A Rural-Urban Comparison Of Prehospital Emergency Medical Services In Nebraska

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Abstract: ***Background:*** **Provision of emergency medical services (EMS) in the rural United States presents a unique challenge. While rural and urban EMS outcomes have been compared, differing urban-rural population characteristics and roles for rural ambulance teams can confound such comparisons.**

Methods: **A year-long study of the prehospital EMS was conducted in rural Richardson County, Nebraska. Data were collected on the age, sex, and race of patients, response time, transport distance, medical problems encountered, and treatment rendered enroute. These data were compared with those from an urban Lancaster County comparison group and statistical data from the Nebraska State Health Department.**

Results: **In the rural county, 70 percent of calls involved the elderly, whereas 38 percent of the urban calls and 36 percent of the Nebraska State calls involved the elderly. The rural ambulance service was more likely to provide for routine transfers, to involve patients with fractures and cardiorespiratory and neurologic problems, and twice as likely to result in hospital admission than was the urban ambulance service. The frequency with which advanced life support measures were applied in the rural area was similar to that in the urban area. The rural area response times were equivalent to the urban area response times after the rural area long-distance transfers were excluded. The location of service in the rural area was more likely to be the hospital or nursing home, whereas the urban location was more likely to be a home, on a highway, or in a public setting.**

Conclusions: **Prehospital EMS in this rural location involved a predominately elderly population with a large number of routine transfers linking the nursing home and community hospital. Further comparisons of rural and urban EMS outcomes should account for possible differences in type and severity of illness and type and location of service. (J Am Board Fam Pract 1991; 4:313-8.)**

Provision of emergency medical services (EMS) in the rural United States presents a unique challenge.[1-9] Several authors have investigated how trauma is handled in rural settings and concluded that regionalized and improved quality of EMS would save lives.[4-6] Specifically, helicopter transport[10] and crews trained to provide advanced trauma life support[11,12] and rapid defibrillation[13,14] could improve outcomes in rural areas. Quicker notification and response times and improved initial hospital management could also have a favorable impact on rural emergency outcomes.[8,15]

To plan appropriately for statewide EMS, it is important to compare and contrast urban and rural settings. Differing urban-rural population characteristics, including age, sex, race, severity of illness, and types of problems, can confound comparisons between rural and urban outcomes.[6,16] Moreover, rural ambulance teams not only provide acute critical care but also serve as an important nonemergency link among the nursing home, community hospital, and referral centers.[8] Thus, before rural and urban emergency outcomes can be appropriately compared, a better understanding of current rural EMS must be gained.

The purpose of this study was to compare Nebraska rural and urban emergency response times, distances, scene locations, and types of injuries encountered and treatments rendered. We hypothesized that rural EMS would serve an older population and provide more transfers over longer distances than would urban or statewide comparison groups.

Methods

A prospective survey of prehospital EMS was conducted in rural Richardson County, Nebraska,

Submitted, revised, 19 April 1991.

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Table 1. Characteristics of Emergency Medical Services Runs in Urban and Rural Nebraska.

Characteristics	Richardson County (Rural)	Lancaster County (Urban)	χ^2 (*P* Value)	*P* Value for Test of Proportions for $P_{rural} = P_{urban}$
Total runs	482	3586		
Crew size < 3 (%)	15	3		< 0.0001
Runs from 0000 to 0800 (%)	18	24		0.0024
Response time (minutes)				
To scene			6.9 (0.032)	
1–10	89	85		0.014
11–20	9	11		N.S.
> 20	2	4		0.016
To destination			187 (< 0.001)	
1–10	58	63		0.035
11–20	13	28		< 0.0001
> 20	29	9		< 0.0001
Scene distance (miles)				
0–10	90	N.A.		N.A.
> 10	10	N.A.		N.A.
Destination distance (miles)			571 (< 0.001)	
0–10	59	94		< 0.0001
> 10	41	6		< 0.0001
Scene location (%)			398 (< 0.001)	
Street or highway	9	24		< 0.0001
Home	32	51		< 0.0001
Hospital	34	9		< 0.0001
Nursing home	17	10		< 0.0001
Public setting	2	6		< 0.0001
Other	6	1		< 0.0001
Time at scene (minutes)			115 (< 0.001)	
1–10	73	47		< 0.0001
11–20	22	43		< 0.0001
> 20	5	10		0.0001

N.A. = Data not available or test not appropriate.

N.S. = Not significant.

which has a population of 10,200 and is in the southeastern corner of the state. The county has two population centers, each with a rescue squad, nursing home, and hospital: Falls City, the county seat (population 5300), and Humboldt (population 1100).

From 1 May 1988 to 30 April 1989, the ambulance crews of Richardson County completed encounter forms for each ambulance run. This form captured information on crew size, response times, scene and destination distances, scene location, time spent at scene, reason for run, and patient age, sex, race, problem type, treatments, and disposition. At the time of this study, there was no standardized, comprehensive, statewide EMS information system. The encounter form did not require the patient's identity and was easy for ambulance crew members to complete quickly. One instrument per patient per run was requested.

We compared results from Richardson County, when possible, with the 1987 summary data of Nebraska EMS patient encounter forms, as prepared by the Nebraska State Health Department, and with 6 months of data collected by Eastern Ambulance Service, the contract ambulance service for all of Lancaster County. Lancaster County has a population of 211,600 and contains the state capital, Lincoln, the second largest city in Nebraska. This urban comparison group was chosen because well-documented comparison data were available.

Table 2. Characteristics of Emergency Medical Services Runs in Urban and Rural Nebraska.

Characteristics	Richardson County (Rural)	Lancaster County (Urban)	Nebraska State	χ^2 (*P* Value)	*P* Value for Test of Proportions for $P_{rural}=P_{urban}$
Sex, female (%)	55	50	44	4.2 (0.039)	0.039
Race, white (%)	99	90	N.A.	42 (< 0.001)	< 0.0001
Age, years (%)				181 (< 0.001)	
< 1	1	1	1		N.S.
1–10	1	4	2		< 0.0001
11–64	28	57	61		< 0.0001
> 64	70	38	36		< 0.0001
Run type				9.8 (0.02)	
Vehicular trauma	8	18	13		< 0.0001
Nonvehicular trauma	10	14	15		0.012
Medical	29	64	35		< 0.0001
Emergency transfer	15	N.A.	5		N.A.
Routine transfer	36	N.A.	14		N.A.
False alarm	1	N.A.	16		N.A.
Other	1	4	2		N.A.
Problem type				23.5 (< 0.001)	
Fracture-laceration	16	9	8		< 0.0000
Head-neck injury	6	8	1		N.S.
Chest injury	1	N.A.	1		N.A.
Shock	5	N.A.	N.A.		N.A.
Wound-burn	1	< 1	< 1		N.S.
Cardiorespiratory	27	14	16		< 0.0000
Gastrointestinal	3	N.A.	3		N.A.
Neurological	15	7	6		< 0.0000
Treatments rendered				31.2 (< 0.001)	
CPR-defibrillation-MAST	3	2	2		N.S.
Extrication	1	< 1	< 1		N.S.
Oxygen-airway-intravenous access	42	45	47		N.S.
Spine precautions	20	39	30		< 0.0000
Disposition				298 (< 0.001)	
DOA-died in emergency department	4	N.A.	4		N.A.
Admitted ICU-CCU	8	34	12		< 0.0000
Admitted	75	38	33		< 0.0000
Discharged	1	14	44		< 0.0000
Other	12	14	7		N.S.

N.A. = Data not available or test not appropriate.
ICU-CCU = Intensive care unit or cardiac care unit.
N.S. = Not significant.
CPR = Cardiopulmonary resuscitation.
DOA = Dead on arrival.

We compared the rural and urban populations using a binomial test of proportions testing the probability that the rural and urban findings were the same. We also used chi-square testing for categorical data for groups of outcomes.

Results

From 1 May 1988 to 30 April 1989, there were 484 reported ambulance runs in Richardson County (all encounter forms were at least partially usable and were concordant with aggregate state information). This figure corresponds to 1 run per 22 people per year compared with the state average of 1 run per 40 people per year and 1 run per 29 people per year in urban Lancaster County. The average frequency of runs per day in Richardson County was 1.25, and there appeared to be no pattern to the calls with respect to day of the week.

Characteristics of the runs are summarized in Table 1. A crew of fewer than 3 was significantly more common in rural Richardson County. The

response times from receipt of the call for service to arrival at the scene were similar for the rural and urban ambulances; but reflecting longer final destination distances, the time to the final destination was significantly longer in the rural county. When transfers between facilities were excluded from all comparison groups, response times were not significantly longer in the rural areas. Statewide, the majority of initial patient contacts occurred at home, on a street or highway, and in a hospital; however, service in the rural area was more likely to be provided in the hospital or nursing home.

Characteristics of the patients, types of problems, treatments rendered, and disposition are presented in Table 2. The rural patients were significantly older, with 34 percent aged 80 years or more. In the rural county, vehicular trauma, nonvehicular trauma, and false alarms were less frequently encountered, whereas routine transfers occurred more frequently. Sixty-one percent of the patients attended to by the Richardson County rescue teams were taken to local hospitals in the area. Upon arrival, 83 percent of the patients were admitted to the hospital (20 percent for 24-hour observation), and 7 percent were transferred from the community hospital to a tertiary care center. Of the patients transferred, 22 percent went to metropolitan hospitals, 6 percent went to out-of-state hospitals, and 7 percent went to nursing homes.

The medical problems recognized and treated in Richardson County varied significantly from those in the state and Lancaster County. In Richardson County, 10 percent of the medical problems involved fractures, with at least 40 percent of those being fractured hips; patients with neurologic and cardiorespiratory problems were also significantly more common. The frequency of treatments was similar among the three areas.

Discussion

Prehospital EMS in this rural Nebraska county involved a predominately elderly population, and a great number of calls were for routine transfers between the nursing home and local community hospital. The transfer rate in Richardson County was higher than that reported in 1986 by Spear[6] for a 15-county area in the southeastern United States, perhaps because of the nature of the primary hospitals in the Richardson County area. The Lancaster County ambulance service was more likely to be called to the home (44 percent) or the street or highway (21 percent) compared with the Richardson County ambulance service. The location of the patient needing help reflected the significantly more acute medical calls (62 percent) and vehicular trauma calls (18 percent) reported in Lancaster County.

Moreover, neurologic problems, such as stroke and syncope, and cardiorespiratory difficulties were more common in the rural than in the urban setting, mirroring results of previous work reported from Texas and South Carolina.[8] These findings probably reflected the aged population of Richardson County. Because current education for emergency medical technicians (EMTs) offers little specific training in geriatrics, and because of the need for accurate on-scene assessments of such problems as syncope and falls, we recommend further training in this area.

Whereas the low numbers of transfers preclude accurate comparison of outcomes controlled for type and severity of illness, overall measures of quality were similar for both rural and urban areas. After long-distance rural transfers were excluded, the rural response times were equivalent to the urban times. It is important, therefore, to control for type of call when comparing urban and rural response times. Also, on average, urban ambulance crews spent more time at the scene than did the rural ambulance teams. This finding may reflect the requirement that paramedics radio in every call and the greater in-field assessment and treatment provided by urban ambulance squads. Donovan, et al.[17] found that compared with EMTs, EMT-intermediates spent significantly more time at the scene because they could place an intravenous catheter, but this procedure did not improve the chances of patients receiving intravenous medication within 10 minutes of arrival in the emergency department.

Crew size is important when providing rural emergency medical care. To handle complex cases or multiple victims, a crew size of more than 2 persons is preferred. Urban ambulance services often provide 3 crew members, but this level of staffing can be difficult to achieve in rural com-

munities. The outmigration of the young[9,18] and the failing health status of the rural elderly[19] place added strains on a largely volunteer EMS.[8] Although the majority of calls in Richardson County were for routine transfers, approximately 15 percent were for life- or limb-threatening conditions. In contrast to the study of Ornato, et al.,[16] which reported the use of defibrillation once every 5.6 years, the EMTs in Richardson County used their defibrillator three times in 1 year, presumably because of the older population served.

Several limitations of our study bear mention. First, the comparison among the rural, urban, and state statistics may be inaccurate because of differences in the data collection. The form used by the state and Eastern Ambulance Service was not the same as that used by the Richardson County ambulance service, but we took pains to construct parallel forms. Second, data collection by the Richardson County EMS may be biased or incomplete. Although we made every attempt to ensure accurate data collection, it is possible that unusually long runs or response times were purposefully withheld. Finally, our survey reported data on only a single rural county and used a limited comparison group. We do not know, therefore, whether these data can be generalized to other counties in the state or nation.

Nonetheless, our study findings highlight some of the challenges facing rural EMS: volunteer staffing, a large service area, a great number of routine transfers punctuated by emergencies, the potential for attrition of EMT skills, and a predominantly elderly population. Several approaches to the unique problems posed by rural emergency services should be explored. Enhanced training in geriatrics and fracture management, airway and arrhythmia management, as well as refresher courses in busier urban emergency departments, might better prepare EMTs. Cross-coverage among medical technicians, paramedics, and nurses might help alleviate personnel shortages. Finally, improved telecommunications, transportation, and linkages with other hospitals might address system issues in care. Further work should document the scope of rural EMS, compare outcomes when controlled for type and severity of illness, and explore the impact of enhanced training, increased personnel availability, and improved emergency medical systems.

We thank Annie Arington, C.N.A., E.M.T.-A., E.M.T.-D., and Allen Fankhauser, J.D., E.M.T.-A., E.M.T.-D., of Humboldt Rescue Service; Peter Beekmman, J.D., E.M.T.-A., of the Falls City Volunteer Ambulance Service; Michael G. Dodge of Eastern Ambulance Service; Alice L. Gorgen, R.N., E.M.T.-P., of the Advanced Emergency Medical Care Board and paramedic instructor at Creighton University for their help in data collection and Carol Gilbert, M.S., of the U.N.M.C. Department of Family Practice for her help in data analysis.

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