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No Time to Spare: Improving Access to Trauma Care

Editor's Note: Since the September 11 attacks, policymakers are paying increasing attention to the adequacy of the U.S. trauma care system to handle potential mass casualty incidents. This attention has led to questions about how well the trauma system covers the population for day-to-day trauma, such as motor vehicle accidents and gunshot wounds. Although the number of trauma centers has increased in the last decade, no national plan exists to assure that everyone has timely access to a specialized trauma center if needed. This Issue Brief summarizes a new study that estimates the proportion of residents that can reach a trauma center by ground or air ambulance within one hour of where they live, using objective measures of travel times and distances.

Trauma center hospitals save lives, but number and geographic distribution varies

Over the past 30 years, the U.S. has developed a systems approach to trauma care that is widely believed to reduce deaths due to injury. A critical component of this systems approach is timely access to a designated trauma center hospital through a network of prehospital services including ground ambulances and helicopters.

- Level I and II trauma centers (as defined by the American College of Surgeons) provide comprehensive care for the most critically ill patients and have immediate availability of trauma surgeons, anesthesiologists and other physician specialists. Level III centers provide prompt assessment, resuscitation, surgery, stabilization, and transfer to a Level I or II center when needed.
- Many trauma experts consider the first 60 minutes after an injury to be a so-called "golden hour" when trauma care is most effective in saving lives. Given that the risk of death for severely injured patients rises significantly after one hour, trauma systems strive to offer access within that time period, from receipt of the initial emergency call to arrival at a trauma center.
- The geographic distribution of trauma centers varies widely across states and regions. Many areas of the country are not well-served by trauma centers, while other areas may have a surplus of centers, possibly leading to inefficiencies, lower patient volumes per center, and reduced quality of care.

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Study assesses adequacy of U.S. trauma care system

Branas and colleagues used national trauma databases and U.S. Census Bureau data to assess the adequacy of the U.S. trauma system. They defined access as the percentage of the population that could reach a trauma center within a certain time (population access) and the percentage of land area from which a trauma center was reachable within a certain time (land area access).

- The researchers obtained the precise geographic location of Level I, II and III trauma centers, as well as base helipad locations across the U.S. They then mapped the U.S. population and compared the locations of all U.S. residents to the locations of the trauma centers and helipads.
- Previously tested in the state of Maryland, the Trauma Resource Allocation Model for Ambulances and Hospitals (TRAMAH) was used to calculate access given the location of existing trauma centers and base helipads. This computer model matches the locations of resident populations with trauma centers that are reachable, by driving or flying, within an hour.
- The analysis accounted for all phases of prehospital trauma care, including the time needed to dispatch or activate an ambulance or helicopter, the response time from an ambulance depot or helipad to the scene of an injury, the time spent on-scene, and the time from the scene to a trauma center. Because no national data existed on these time intervals, the researchers conducted a systematic review of existing studies (or meta-analysis) to obtain estimates for their analysis.

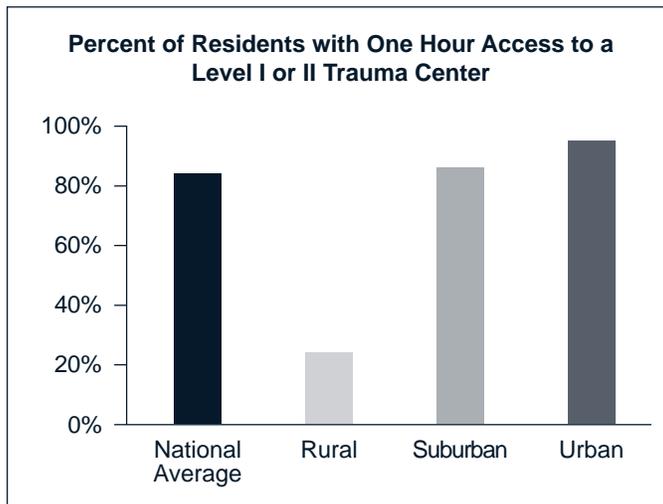
Systematic review establishes national norms for prehospital travel times

The meta-analysis synthesized the findings from 49 observational studies over a 30-year period (1975-2005). The studies represent the experience of more than 155,000 patients from 20 states in all regions of the country. The findings establish national norms for driving and flying speeds, and average times for prespecified phases of prehospital care.

- Average helicopter speed was 142.6 miles per hour (mph). Average ground ambulance speeds were 20.1 mph in urban, 47.5 mph in suburban, and 56.4 mph in rural areas.
 - The activation interval is the time from receipt of emergency call to departure from the ambulance depot or base helipad. Ground ambulances took an average of 1.4, 1.4 and 2.9 minutes to depart the depot in urban, suburban, and rural areas. Helicopters took an average of 3.5 minutes to liftoff from the base helipad.
 - The response interval is the time from departure to arrival on the scene. Ground ambulances arrived on-scene in 5.3 and 5.2 minutes on average in urban and suburban areas, and 7.9 minutes in rural areas. Helicopters arrived on-scene an average of 22.3 minutes after liftoff.
 - At the scene, ground ambulances crews spent an average of 13.5 in urban and suburban areas, and 15.1 minutes in rural areas. Helicopter crews spent an average of 21.6 minutes on scene.
 - The transport interval is the time from departing the scene to arriving at the trauma center. Ground ambulances took 10.8, 10.9, and 17.4 minutes to arrive at the trauma center in urban, suburban, and rural areas. Helicopters arrived at the trauma center an average of 25.5 minutes after leaving the scene.
 - Total average prehospital time for ground ambulances was 31 minutes in urban and suburban areas, and 43.2 minutes in rural areas. Total prehospital time for helicopters averaged 73 minutes. For helicopters, this total time was higher in later years (1990-2005) than in earlier years (1975-1989). For ground ambulances, total time decreased in later years.
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More than 84% of U.S. residents can reach level I or II trauma center within an hour, but access lags in rural areas

Using some of the findings from the meta-analysis, Branas and colleagues calculated one-hour access to trauma care for the U.S. population. As of January 2005, there were 190 level I, 255 level II, and 258 level III trauma centers throughout the U.S. These trauma centers were served by 571 base helipads and 683 helicopters.



- About 84.1% of the U.S. population has access to a level I or II trauma center within one hour. The Northeast has the greatest access, followed by the West, the Midwest, and the South. An additional 4.6% of the population has access to a level III trauma center only.
- About 46.7 million people do not have access within an hour. These people live mostly in rural areas. All told, 24.0% of rural residents have one-hour access to a level I or II trauma center, compared to 86.2% of suburban residents and 95.3% of urban residents.

- About 25.1% of the U.S. land area is located within one hour of a level I or II trauma center, with the Northeast having the highest land area coverage, and West having the least land area coverage. Clearly, land area metrics can result in potentially misleading impressions of where access is adequate for the population and where it is not.
- There is evidence of a possible oversupply of trauma centers in certain areas. Americans had an average of 10 level I and II centers and 11.5 level I, II, and III centers accessible within one hour, with the greatest number accessible in the Northeast. About 42.8 million people (14.6% of the population) had access to 20 or more level I or II centers.

Helicopters greatly improve one-hour access to trauma centers, sometimes by transport across state lines

Although trauma systems are state-based, the resources of a neighboring state may substantially increase access to trauma centers, particularly when nearby trauma systems are just across state lines. The researchers estimated the contributions of helicopters and cross-state resources in providing access to timely trauma care.

- A total of 27.7% of the population had access to a level I or II trauma center within one hour only if they were flown by helicopter. Helicopters had the greatest impact on access in the South, followed by the Midwest.
- A total of 1.9% and 3.1% of the population had access solely due to trauma centers or base helipads (or both) located outside their home states. The resources of neighboring states had the greatest impact on access in the Midwest, followed by the South.

POLICY IMPLICATIONS

This study is the first national assessment of trauma center access to objectively incorporate the locations of trauma centers, ambulances and residential populations. It points to several modifiable aspects of trauma systems that could improve one-hour access.

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POLICY IMPLICATIONS

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- Policymakers can use benchmarks for prehospital intervals to evaluate their trauma systems relative to national norms and thereby more realistically allocate scarce resources.
- More than 13 million Americans had access to level III, but not level I or II, trauma centers. Level III hospitals provide initial evaluation of injured patients, and transfer the more severely injured to high levels of care. Although there is debate over the correct use of level III trauma centers, access to trauma care can be increased by designating level III centers in communities where no level I or II centers exist.
- More than 10 million Americans had access to trauma care within an hour via the trauma centers and helicopters of neighboring states. As of 2005, 47 states had protocols to enhance interstate cooperation during mass casualty incidents, but just 31 states had standardized protocols for border crossing of day-to-day trauma patients. Neighboring states should consider establishing formal agreements for sharing trauma care resources because of the high numbers of patients who might benefit.
- Helicopters provide one-hour access for more than 81 million Americans. Because base helipads are more moveable than trauma centers, the creation of additional medical helicopter flight programs could expand trauma center access. Locating new base helipads as satellites to urban trauma centers, rather than at the trauma centers themselves, is often the best geographic strategy that will benefit the greatest number of trauma patients in nearby suburban and rural areas.

This Issue Brief is based on the following articles: C.C. Branas, E.J. MacKenzie, J.C. Williams, C.W. Schwab, H.M. Teter, M.C. Flanigan, A.J. Blatt, C.S. ReVelle. Access to trauma centers in the United States. JAMA, June 1, 2005, vol. 293, pp. 2626-2633; C.C. Branas, E.J. MacKenzie, C.S. ReVelle. A trauma resource allocation model for ambulances and hospitals. Health Services Research, June 2000, vol. 35, pp. 489-507.

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