1). There are two Level-I trauma facilities, one Trauma-II facility, five Trauma-III facilities, 28 Trauma-IV facilities, and 13 stroke facilities.⁷

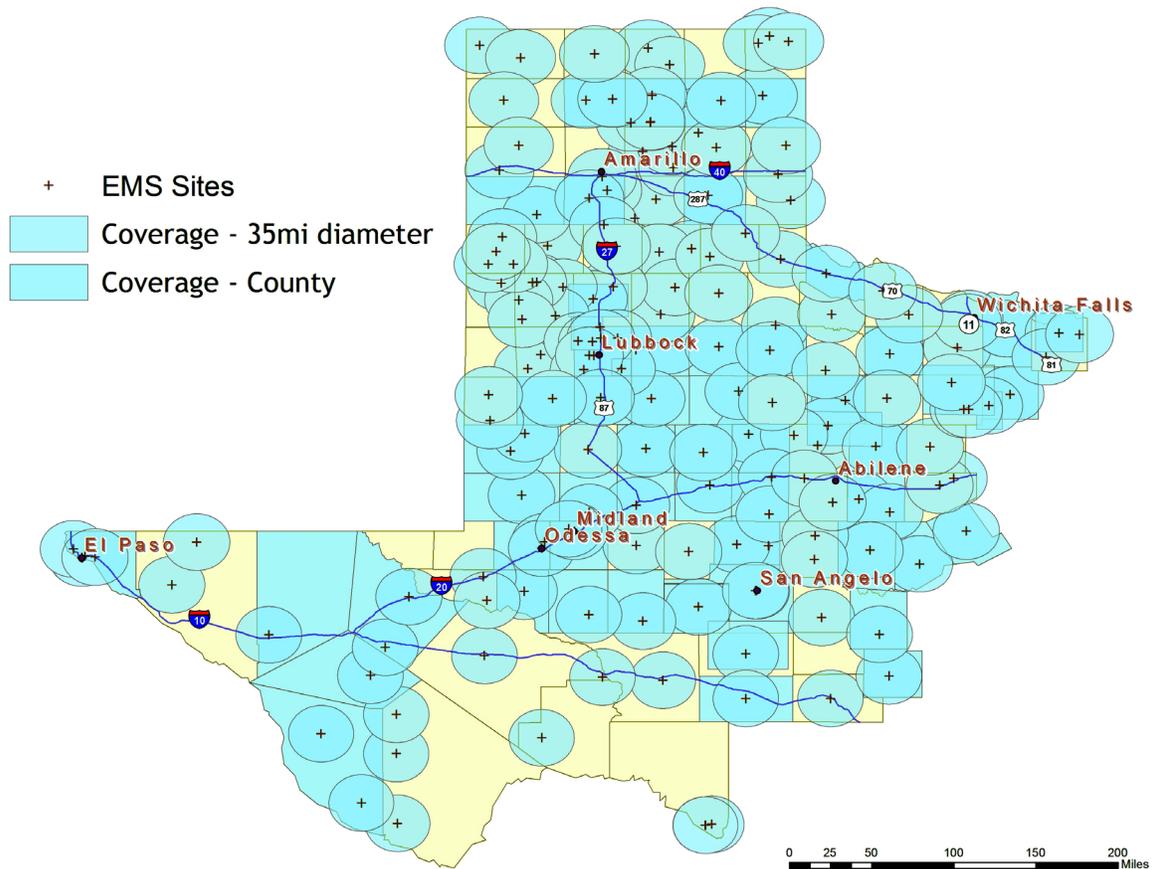


Figure 1: Trauma Facilities and Coverage Sites

⁵ Texas Department of State Health Services; *Census 2010: Changes in Texas*. <http://www.dshs.state.tx.us/chs/popdat/Census-2010/>

⁶ ESRI, Tele Atlas North America, Inc., Department of Commerce, Census Bureau, United States Department of Agriculture (USDA), National Agricultural Statistics Service (NASS).

⁷ Texas Department of State Health Services. *Texas trauma facilities*. <http://www.dshs.state.tx.us/emstraumasystems/Etrahosp.shtm>

A report by the American College of Surgeons in 2010 indicated that citizens of Texas who live in rural and frontier locations have limited access to health and trauma care. It also suggested that there are a variety of problems including the following:

- o Distance to care
- o Recruitment of health care professionals
- o Loss of legislative representation of rural areas due to redistricting
- o Rule modifications from state medical regulatory boards
- o Economic hardships of rural and frontier hospitals and EMS provider agencies
- o Transient, pass-through population along major interstate highways.⁸

The map below (*Figure 2*) reflects EMS to trauma center as reported by the West Texas EMS services that participated in the survey.

Distance to Trauma Facilities

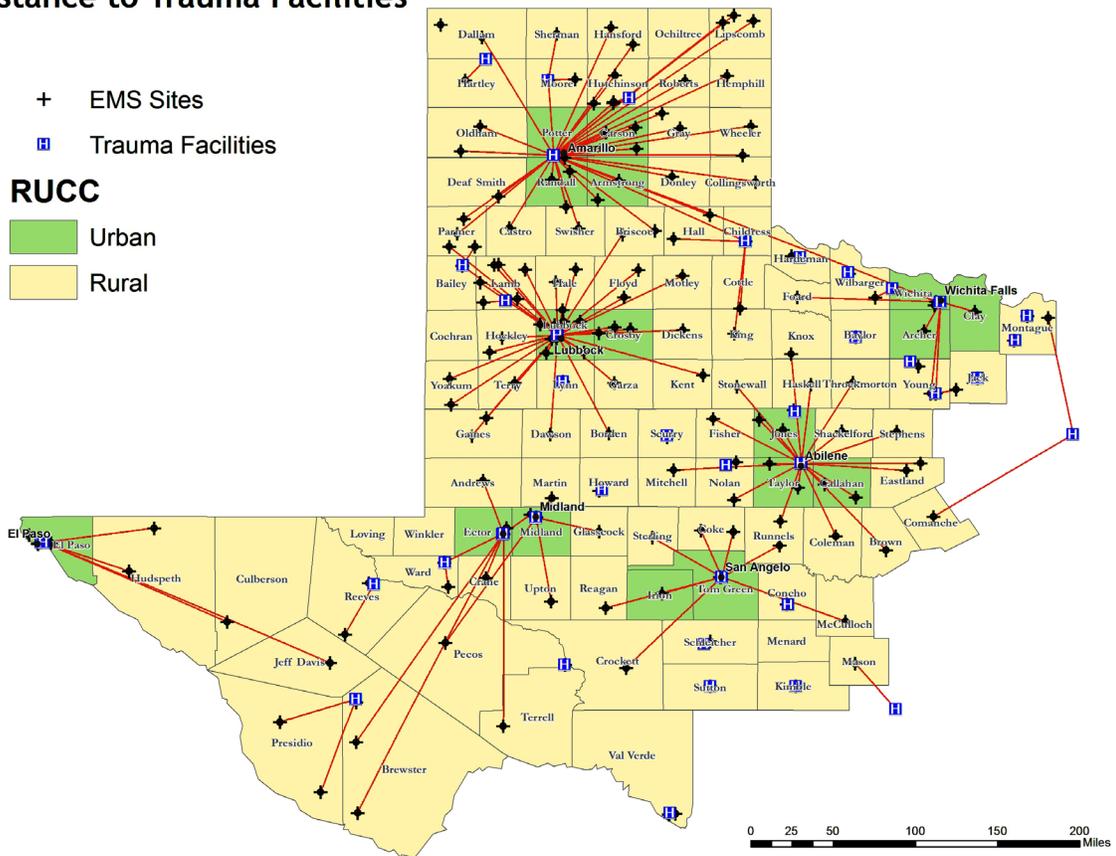


Figure 2: Distance to Trauma Facilities

⁸Trauma system consultation. (2010, May 18-20). State of Texas, Austin, Texas: 2010 American College of Surgeons Committee on Trauma. <http://www.facs.org/trauma/tsepc/pdfs/texas.pdf>

EMS and trauma care is a complex system and not a mandated service in Texas. Only the fire and police departments are mandated by the Texas Administrative Code.

Emergency medical and trauma care consists of EMS, trauma facilities, stroke facilities, the Trauma Service Areas (TSA), the Regional Advisory Councils (RAC), the Trauma Registry, a medical director, and emergency room providers.

Personnel

There are many levels of EMS personnel, each with specific skills and training.

First-Responders are certified or non-certified emergency personnel who work in cooperation with a certified EMS provider. First-Responders may be a police department, fire department, first responder organization, or a volunteer. There are also local people in the communities who are designated as “drivers”. These drivers are community volunteers who help in emergency situations by transporting a patient so that a provider may treat the patient en route to the care facility. Out of the 183 EMS services in the TTUHSC region, 87 have First-Responders.

Emergency Care Attendants (ECAs) are certified by DSHS as minimally proficient in providing pre-hospital care. Their duties include first aid, offering comfort, and avoidance of aggravation of an injury or illness until a patient is handed over to a higher level of care.

Emergency Medical Technicians (EMTs) are individuals certified by DSHS as minimally proficient to perform pre-hospital care needed for Basic-Life Support (BLS). BLS includes cardio pulmonary resuscitation and control of hemorrhaging. An Emergency Medical Technician - Intermediate (EMT-I) performs the same duties as an EMT, and under medical supervision can provide certain procedures such as intravenous therapy, endotracheal, and esophageal intubation. A Paramedic (EMT-P) and Licensed Paramedic (LP) also performs the same procedures as an EMT-I, and under medical supervision can do procedures such as electrical cardiac defibrillation, or cardioversion, and drug therapy. With the December 31, 2012 ruling, any person wanting to be a paramedic will have to attend a two-year accredited college for classroom requirements.⁹

In this report, the EMT-P and LP (paramedics) were combined and 1,687 paramedics were reported in the survey as practicing in the TTUHSC region.

⁹HEALTH AND SAFETY CODE, CHAPTER 773. Emergency Medical Services; Subchapter A, General Provisions.
<http://www.statutes.legis.state.tx.us/Docs/HS/htm/HS.773.htm>

According to the survey, there are 3,685 Emergency Medical Providers practicing in West Texas. DSHS has 6,748 providers listed as licensed EMS providers in the TTUHSC region. The difference in number could be due to licensed personnel no longer practicing because of retirement, change in career, change in address, or other factors.

There are a limited number of paramedics in rural areas. Most of the paramedics are located in the urban areas of West Texas. (See Figure 3). Lack of EMS personnel is an issue in West Texas, especially at the volunteer service locations.

This presents a major problem in areas with remote interstate highways, such as the extreme western side of Texas, an area where there are limited resources, few EMS services, and a lot of through-traffic coming from the western portion of the lower United States. This through-traffic not only consists of traveling families, but also large tankers and other vehicles with hazardous materials, which can lead to an increased level of public endangerment should a wreck occur.

Clinical training to become a paramedic is costly and difficult for non-professional EMS workers to request time away from their jobs. Clinical training for paramedics is often hours away from their place of residence and employment. Since there are a limited number of higher-level providers, such as paramedics, some counties function with ECAs and EMTs. Counties may have only one ECA to cover the entire county.

As per legislative mandates, if a service loses all paramedics, they have to downgrade to a status that offers a lower level of care. Paramedics offer the highest level of care and can administer drugs within their scope of practice that lower level providers cannot. If a service has a Medical Intensive Care Unit (MICU) capable truck without a paramedic, that service will not have MICU capability, and the truck downgrades to a lower level of care. This presents a major problem in rural areas as rural roads have more traffic accidents, injuries are usually more severe, and the distances to facilities are greater, making the golden-hour goal of less than one hour to care nearly impossible.¹⁰

These factors require higher-level emergency care that may not always be available due to the shortage of paramedics in the West Texas EMS labor pool. According to the Texas Department of Transportation (TxDOT), in 2012 the total number of motor vehicle crashes in Texas was 416,476, with 48,666 (11.7 percent) located in rural areas. In the TTUHSC region, there were 53,419 crashes, with 12,335 (23.1 percent) located in rural areas. There were 3,025 fatalities due to crashes in Texas with 37.7 percent in rural areas. There were 507 fatalities in the TTUHSC region with 49.7 percent in the rural areas.¹¹

¹⁰ Henry, T. (2013, March 27). While south Texas sees dollar signs, roads see damage and accidents. *STATE IMPACT*. <http://stateimpact.npr.org/texas/2013/03/27/while-south-texas-sees-dollar-signs-roads-see-damage-and-accidents/>

¹¹ TxDOT, Safety Construction Programs & Data Analysis, Traffic and Engineering Section, Traffic Operations Division

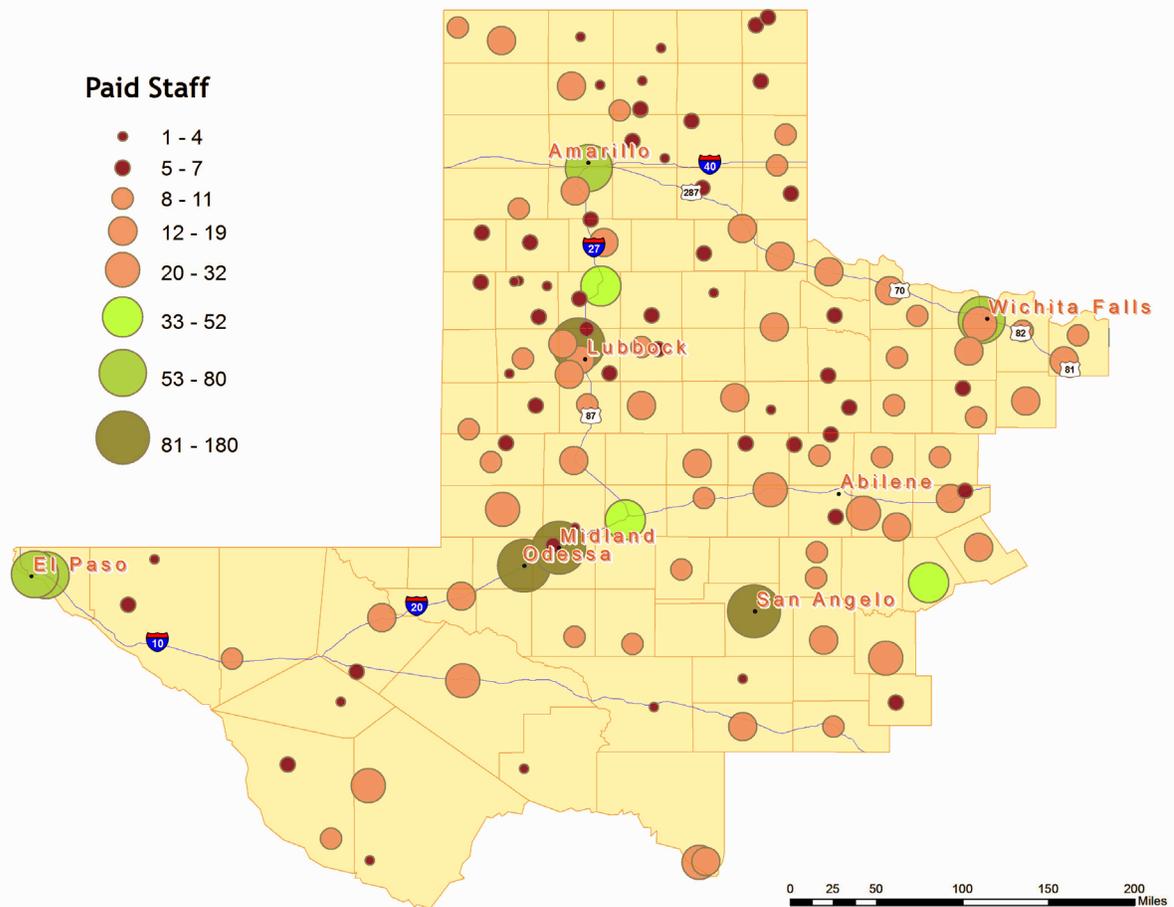


Figure 3: EMS Salaried Personnel in West Texas

According to the National Highway Traffic Safety Administration (NHTSA), “Although 19 percent of the U.S. population lived in rural areas in 2010, rural fatalities accounted for 55 percent of all traffic fatalities in 2010. From 2001 to 2010, rural fatalities decreased 28 percent, whereas urban fatalities decreased by 14 percent.”¹² In the August 2006 *Journal of Trauma*, it was observed by using crash reports and EMS data that more fatalities occur in rural areas and decreased response time is believed to be a critical factor.¹³

Lack of personnel may lead to compliance issues. EMS providers must report trauma cases to the Texas Trauma Registry; they must maintain compliance on their vehicles, medical drugs, and equipment; and they may have difficulties with billing processes.

¹² U.S. Department of Transportation, National Highway Traffic and Safety Administration. (2010). *Traffic safety facts 2010 data: Rural/urban comparison* (DOT HS B11 637). <http://www-nrd.nhtsa.dot.gov/Pubs/811637.pdf>

¹³ Gonzalez, R., Cummings, G., Mulekar, M., Harlan, S., & Rodning, C. (2006). Increased mortality in rural vehicular trauma: identifying contributing factors through data linkage. *Department of Surgery, Center for the Study of Rural Vehicular Trauma, University of South Alabama*. <http://www.ncbi.nlm.nih.gov/pubmed/16917458>

DSHS is aware of these problems and some allowances have been made to help these EMS services. If they cannot report to the Texas Trauma Registry, they may report their cases by affidavit in order to remain compliant. Some EMS Services may use the Texas Health and Safety Code 773.0045, a temporary exemption for emergency personnel practicing in rural areas. To qualify for this exemption, a county must have a population of 50,000 or less, or be relatively large, isolated, and sparsely populated in a county of more than 50,000. This is done on a case-by-case basis. When an exemption is granted, the department must require the affected emergency medical services personnel or the appropriate emergency medical services provider to adopt a written plan under which the applicable requirement will be met as soon as possible. This ruling will also allow a temporary exemption; therefore, the emergency medical services personnel who are applicants for certification at a higher level of training may temporarily practice at the higher level.¹⁴

In one small county in West Texas, all police officers are cross-trained as paramedics or EMTs. According to the EMS survey conducted for this report, many providers have left EMS services to work in the oil fields during the recent West Texas oil boom. EMS services also lose staff to wage issues due to dramatically higher wages being paid to registered nurses for a somewhat similar scope of care. Attrition is also felt adversely when rural, smaller, less well-funded EMS services expend training dollars on staff only to lose them to larger, better-funded urban counterparts.

Having EMS services is crucial to a rural community. There is a shortage of health care personnel in general, especially in rural areas, and in some areas EMS workers are filling in the gaps of service for many of these remote and frontier communities.

Volunteer

There are 51 volunteer-only EMS services in West Texas, and 7 municipal services with primarily volunteer EMS services. (See Figure 4).

According to the 2004 Governor's EMS and Trauma Advisory Council (GETAC) Report, "Recruiting can be difficult in rural/frontier Texas because of dependency on volunteer EMS personnel."¹⁵

In accordance with the Health and Safety code 773.0, a variance is granted when a volunteer emergency medical services provider with a specific hardship applies for a variance from the minimum standards for staffing and equipment for the provision of basic life-support

¹⁴ LawServer. *Texas health and safety code 773.0045 - temporary exemptions for emergency medical services personnel practicing in rural area.* http://www.lawsolver.com/law/state/texas/tx-codes/texas_health_and_safety_code_773-0045

¹⁵ 2004 GETAC Report: Texas Elected Officials' Guide To Emergency Medical Services <http://www.dshs.state.tx.us/emstraumasystems/govtaskforce.shtm>

emergency medical services.¹⁶ Normally, it is mandated that there are two certified personnel on a truck when going on a call, but with a variance a truck can go with one. DSHS allows for variances for volunteer services in counties that do not have enough providers.

Requests for variances increased by 10 percent during the 2003 through 2011 period referenced in the March issue of *Texas EMS*. In 2013, 36 variances were issued by the State of Texas and 25 are located in West Texas.¹⁷

The personnel decline in West Texas is partially due to the declining population and decrease in time people have to volunteer. The population is also getting older, and the people who were once able to volunteer now need the care.

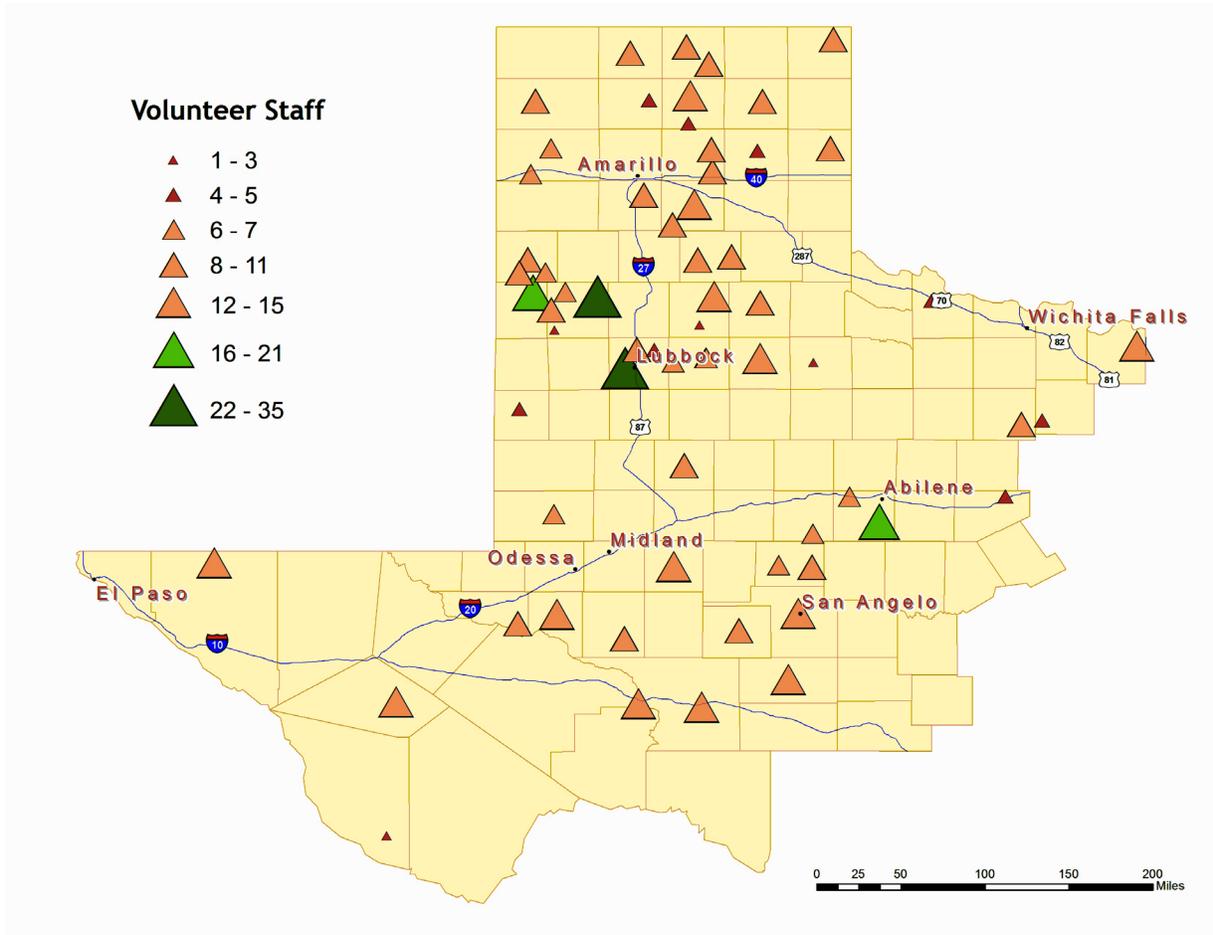


Figure 4: EMS Volunteer Personnel in West Texas

¹⁶ Texas Department of State Health Services. *Texas EMS*, March-April 2012, p. 16. http://www.dshs.state.tx.us/emstraumasystems/Mag_MarApr12.shtm

¹⁷ Texas Department of State Health Services. *Texas EMS*, March-April 2012, p. 8. http://www.dshs.state.tx.us/emstraumasystems/Mag_MarApr12.shtm

Service Types

There are three major EMS service types in the State of Texas:

- o Basic Life Support (BLS) systems transport the sick or injured and have personnel and sufficient equipment for providing basic life support.
- o Advanced Life Support (ALS) systems, in addition to having BLS, have personnel and equipment to provide intravenous and endotracheal or esophageal intubation.
- o Mobile Intensive Care Units (MICUs) meet all BLS, ALS requirements and have sufficient personnel to provide cardiac monitoring, cardioversion, drug therapy, and two-way radio communication.¹⁸

A BLS unit may operate with an ECA or higher-level provider. An ALS unit may operate with an Emergency Medical Technician – Intermediate (EMT-I) or higher-level provider, and an MICU unit must always have a paramedic on the vehicle. Most emergency services register their units as BLS with higher capabilities. Registration is completed in this manner so that a service can use their unit in the event only an ECA is available. In the rural areas, paramedics are not always readily available, and some cover more than one county. One paramedic interviewed during the survey for this report stated that he drives from a major city to a very large county so the county will have coverage. It takes four hours, on rural highways, for this paramedic to get to the destination.

The EMS services within cities of West Texas are either hospital-based or part of a fire department; subsequently, they have more access to updating equipment.

The total number of services for West Texas is 196 according to DSHS. We were able to contact 176 services of which 91 are municipal (mostly in urban areas), 52 are volunteer, 7 are municipal with volunteer, 25 are private, and 7 are air ambulance services as seen below in Figure 5.

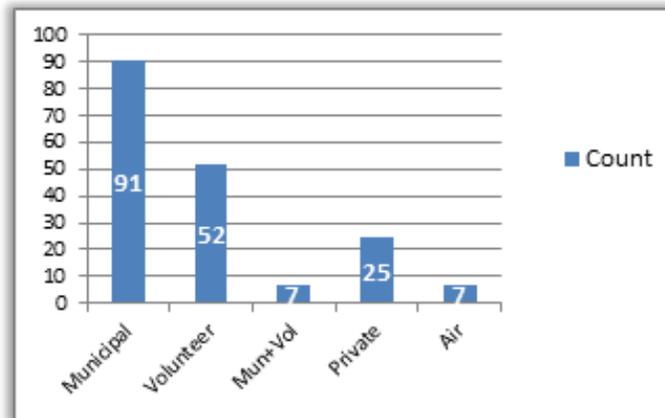


Figure 5: Count of EMS Services in West Texas

¹⁸HEALTH AND SAFETY CODE, CHAPTER 773. Emergency Medical Services; Subchapter C Licenses, Certification, and Qualifications. <http://www.statutes.legis.state.tx.us/Docs/HS/htm/HS.773.htm>

Other EMS providers that might be available in a crisis include EMS trained staff from oil refineries, some private companies, Big Bend National Park Rangers, and the Border Patrol Search Trauma and Rescue (BORSTAR). Some oil refineries have in-house EMS services and small triage areas for injured workers' care until they can be transported to a higher level of care.

BORSTAR is the division of the U.S. Border Patrol's search, trauma, and rescue teams serving the West Texas border area. BORSTAR's industrial ambulance aids the border areas of West Texas where there is no EMS service. They will also aid in the event a service cannot travel by road due to rugged conditions or if there is a need for other special equipment. BORSTAR is nationally headquartered in El Paso, Texas.

Big Bend National Park, located in Brewster County, has an internal EMS service for the park and an available heliport, which in certain crisis events may be available to the outlying communities of Brewster County. The local EMS and park rangers work together when EMS air transport is required.

Private EMS companies are another option utilized in some areas, often contracted by public entities to be the primary 911 service, and in some cases to cover prisons in West Texas.

In many counties, EMS services are part of the fire department or other municipal service.

Funding

EMS funding in Texas is very complex. Funds come from many sources and are dispersed through the Comptroller's Office.

According to DSHS:

Funding is dependent on the amount of money available in the accounts and calculation of the funding formula. The formula includes trauma service area's geographic size, its population, and the number of eligible emergency healthcare runs (trauma AND medical) submitted to the DSHS State EMS/Trauma Registry. The total allotment available for fiscal year 2012 distribution was \$2.99 million.¹⁹

Some of the sources for these funds come from:

- o The Driver's Responsibility Act
- o A Tobacco Settlement with the American Tobacco Company
- o 911 Equalization Surcharge
- o DUI and DWI conviction Surcharges
- o State moving violation fines

¹⁹Texas Department of State Health Services. *FY13 EMS allotment allocation eligibility table*.
<http://www.dshs.state.tx.us/emstraumasystems/SB102Elig.shtm>

Money from the above stated funds is also set aside in an Extraordinary Emergency Fund in the event there is an unexpected emergency. DSHS receives the funds and disperses them to Regional Advisory Councils (RACs).

A RAC, according to Texas Administrative Code 157.123(c), is defined as:

An organized group of health care entities and other concerned citizens who have an interest in improving and organizing trauma care within a specific Trauma Service Area (TSA). RAC membership may include hospitals, physicians, nurses, EMS providers, rehabilitation facilities, dispatchers, as well as other community groups. Each RAC develops, implements, and monitors a regional emergency medical services (EMS) trauma system plan. This plan facilitates trauma and emergency health care system networking within a TSA or a group of TSAs. All of the counties in the state have been grouped into twenty-two TSAs, lettered 'A' through 'V'. The TSAs are multi-county and each contains a minimum of three counties. The state EMS/Trauma System is a network of the regional systems or a network of the TSAs. Each RAC must adhere to 501(c) (3) regulations.²⁰

There are 22 RACs in Texas and 8 in the West Texas area.

Each individual EMS service who receives RAC money is required to belong to a RAC. Some services do not qualify for RAC money because they cannot attend the monthly meetings due to lack of personnel or driving distance. One EMS service that participated in the survey stated they attend meetings through a webinar. This enables all members to participate and not miss available funding. Of EMS services surveyed, 135 received RAC funding.

Grant money is available from Texas A&M University Engineering Extension (TEEX) through the National Traffic and Highway Safety Administration (NTHSA) and is designated for rural areas. The DSHS offers the Local Project Grant (LPG) once a year for EMS services to buy equipment. This is a matching grant, and it is difficult for some providers to meet the match requirements due to a lack of available funds. Of EMS services surveyed, 21 receive TEEX funding and 33 receive LPG grant funds.

Some oil and gas companies give small donations and occasionally help buy emergency equipment. Some services depend on private donations from deceased community members, private family foundations, and farmers. According to information garnered from the survey, local farmers have been known to help with fuel costs in some areas of West Texas.

²⁰ Texas Department of State Health Services. *RAC Operation Guidelines*, p. 1.
<http://www.dshs.state.tx.us/emstraumasystems/RACOpGuidelines.shtm>

Revenue from collection and billing could be a valuable source of income. Many counties in West Texas are considered “Super Rural” by the Centers for Medicare and Medicaid (CMS). CMS pays a higher reimbursement for super rural areas. The caveat to this is that the services need personnel with the expertise to properly code billing forms. Due to a lack of qualified EMS billing personnel, another EMS service or private billing service may be required to do the billing for them. According to an interview with a Certified Ambulance Coder (CAC) and discussion with EMS services, CMS makes it very difficult to obtain reimbursement and denials are frequent.

Education and Training

On January 1, 2013, Texas mandated a rule that all paramedics be required to go through a two-year college accredited program. All Texas EMTs, EMT-Is, and paramedics are tested through the National Registry of Emergency Medical Technicians (NREMT). DSHS continues to keep track of licensure and maintains the state registry.

The NREMT has created change in reciprocity. According to an article in the March/April issue of *EMS Texas*, if an EMS provider is attending an out-of-state training program it must be accredited by the Committee on Accreditation of Educational Programs for the Emergency Medical Services Professions (CoAESMP) in order to gain reciprocity in Texas. The estimated cost of a two-year education for a paramedic degree at South Plains College (SPC), a West Texas community college, is approximately \$8,000 for in-district students and \$9,000 for out-of-district students. This associate degree will net the student approximately \$35,000 annually. Offered in other colleges around Texas, the estimated educational cost of a Registered Nurse (ADN-RN) in a three-year RN program is approximately \$8,500 for in-district students and \$11,500 for out-of-district students, with an estimated return of \$65,000 annually.²¹

According to the Commission on Accreditation of Allied Health Education Programs, (CAAHEP) West Texas currently has four accredited schools for paramedics. Currently there are three West Texas paramedic schools in the process of seeking initial accreditation by the Commission on Accreditation of Educational Programs for Emergency Medical services Professions (CoAESMSP). They are located in El Paso, San Angelo, and Odessa. Many survey respondents from rural counties voiced concerns about the cost of tuition, travel distances, schedule conflicts with their paid jobs, and having to leave their community with no one to cover their service area.

At present, Amarillo College is the only accredited paramedic school in the Texas Panhandle region. Outlying Panhandle counties, such as Dallam County (85 linear miles away) and Lipscomb County (125 linear miles away), require significant travel to Amarillo College for paramedic training. The next closest accredited school is South Plains College in Hockley County.

²¹Texas H.O.T. Jobs. <http://www.texashotjobs.org/>

Gaines County is 72 miles away from SPC and King County is 122 miles from the college.²² The other two accredited paramedic schools in West Texas are located in Taylor County at Texas State Technical College, and in Midland County at Midland College.²³

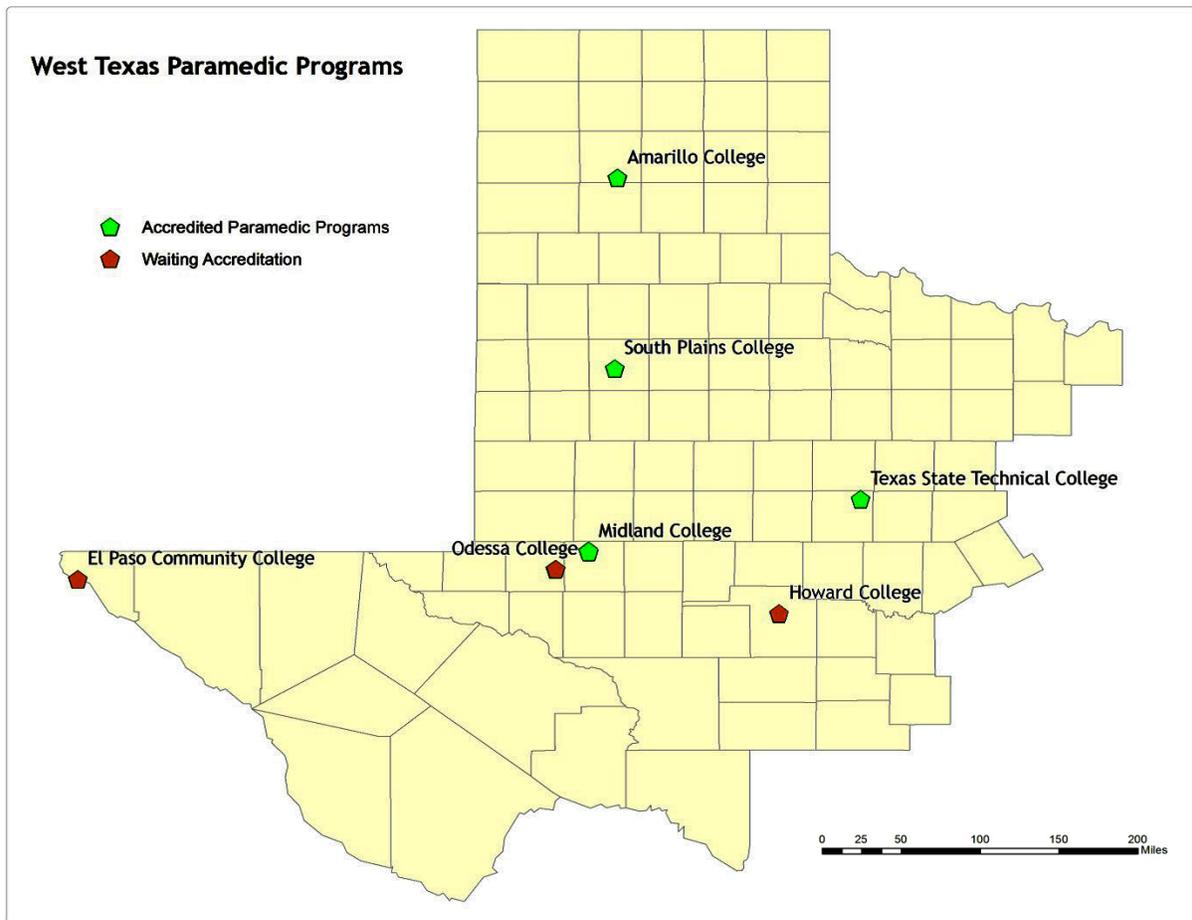


Figure 6: Accredited Schools Offering Paramedic Programs in West Texas

Distances between service locations, educational facilities, and a new training law, led one paramedic to state, “We will never get another paramedic unless they move into the town.” Areas that have oil and gas drilling, or wind farms, often need MICU capable trucks due to the nature of the injuries. MICU capable trucks require a paramedic aboard. Many of these areas only have a rural health clinic or no medical care at all and depend on a paramedic for primary care and more than just transport.

The State of Texas has made some training available, and Texas is starting to recognize the difficulty in rural areas. To allow communities to function with some EMS care, they passed HB 2446 in 2001. This bill stated that Texas would provide or facilitate ECA training if it was unavailable as stated above through grant funding.²⁴

²²ESRI, Tele Atlas North America, Inc., Department of Commerce, Census Bureau, United States Department of Agriculture (USDA), National Agricultural Statistics Service (NASS).

²³Commission on Accreditation of Allied Health Education Programs. <http://www.caahep.org/Find-An-Accredited-Program/>

²⁴Texas Department of State Health Services (2012). *Training funding*. <http://www.dshs.state.tx.us/emstraumasystems/TrainingFunding.shtm>

South Plains EMS (SPEMS), located in Lubbock, provides Continuing Education (CE) in the West Texas area. They do training at conferences and as part of their member services. EMS providers, however, may not be able to attend these continuing education sessions due to the distances from their service areas. The TEEEX, which is facilitated by Texas A&M University, is a program to aid EMS workers in educational needs. The TEEEX, in conjunction/cooperation with the Texas Department of Transportation (TxDOT), is committed to improving pre-hospital care and emergency medical response in rural and frontier areas of Texas. The goal of Rural/Frontier EMS Education Funding is to improve accessibility of training in these areas and EMS involvement in local communities. Through this program, TEEEX can assist agencies and departments with initial EMS training, refresher training, continuing education training, and/or instructor training.²⁵

According to the 176 West Texas EMS services surveyed, 44 provided basic, 39 provided moderate, and 75 provided comprehensive continuing education in-house.

Funding in support of these efforts comes from the National Highway Traffic and Safety Administration (NHTSA). The money is dedicated to reducing fatalities on rural and frontier roadways by targeting highway traffic safety issues. Training is available through the RAC, online webinars, and sometimes in collaboration with other EMS agencies.

Some major oil companies offer dual training in a few communities to ensure workers have knowledge related to EMS procedures and incidents that can happen around oil field drilling. (See Figure 7 below).

| Dual Training | |
|---------------------------------|--|
| Oil and Energy Companies | <ul style="list-style-type: none"> ○ Oxi-Petroleum- Levelland/Cochran area ○ Shell Wind Energy- Bordan area ○ Chevron- Levelland/Cochran area ○ Devon Energy- Midland area |
| Chemical Companies | <ul style="list-style-type: none"> ○ Reagent Chemical- Midland area |

Figure 7: Companies Offering Dual Training in West Texas

²⁵TX-DOT EMS education grants program. (2013, March 19). http://teexweb.tamu.edu/file/ESTI/EMS/TXDOT/FAQ_FY2013_EMS_grant.pdf

Ambulances and Equipment

All ambulances must meet minimum standards in accordance with Texas Health and Safety Code 773.050. As stated in the Safety Code, “Each basic life-support emergency medical services vehicle, when in service, must be staffed by at least two individuals certified as emergency care attendants or certified at a higher level of training.”²⁶

Based on information obtained from the survey, ambulances in many rural areas of West Texas are in poor condition and not up-to-date with current technology.

Ambulances are required to be insured, and owners must pay a state fee for motor vehicle liability insurance, maintain professional liability insurance (PLI), have vehicle titles, a medical director, and meet all requirements listed in the Texas Health and Safety Code as it pertains to the type of service they are.

For each type of service, there is a list of supplies that is necessary by state law to run a truck. This list also includes various supplies such as stretchers, EMS equipment and supplies, pharmaceuticals, medical devices, parenteral solutions, oxygen, airways, suction, cervical immobilizers, splints, blood pressure cuffs, and numerous other supplies.²⁷

There are 539 ambulances in the 108 county area of West Texas. The production years of the ambulances range from 1986 to 2013. According to information gathered from the survey, due to funding, ambulances in rural areas tend to be fewer in number and older than ambulances in urban areas. (See Figure 8). Urban emergency services have more stations and vehicles.

Some services have ambulances that are brand new, and some have had to refurbish their existing ones. Due to a lack of funds to pay for maintenance, the EMS services surveyed expressed concerns regarding wear and tear on the vehicles that are a direct result from the distances often traveled on less than quality road surfaces.

According to the survey, the combination of distance and lack of vehicle maintenance leads to breakdown issues during transport. There were numerous instances reported in the survey where an ambulance broke down during transport to a facility because of their vehicle condition.

²⁶HEALTH AND SAFETY CODE, CHAPTER 773. Emergency Medical Services; Subchapter C Licenses, Certification, and Qualifications <http://www.statutes.legis.state.tx.us/Docs/HS/htm/HS.773.htm>

²⁷Texas Administrative Code, CHAPTER 157, Emergency Medical Care; Subchapter B Emergency Medical Services Provider Licenses, Rule 157.11. [http://info.sos.state.tx.us/pls/pub/readtac\\$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=25&pt=1&ch=157&rl=11](http://info.sos.state.tx.us/pls/pub/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=25&pt=1&ch=157&rl=11)

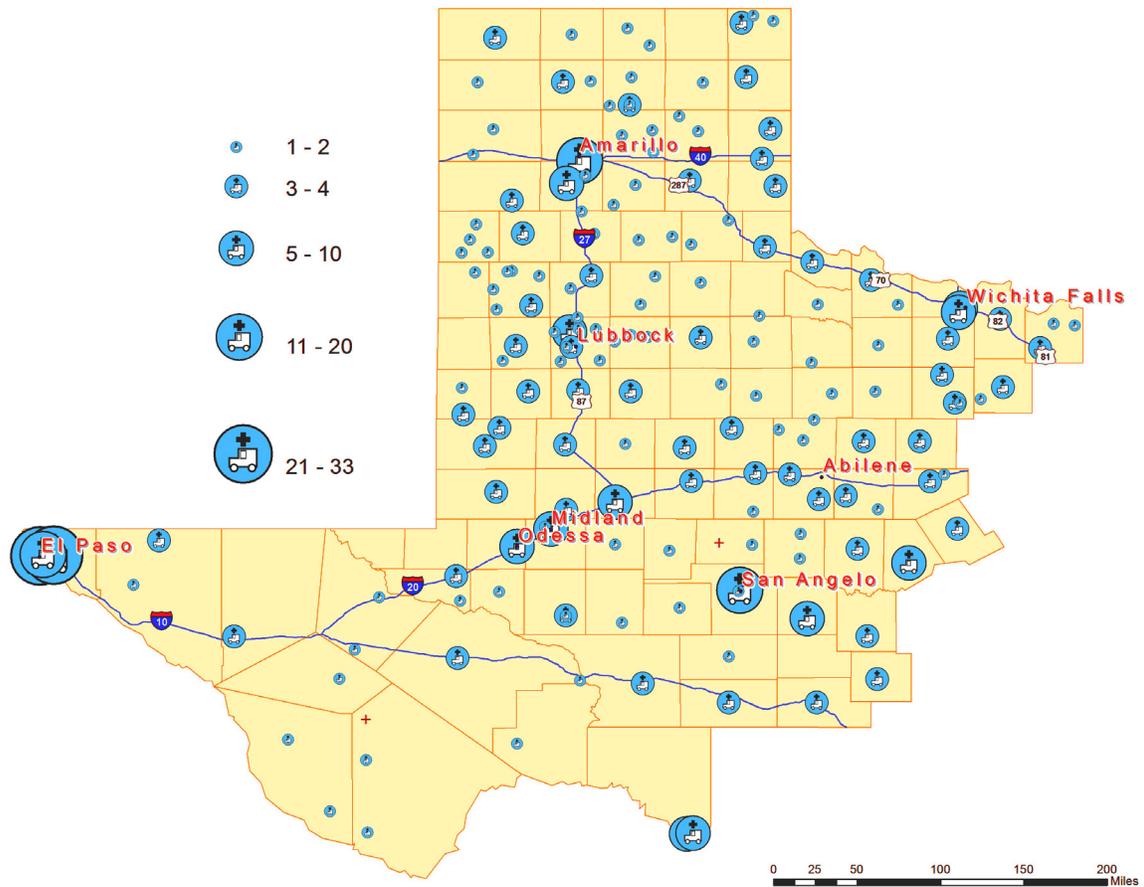


Figure 8: Ambulances in West Texas

Emergency Medical Task Force (EMTF)

Texas has put into place an Emergency Medical Task Force (EMTF). An EMTF is used when there is a mass casualty incident. This force consists of eight regions statewide. The main portion of TTUHSC service region is covered by EMTF Regions 1, 2, and 9. Val Verde County, also in TTUHSC region, is covered by Region 8.

Mass casualty incidents (MCIs) are not uncommon in rural areas. A nationwide survey of rural hospital emergency departments conducted in 2006 found that more than one-third of those responding had been overwhelmed by what they classified as an MCI at least once within the prior two years, and more than half reported activating their disaster plans within the prior two years.²⁸

²⁸Viwanathan, K., Wizemann, T., Altevogt, B., & Rapporteurs, (2011). *Preparedness and response to a rural mass casualty incident: Workshop summary*. Forum on Medical and Public Health Preparedness for Catastrophic Events; Institute of Medicine. <http://www.dhs.wisconsin.gov/preparedness/pdfs/hospprep/ruralmci.pdf>

An EMTF consists of an Ambulance Bus (AMBUS), Mobile Medical Unit (MMU), Ambulance Strike Team (AST), AMBUS Strike Team (AST), and a Registered Nurse Strike Team (RNST).

The TTUHSC service region is covered by seven Ambuses and four MMUs. These units are distributed across a vast amount of land and located in major cities. There are three buses in Arlington, located in EMTF-2; two in San Antonio, located in EMTF-8; one in El Paso, located in EMTF-9; and one in Lubbock, located in EMTF-1. Each location has one MMU. If there is a casualty incident in Hutchinson County, it is 160 linear miles from Lubbock to Hutchinson County. It is 238 linear miles from El Paso to Brewster County, and 170 from San Antonio to Val Verde County.²⁹

Communication Issues

In 1968, the first 911 system was installed in Alabama as a means of communication for someone with an emergency to access a police station or EMS. The wireless communication public safety act mandated the digits 9, 1, 1.³⁰

According to DSHS, “In 1987, House Bill 911 was passed, forming the Advisory Commission on State Emergency Communications (911 Commission). Their primary role is to facilitate the implementation of the use of 911 in Texas. This has eventually made public access to EMS available statewide and much easier.”³¹

In Texas, the Commission on State Emergency Communications (CSEC) is the governing entity over 911. CSEC oversees and funds the 911 system.

In some instances of emergency calls, the rural EMS providers travel 77 to 100 miles to the nearest trauma facility. An ambulance run may take from five to six hours round-trip in some areas. Often they are medical runs, such as transporting an ill or injured patient from one health care facility to another, rather than an emergent transport. In 2006, the University of Texas Medical Branch, in conjunction with the East Texas Area Health Education Center, conducted a pilot study on Emergency Medical Services Dispatch Resource Centers. The study, approved by the Texas Legislature (SB 523), was to evaluate the efficiency of emergency medical dispatchers located in regional dispatch resource centers. Emergency medical dispatchers were to serve as a resource in providing pre-arrival instruction to the 911 caller. The pilot study appears to support the idea that better trained dispatchers equal a better outcome for the patient, as stated in the following excerpt from the project findings:

²⁹ESRI, Tele Atlas North America, Inc., Department of Commerce, Census Bureau, United States Department of Agriculture (USDA), National Agricultural Statistics Service (NASS).

³⁰9-1-1 National Emergency Number Association. *9-1-1 facts*.
<http://web.archive.org/web/20080804001221/http://www.nena.org/pages/ContentList.asp?CTID=22>

³¹Texas Department of State Health Services (2013). *EMS communications in Texas*.
<http://www.dshs.state.tx.us/emstraumasystems/eemscmm.shtm>

Urban settings usually have well-developed technology-based dispatch systems staffed by trained dispatchers. Rural EMS infrastructure usually results from the well-intentioned efforts of dedicated local individuals who are compelled to work with a wide range of conditions to create a response system defined by availability of local resources, including personnel, equipment, training, administrative hierarchy, and leadership interest. This engenders a wide range of technical sophistication, administrative proficiency, and basic service effectiveness. Rural EMS systems range from the use of a minimally trained individual who answers the phone and dispatches a first responder for any request, to fully trained dispatchers who use computer-based algorithms and patient care protocols to assess the call and specifically dispatch emergency care providers.³²

West Texas is at a cellular communication disadvantage due to the lack of communication towers, support of 4G communications, inaccurate mapping, geography, and a shortage of well-known, widely dispersed landmarks.

An online 911 magazine stated, "...in the State of Texas, 85 percent of supporting 9-1-1 address data was found to have some degree of error, according to a 2011 report from the Communications Security, Reliability and Interoperability Council."³³

There are counties in West Texas that have "dead areas" where cell service is unreliable. Some West Texas counties have no 911 service due to the lack of 24-hour EMS coverage. To compensate for the lack of 911 services, they carry radios that use various low technology "patches" to help with radio transmission. They depend on the adjacent counties to take their calls, and they page responders in the county without 911 service. For example, in one instance, a county is fully equipped with MICU capabilities and has three paramedics, but does not have 911 services and must depend upon the adjacent county to forward their calls and activate the EMS system. Counties with 911 services, who get the 911 calls, do their best to contact the closest county with available and appropriate EMS resources. EMS services and their communities in these situations have made many provisions to address the problems of communication issues. Many resourceful and original ways to communicate have been enacted. One local store hands out refrigerator-magnets with phone numbers to inform hunters how to get EMS help when in the remote areas surrounding the community.

³²*Emergency medical services, S.B. 523: Emergency medical services dispatch resource center pilot project: Report to the Texas legislature prepared by East Texas Area Health Education Center Division of Community Outreach (November 2006).* Office of Community Health Services, The University of Texas Medical Branch, Galveston, Texas. <http://txaheceast.org/Portals/0/EMS%20Dispatch%20REPORT%20final.pdf>

³³Cramer, R. (2011, October 06). The underlying problem with 9-1-1: Rescuers can't help citizens if they can't locate them. *9-1-1 Magazine*. <http://www.9-1-1magazine.com/Cramer-Underlying-Problem-911>

Air Medical Transport

Due to the distances between services and the lack of service in some areas, many EMS services depend on air medical transport to get patients to health care facilities. Many services have access to air transport, but there are still services in West Texas that do not. Calls to 911 do not go directly to air ambulance services; they go to the local law enforcement and EMS services. At that time, the aircrew is notified, and they engage a helicopter or an airplane. Lift-time for a helicopter is seven minutes. When EMS arrives at the scene, they will evaluate whether a helicopter is warranted. This costs time for patient care but is the most efficient way to move the patient to a higher-level facility.

There are heliports at most of the major hospitals, at some national parks such as Big Bend National Park, and at local airports. If there is not a permanent helipad near an accident site, the Department of Public Safety sets up a landing area before air services arrive on the scene. In West Texas, there are fewer DPS stations making troopers less available, affecting the ability to prepare for air services at a scene.

With the world's largest and continually growing wind-farm industry in West Texas, job-related injuries happen in rural areas, and it can be more difficult to land close to the site of an accident. The helicopter needs a minimum of 100' by 10' safe clearance to land. One county, which is about 1,000 square miles, has landing pads in the four corners of the county. Weather issues in West Texas, particularly the high winds, may also adversely affect air ambulance work. The Federal Aviation Administration works closely with air medical services and is notified as soon as a helicopter is launched.

AeroCare is one example of the helicopter and fixed wing plane air ambulance services covering West Texas. They are MICU capable and have the ability to insert chest tubes and do pericardio-centesis, among other things. They have cardiac monitors, ventilators, defibrillators, EKG machines, and all DSHS required equipment on their air units.

Since there are few helicopters in West Texas, the EMS services will triage and call air units from other areas to respond when necessary.

Air service could be vital in areas in West Texas that have no EMS coverage or when the driving time to a facility is more than an hour. If someone is driving on I-10 in certain areas of West Texas, there is a 200 to 300 mile gap in EMS coverage. It may take a service over an hour or two to get to that person.

In rural areas, helicopters and fixed wing planes are the best way to transport patients. They can transport a patient to a facility in half the time of an ambulance because they do not have traffic issues and can do door-to-door transporting.

West Texas has twelve air ambulance helicopters, including one based in Clovis, New Mexico, and seven fixed wing planes. There are air ambulance helicopters stationed in Amarillo, Brownwood, Big Spring, San Angelo, Dalhart, Gray, Pampa, Lubbock, Fort Stockton, Odessa, Seminole, Wichita Falls, and Abilene.

According to the online website *AirNav.com*, a data website for aviation information, there are 458 heliports in Texas; 29 of those are in the TTUHSC region.³⁴

The fixed wing planes in West Texas are stationed in Lubbock, El Paso, Dalhart, Childress, and Pecos.

These fixed wing planes are MICU capable and can provide insertion of chest tubes, central lines, and do pericardio-centesis. They can carry all classes of medical drugs, an ultrasound unit, and a portable Arterial Blood Gas (ABG). They are also capable of doing chemistries, fetal monitoring, and are equipped with intubation equipment.

Due to the distances that a helicopter may have to fly, it may not be able to cover the vast distances in certain parts of West Texas without refueling. In these cases, a fixed wing airplane, or much larger helicopter is essential.

Aircraft manufacturers, in accordance with the Federal Aviation Administration (FAA), have to meet standards for each aircraft. The aircraft has to meet certain physical and balance criteria. The FAA puts weight limitations on an aircraft. If the air medical aircraft is a small model, it is limited by the total weight/volume of the patient, equipment, personnel and fuel. Therefore, it may need to be refueled before it returns to its original destination. It is the pilot's responsibility to know these constraints.³⁵

In some remote areas, such as Presidio, Brewster, Pecos, Culberson, and Hudspeth counties, a small aircraft may find it more difficult due to the distance and fuel constraints on a mission.

According to online news sources, such as *EMSWorld*, there have been helicopter crashes due to the aircrafts running out of fuel, weather factors, and other conditions. The FAA requires that all planes and helicopters have a designated alternative route in place in case of bad weather or other factors. If a helicopter picks up a patient in Dallam County and needs to bring that patient to North West Texas hospital in Amarillo but cannot travel that route due to bad weather, they may have to reroute to Oklahoma or Colorado. In this event, they may not be able to get to the destination due to lack of fuel. Fixed-wing planes and larger helicopters are capable of carrying more fuel and weight. Unfortunately, there are few fixed wing air ambulances in West Texas. If one of the fixed wing aircraft is out on a call, then either a helicopter would try to respond to an emergency or the patient may not be able to have transport until the plane becomes available.

³⁴ *Airnav.com; Browse heliports; United States of America; Texas.* <http://www.airnav.com/airports/us/TX?type=H&use=R>

³⁵Cliff McGee, Federal Aviation Administration, Southwest Region. (2013).

³⁶Texas careflight helicopter crash injures three. (2012, October 1). *EMSWorld.com News.* <http://www.emsworld.com/news/10796784/texas-careflight-helicopter-crash-injures-three>

A report, based on special investigation results, published in 2010 by the Department of Transportation's Federal Aviation Administration agency states:

In 1988, the National Transportation Safety Board (NTSB) conducted a safety study of emergency medical service operations that examined 59 accidents. This study determined that the accident rate for helicopter air ambulances was almost twice the estimated accident rate of non-scheduled part 135 helicopter air taxi operations, and were 3.5 times more likely to be fatal. The NTSB found reduced visibility to be the most common factor associated with such crashes.³⁷

In January 2006, the NTSB conducted a special investigation of emergency medical services operations. An investigation was conducted and issues were reported to the FAA. In February 2009, the NTSB held a public hearing on "Helicopter Emergency Medical Services" to examine the safety issues associated with these operations. Testimony was gathered from several agencies involved in air medical transport. They included, but were not limited to hospitals, manufacturers, operators, and government officials. Post-hearing, the NTSB issued a series of safety recommendations based on the findings. At that time, the FAA did not find the NTSB recommendations warranted any further rule making.

The NTSB also made recommendations to public aircraft operators, the Federal Interagency Emergency Medical Services Committee, and the U.S. Department of Health and Human Services' Centers for Medicare & Medicaid Services.

Due to its investigations and studies, the NTSB identified several probable causes of helicopter accidents, such as spatial disorientation, lack of general awareness, loss of control, poor decision-making, failure to maintain clearance of obstacles, inadequate planning, and improper execution of standard operating procedures. As a result of the findings, rules were put into place.

In some areas of West Texas, it may take a helicopter an hour from the time of launch to transport a patient to a facility. In some areas, the ambulances bring the patient to the helicopter or fixed wing aircraft, yet it may still take 45 minutes for transport time. In one county in the Texas Panhandle region, near a refinery, it takes a helicopter 60 minutes to get a patient to a Level II trauma facility. If the weather is a trying factor, the time is longer.

To give an example of some flight coverage areas of EMS, the following map (*Figure 9*) is a representation of two emergency medical air services' coverage in West Texas. The services are based out of Amarillo, Texas, and Lubbock, Texas.

³⁷Federal Aviation Administration (FAA). (2010). *Air ambulance and commercial helicopter operations, part 91 helicopter operations, and part 135 aircraft operations: Safety initiatives and miscellaneous amendments*. <http://www.regulations.gov/#!documentDetail;D=FAA-2010-0982-0001;oldLink=false>



Figure 9: Flight Coverage Areas in West Texas

Source: AeroCare of Lubbock, Texas

EMS Provider Trauma

According to the CDC, EMS work can be a hazardous profession. Workers are exposed to bio-hazards, infectious illnesses, heavy lifting, and other injuries. Research has shown EMS workers have an increased rate of fatal and non-fatal injuries.³⁸ Discussing stress and mental health in the EMS profession, an online article on *EMSWorld.com* states:

³⁸(2012). Emergency medical services workers. Centers for Disease Control and Prevention: Workplace Safety & Health Topics. <http://www.cdc.gov/niosh/topics/ems/>

Many people, particularly those in the emergency and medical fields, go through emotional turmoil. In our careers in EMS we've had coworkers commit suicide and several partners with depression and alcohol abuse problems. In Melbourne, Australia, over 36 percent of paramedics suffer some form of depression. In the United States, the Chicago Fire Department experienced seven suicides in an 18-month period between 2007 and 2008. EMS workers are subject to the high use of 911 systems and relatively frequent exposure to stressful situations, such as abuse cases, assaults, motor vehicle crashes, deaths, and other factors. All of this places providers at high risk for emotional unrest and exhaustion, as they lack training on how to personally deal with emotional stress. Without intervention, mental and emotional fatigue can rapidly lead to burnout in a provider.³⁹

Critical Incident Stress Management (CISM) is defined as:

Any situation faced by emergency service personnel that cause them to experience unusually strong emotional reactions which have the potential to interfere with their ability to function either at the scene or later. All that is necessary is that the incident, regardless of the type, generates unusually strong feelings in the emergency workers.⁴⁰

Texas has CISM teams across the state. These teams are composed of mental health professionals, chaplains, and peers. They are available on a 24-hour basis. Trained CISM personnel may assist smaller EMS services if they are in need of assistance.

CISM goes from the pre-crisis phase to the post-crisis phase. It is comprehensive and applies to both large and small groups, individuals, communities, and families.

Methodology

For this report, a 23-point telephone survey was completed by personnel of the F. Marie Hall Institute for Rural and Community Health at the TTUHSC. Personal contact interviews typically have a better response rate due to direct communication. The survey consisted of questions including types of service, types of personnel, coverage area, wages, training, funding, equipment, and distance to facilities. Participants were informed of the purpose and assured personal anonymity.

Initially, an excel sheet of EMS services of Texas was downloaded from the Department of State Health Services (DSHS) website. All EMS Services from the 108 counties that make up the TTUHSC county service region were extracted from the DSHS spreadsheet containing all of Texas' 254 counties. The result was 196 EMS services in the TTUHSC region. (See Figure 5).

³⁹EMS World. (2012). <http://www.emsworld.com/article/10776875/are-you-under-stress-in-ems>

⁴⁰Texas Department of State Health Services, (2013). *Texas critical incident stress management (CISM) network; what is the Texas critical incident stress management (CISM) network?* <http://www.dshs.state.tx.us/mhsa-disaster/cism/>

Multiple attempts were made to contact all 196 services. Of the 196 services, seven did not fit the criteria of 911 services. Of the 196 attempted, 176 were ground EMS services, seven were flight services, and there was no response from six services.

Research on data and statistics was done using 2012 DSHS data and other sources no older than ten years from publication.

All maps were made using ERSI's ArcGIS Desktop Software. Basic county, road, and labeling map data were obtained from ArcGIS. Other data was obtained from DSHS and the survey responses.

The *Trauma Facilities, Stroke Facilities, and EMS Services map*, and the *Distance to Trauma Facilities map*, were plotted using the addresses of the facilities obtained from DSHS. The trauma facilities' names were obtained through the 23-point survey. Each EMS service was asked which facility they use for trauma. These services were re-called to obtain accuracy. When asked, each service reported the trauma facility they were most likely to use. The information used to create the distance lines on these maps were reported from the survey. Some EMS services did not use the closest facility to their station as represented on the map. (See *Figure 1: Trauma Facilities and Coverage Areas*).

For the coverage area map, a 35-mile diameter (961.6 square miles) with the EMS service as the center was used. The average coverage area was about 1,000 square miles. This map under-represents some EMS coverage areas due to cross-county mutual aid agreements.

ECA, EMT, EMT-I, P, LP were the personnel included in the count. Drivers were excluded since they are not always available and not state registered personnel. All paramedics (P and LP) were counted as one in the same. (See *Figure 3: EMS Salaried Personnel in West Texas*).

Each part-time person was counted as 0.5 personnel. As-needed personnel, such as PRNs, were not counted. (See *Figure 4: EMS Salaried and Volunteer Personnel in West Texas*).

The count of the ambulances was obtained from the survey for each EMS service and plotted on a map based on the reported count of the ambulances for each service.

Weaknesses of the report stem from a lack of vetted, uniform data, and information being obtained by word of mouth via local providers and other related parties.

Conclusion

EMS in rural West Texas is limited by funding, aging of or lack of equipment, distances, personnel, and failing road systems.

West Texas EMS services have a history of collaboration and mutual support across city, county, and even state boundaries.

EMS services are relatively widely dispersed, but often with thin coverage in areas where there is the greatest need. Great expanses of geography are often covered by a single, sparsely equipped EMS unit, manned by a few dedicated volunteers.

EMS services vary considerably across rural versus urban areas, with the urban areas enjoying better-supported services that result in newer, better-equipped EMS vehicles and salaried professionals who have better access to training.

Less populated, geographically large counties lead to an overall lack of available health care resources, including emergency physicians, trauma centers, and hospitals.

As West Texas continues to age and migrate from rural to urban living centers, and supports large numbers of industrial and traveling families co-existing on its roads, it is vital that the community at large look at the most efficient and innovative means to reduce the barriers to golden-hour care. This includes more use of air support, with on-the-ground telehealth access and better communication systems.

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Appendix A

Definitions

Advanced Life Support (ALS) – Emergency pre-hospital care that uses invasive medical procedures

Ambulance Bus (AMBUS) – A type of ambulance used to transport multiple patients who require ambulance level care

Ambulance Strike Team (AST) – A group of five ambulances of the same type with common communications and a leader

AMBUS Strike Team (ABST) – A group of multi-patient vehicles able to serve during State-tasks missions and in their home communities

Basic Life Support (BLS) – Pre-hospital care that uses noninvasive medical acts

Cardio pulmonary resuscitation - Emergency medical procedures for restoring normal heart-beat and breathing to victims of heart failure, drowning, etc.

Cardioversion – A procedure that can restore a fast or irregular heartbeat to a normal rhythm

Drug therapy – Use of medication to treat an ailment

Electrical cardiac defibrillation – Use of electric shock to make the heart start beating, or to correct abnormal heart rate or rhythm

Emergency Care Attendants (ECAs) – Provide initial aid to patients to promote comfort

Emergency Medical Task Force (EMTF) – A team of 10 Ambulance Strike Teams or less that function separately but have common communications capability

Emergency Medical Technician (EMT) – Provides initial care and basic life support; is specially trained and certified to provide basic emergency services before and during transportation to a hospital

Emergency Medical Technician- Paramedic – An individual EMT who has received additional training in Advanced Life Support

Endotracheal – A breathing tube inside the windpipe (trachea)

Esophageal intubation – Placing a breathing tube into the trachea to prevent aspiration and provide a secure airway

Hemorrhaging - Profuse bleeding from ruptured blood vessels

Intravenous (IV) therapy – The infusion of liquid substances directly into a vein

Licensed Paramedic (LP) – A specially trained medical technician licensed to provide a wide range of emergency services before or during transportation to a hospital

Mobile Intensive Care Unit (MICU) – A vehicle that is designed for advanced life support and has equipment and supplies to provide cardiac monitoring, defibrillation, cardio-version, drug therapy, and two-way communications

Mobile Medical Unit (MMU) – An easily transportable radiography unit designed for use outside

Paramedic – A person who is trained to do medical work but is not a fully qualified doctor; performs advanced life support

Registered Nurse Strike Team (RNST) – A group of five R.N. Strike Teams that have common communications with each other and other EMTF members

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