

# MOUNTAIN-PLAINS CONSORTIUM

PROJECT BRIEF | MPC 15-301 | December 2015

## Improving Rural Emergency Medical Services (EMS) through Transportation System Enhancements Phase II



### the **ISSUE**

Emergency Medical Services (EMS) is crucial in rural environments where hospitals are not close by and are difficult to access. Establishing performance measures is critical in improving a rural community's access to these services and eliminating systemic inequalities. However, an absence of quantitative performance measures challenges the development of attainable objectives.

### the **RESEARCH**

This study used the National EMS Information System (NEMSIS) South Dakota data to develop data-driven performance metrics for EMS. Researchers used the data for three tasks: geospatial analysis of EMS events, optimization of station locations, and service performance evaluation. The measures—timely service and service coverage—are both dependent on mobility and the accessibility of the transportation network. Service coverage is measured by the ratio of the number of emergency calls within the 8-minute travel time zone to the total number of emergency calls responded to by the EMS agency. Timely service is gauged by the percentage of emergency calls that were actually responded to in less than 8 minutes within the 8-minute zone. The results help to identify the specific areas for needed resources and training. If the service provided at the current capacity is not adequate, the EMS



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## Project Title

Improving Rural  
Emergency Medical  
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stations can either be relocated or augmented to increase coverage and quality. The bi-objective of maximizing ambulance coverage area and minimizing en route time has been established and solved by the genetic algorithm. Case studies were performed for counties under different constraints. Moreover, the factors contributing to en route time were thoroughly reviewed. Thirteen key variables were identified and their coefficients were estimated by the geographically weighted regression model.

## the **FINDINGS**

We discovered the clustering of 911 calls and confirmed the strong spatial association between 911 calls and EMS stations. To better evaluate the positioning and service of each provider, we developed two indexes to measure the 8-minute coverage ratio of each station and the percentage of events with an actual en route time less than 8 minutes. Next, we piloted the strategies for optimizing EMS locations for Todd County (high demand with few stations) and Minnehaha County (moderate demand with multiple stations). In general, the added equity has a negative effect on the coverage ratio, but it reduces the average en route time for uncovered areas. The trade-off is influenced by the proportion of call demand and supply. Finally, we found the geographically weighted regression model not only identifies statistically significant factors that affect service quality at the provider level, but also predicts a more accurate en route time.

## the **IMPACT**

Rural safety and health are vital for sustaining livable communities and are a strong indicator of social welfare and quality of life. The findings of this research can be used by policy-makers and service providers to establish simple, specific, and data-driven performance measures, to quantify and monitor service quality over time, to identify provider-specific or case-specific contributing factors that may hinder service efficiency, and to optimize limited resource to continuously provide quality and effective EMS to rural residents.

For more information on this project, download the entire report at <http://www.ugpti.org/resources/reports/details.php?id=837>

For more information or additional copies, visit the Web site at [www.mountain-plains.org](http://www.mountain-plains.org), call (701) 231-7938 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.



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