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## *The Quality of Emergency Medical Services*

Editor's note: Although Emergency Medical Services (EMS) is a crucial part of the health care system, there is relatively little research on the quality of those services. EMS agencies often measure their performance using criteria such as response time or total prehospital time. But larger scale studies that cross counties and providers are rare. This Issue Brief summarizes two studies that use comprehensive, longitudinal data from one state to assess the demographic, geographic, and professional factors that affect EMS performance.

### *The goal of EMS is to transport patients to definitive care as soon and as safely as possible*

EMS networks respond to, stabilize, and transport patients experiencing acute medical symptoms or trauma. They play a pivotal role in saving lives and ensuring timely transport of patients in need of advanced medical care.

- EMS systems provide prehospital care for more than 18 million patients each year. The systems vary in their ownership, structure, and personnel, but their goal is the same: to get patients to definitive care as soon and as safely as possible. Transport services are provided by fire department agencies, private ambulance services, or hospital-based agencies.
- Response time (time from initial dispatch to arrival on the scene) and total prehospital time are recognized quality measures in EMS. For example, faster response times generally improve a patient's likelihood of surviving an out-of-hospital cardiac arrest. For trauma patients, the first hour of care (also known as the "golden hour" from incident to hospital treatment) is usually considered critical.
- Despite general agreement on these process measures of EMS quality, little is known about the factors that affect quality. Do more experienced or skilled personnel provide higher-quality care? Are county-level characteristics, such as population density, racial composition, or income, associated with performance? Are there racial disparities in the process or outcomes of EMS?

### *Studies investigate provision of EMS in one state over a decade*

David and colleagues used longitudinal data from Mississippi to assess characteristics that affect the process and outcomes of EMS care. Mississippi has systematically collected data on EMS incidents through its information systems since 1991.

- The data include detailed information on each incident, including response time and total travel time; race, age, and sex of the patient; when and from where the emergency call was made, and the condition/diagnosis of the patient.

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- The data also include information on the type of personnel who respond. Three levels of training exist: Emergency Medical Technicians (EMT)-Basic, EMT-Intermediate, and EMT-Paramedic. Having the most advanced skills, only paramedics can give shots, start and manage intravenous lines, and provide advanced life support.

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### ***Study analyzes racial differences in EMS care***

David and Harrington analyzed the existence and scope of possible racial disparities in EMS care in Mississippi during 1995-2004. They focused on emergency calls for chest pain and cardiac arrest, for which rapid response time, advanced technology, and skilled paramedics are important dimensions of quality.

- The study included nearly 120,000 heart disease-related EMS episodes. These calls are always treated as emergencies and require a team with advanced life-support capabilities.
- The investigators looked at two important process measures of care: response time, and whether or not a paramedic was part of the response team. They also measured the percentage of ambulance “runs” with a response time of 8 minutes or less, which is a common benchmark among EMS providers.
- The investigators also analyzed one medical outcome measure: whether the patient was dead-on-arrival of responders to the scene (DOA). Because of missing data, this analysis was limited to the period 2001-2004. In that period, 2,015 patients were DOA.
- The study controlled for other factors that could affect EMS outcomes, including county-level indicators for population density, racial composition, and income.

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### ***No racial disparities found in response time or responder training, but African Americans were more likely than whites to be deceased when ambulance arrived***

Overall, paramedics responded to 90% of all incidents. The average response time was about nine minutes, with 62% of incidents falling within the eight-minute benchmark. After controlling for population density and other factors, the results revealed no differences between African American and white patients in response time or in the certification of responders.

- Initially, the investigators used a simple county-level measure of population density (population per square mile) and found that response times were faster for African Americans than whites. However, when they used a more refined measure that accounts for racial differences in density at the Census-tract level, the counter-intuitive, reverse disparity disappeared.
- Controlling for response time and other factors, African Americans were significantly more likely to be DOA at the scene than whites. Not surprisingly, longer response times increased the likelihood of a death on arrival. Population density was associated with a lower probability of death on arrival.
- The greatest racial disparity was in the age 80 and over male population, where African Americans were 4.5 percentage points more likely to be found DOA than whites.

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### ***Another study assesses whether paramedic experience matters in the prehospital setting***

While there is considerable evidence in the case of hospitals and surgeons that high volume is associated with better patient outcomes across a variety of medical conditions, no study has examined whether paramedic experience matters in a prehospital setting. David and Brachet used the Mississippi data to study the effects of paramedic experience, tenure, and credentials on EMS performance.

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- To focus on EMS incidents where time to definitive care is most likely to be important, the investigators analyzed EMS incidents between 1991 and 2005 for which the initial call was related to trauma (defined as motor vehicle crashes, motorcycle crashes, pedestrian injuries, stabbings, assaults, gunshots, or falls). They excluded cases of death on arrival and limited the study to patients transported to hospitals by ground transportation.
  - They assessed performance using two key markers of EMS trauma care: total out-of-hospital time and time spent at the scene.
  - Detailed data on procedures performed on scene were available only for the 2001-2005 period. The analysis of the effects of paramedic experience on outcomes covered only those years, but the investigators used data for all years (1991-2005) to construct the history of paramedics' experiences.
  - The study included about 175,000 incidents in the later period, involving 1,728 paramedics with a cumulative experience of about 613,000 trauma-related ambulance runs.
  - The investigators controlled for other factors that could affect EMS performance, including type of trauma, geographic location, time of day, day of week, month and year, patient characteristics, procedures performed, number of victims, certification level of EMTs, type of agency that employs them and the municipality they operate in.

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### ***Paramedic tenure and cumulative experience is associated with better EMS performance***

Overall, total out-of-hospital time averaged 36 minutes, with about 8 minutes of response time, nearly 15 minutes of on-scene time and 13 minutes of transport time. Paramedics had an average of nearly 18 trauma runs in the previous three months, 409 lifetime trauma runs, and an average tenure of 6.5 years since completion of training.

- Controlling for other factors, the results indicate that greater individual experience (as measured by accumulated volume of trauma runs) is associated with reduced total out-of-hospital time and on-scene time. Twenty additional EMS runs per quarter are associated with a one minute reduction in total out-of-hospital time.
- Recent experience appears to be more strongly associated with performance than past experience. Furthermore, experience was more strongly associated with performance among paramedics with more than six years of service.
- To illustrate the value of personnel retention, the investigators translated their results into a hypothetical situation in which a paramedic with average experience is replaced by a new one. They estimate that this substitution would add four minutes of total out-of-hospital time, and two minutes of on-scene time, in the first three months after replacement. This difference is slowly reduced over time, as the new paramedic gains experience, and amounts to about one minute by 36 months.

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### ***POLICY IMPLICATIONS***

These results have policy implications for EMS agencies, local governments that are charged with EMS delivery, and for researchers who investigate health disparities.

- Given the positive relationship between trauma experience and outcomes, policies designed to expose paramedics to greater volume should be considered. Of course, reducing the number of paramedics will result in more runs for each paramedic, but would likely result in longer waiting times and burnout. The more promising route

## POLICY IMPLICATIONS

Continued

would be strategies to increase the career duration for paramedics, thereby concentrating volume in the hands of paramedics who have already accumulated experience.

- The absence of racial disparities in the process of EMS care for cardiac patients is reassuring, especially in a state in the deep South with a history of segregation. The results highlight the importance of carefully considering and controlling for underlying factors that may drive race-related outcomes. Such consideration will contribute to an understanding of health disparities and help avoid erroneous inferences as to their extent and causes.
- The finding of a significantly higher rate of DOA at the scene for African Americans than whites needs further study. It could reflect differences in severity not captured in the data, less prevalent assistance to victims prior to EMS arrival, or a longer time between the onset of symptoms and the call for EMS.

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*This Issue Brief is based on the following articles: G. David and S.E. Harrington. Population density and racial differences in the performance of emergency medical services. Journal of Health Economics, July 2010, vol. 29, pp. 603-615; G. David and T. Brachet. Retention, learning by doing, and performance in emergency medical services. Health Services Research, June 2009, vol. 44, pp. 902-925.*

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## Issue Brief



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