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## Urban Sprawl and Delayed Emergency Services Arrival

In medicine, the *golden hour* refers to the first 60 minutes immediately following traumatic injury. It is during this *golden hour* that medical treatment to prevent irreversible damage and optimize the chance of survival is most effective. To increase the portion of the *golden hour* injured persons spend at the hospital, Emergency Medical Services (EMS) personnel and equipment must arrive at the injury scene as quickly as possible. Researchers at the University of Alabama at Birmingham University Transportation Center (UAB UTC) are working to cut EMS response times in urban sprawl areas, where the Center learned response times are often double those found elsewhere.

Urban sprawl is an increasingly common development pattern in the United States, characterized by low-density construction, poor street connectivity, and single-use zoning (i.e., separation of residential and commercial areas). Urban planning and public health research show that urban sprawl increases trip distances and traffic density for personal automobile travel, which decrease travel efficiency. These findings led researchers to hypothesize that sprawl may also be associated with delayed EMS arrivals as well.



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**Urban sprawl results from the unplanned and uncontrolled spread of urban development into areas adjoining city confines.**

Through a recently completed research project, *Urban Sprawl and Pre-hospital Emergency Care Time*, Matthew Trowbridge, MD, MPH, and his team measured the relationship between county-level urban sprawl and EMS response times in the United States.

To accomplish this, Dr. Trowbridge used EMS response time data from the U.S. Department of Transportation's Fatal Analysis Reporting System (FARS) and a previously developed county-level sprawl index that is widely used by urban planning researchers. FARS is a nationwide motor vehicle crash data collection program that provides information on crashes in which at least

one fatality occurs within 30 days of the crash. FARS includes extensive data regarding the circumstances of each crash including location, road conditions, EMS notification time, and EMS arrival time at the scene. The sprawl index is based on more than 20 land-use characteristics drawn from the U.S. Census and other sources that reflect the residential density, segregation of land use, strength of metropolitan centers, and accessibility of the street network for the counties in which each crash occurred.

*This monthly report from the UTC Program highlights some of the recent accomplishments and products from one of the participating universities. The Program is administered by the U.S. Department of Transportation's Research and Innovative Technology Administration.*



*The views presented in the UTC Spotlight are those of the authors and not necessarily the views of the Research and Innovative Technology Administration or the U.S. Department of Transportation.*



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Using these data, Dr. Trowbridge determined urban sprawl to be associated with increased EMS response time and a higher probability of delayed EMS arrival following motor vehicle crashes. The probability of delayed EMS arrival is nearly twice as high in counties with prominent features of sprawl (low-density construction, limited street connectivity, and segregation of residential development from civic and commercial districts), compared to counties with less urban sprawl.



**Less expensive housing in areas of urban sprawl attracts lower income populations, including the elderly, who often have limited transportation options.**

Although the impact of unregulated sprawling development on the performance, efficiency, and cost of EMS has not been studied extensively, there are efforts to integrate population density and emergency event location factors into predictive models to guide EMS resource allocation. Findings from this study suggest that integration of more comprehensive land use metrics, like urban sprawl, into EMS dispatch algorithms could improve resource utilization and response reliability.

UAB UTC's confirmation of sprawl's association with increased EMS response time calls for consideration of land use and its potential impact on emergency care. The lagging of medical infrastructure behind residential development in sprawling suburban areas distances these communities from major trauma and tertiary care centers. Moreover, less expensive

home prices in sprawling urban areas tend to attract lower income populations, including the elderly, who often have limited access to transportation. Data have confirmed that both demographic groups are at higher risk for emergency medical issues and the need for EMS services. EMS service is increased per capita in the same sprawling areas where it is more difficult and expensive to provide.

Working to reconfigure street networks in existing suburban areas to reduce their sprawling characteristics will take time. In the interim, it is reasonable to consider reorganizing pre-hospital and hospital resources to better compensate for the impact of urban sprawl on emergency response. The results of this research, combined with information from other related UAB UTC-sponsored research projects, are being used to develop land use and public safety recommendations. It is expected that these recommendations will help change the way communities are planned and the way hospital and other health care resources are allocated (see also the April edition of *Spotlight*: "Improving Highway Safety by Identifying High Risk Rural Road Segments and Safety Countermeasures").

The UAB UTC is working to help achieve livable, sustainable, and healthy communities through projects like *Urban Sprawl and Pre-hospital Emergency Care Time* and other complementary research efforts. For more information about this project, or the other UAB UTC-sponsored projects, visit the UAB UTC website [www.uab.edu/utc](http://www.uab.edu/utc). ♻️

### About This Project

Russ Fine, Ph.D., MSPH, Professor of Medicine at the University of Alabama School of Medicine is the founding director and principal investigator of the University of Alabama at Birmingham's University Transportation Center (UAB-UTC). The "Urban Sprawl" project team was led by Matthew Trowbridge, MD, MPH, Assistant Professor, Department of Emergency Medicine, University of Virginia School of Medicine and the Center for Applied Biomechanics, University of Virginia School of Engineering. He was assisted by Matthew J. Gurka, Ph.D. and Robert E. O'Connor, MD, MPH. For more information on this project and other UAB-UTC projects please visit <http://www.uab.edu/utc>.

