

# healthyGIS

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GIS for Health and Human Services

## Trauma Center Location Planning Gets Relief

### Resource Allocation Model Now Online

Accidents happen, and the difference between a life-or-death outcome can depend on the time it takes to get a severely injured person to a trauma center hospital. The process of choosing optimum locations for these life-saving trauma centers requires consideration of a complex set of variables. When a team of researchers at the University of Pennsylvania and Johns Hopkins University developed a geomathematical model that analyzes trauma center accessibility in the United States, they wanted to share the results in a way others could use. Using ESRI software, they developed a geographic infor-

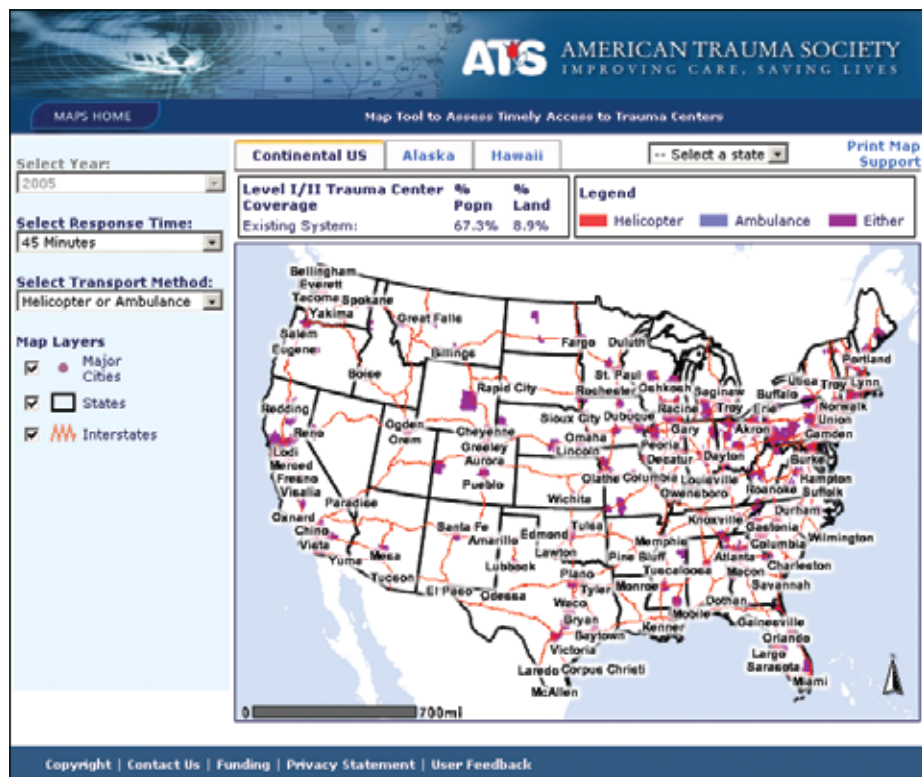
mation system (GIS) application that puts the model's results on a map and displays it on an interactive Web page.

Research shows that patients with severe injuries treated at trauma center hospitals are significantly more likely to survive their injuries than patients treated at other hospitals. Therefore, increasing the number of people whose lives are saved may be achieved by maximizing access to trauma centers, which is an important goal of the American Trauma Society (ATS), a non-profit advocacy agency, and the National Center for Injury Prevention and Control.

Between 1999 and 2003, Charles Branas, Ph.D., associate professor, Department of Biostatistics and Epidemiology, University of Pennsylvania School of Medicine, developed and refined a model for analyzing access to current trauma center locations using an inventory of trauma centers maintained by ATS. Called the Trauma Resource Allocation Model for Ambulances and Hospitals (TRAMAH), the model's output was in a text format that was made for quick interpretation but was not intended for direct consumption by planners. To better use the information, a way was needed to improve understanding of the output and share it with others. Branas also wanted to develop what-if scenarios for locating centers that maximize efficient use of scarce resources so they may save the most lives possible.

"We knew that these measures were really important and should be tracked over time," says Anthony Carlini, director of the ATS Trauma Information Exchange Program (TIEP) in collaboration with the Johns Hopkins Center for Injury Research and Policy. Carlini adds, "We wanted to get this information into a visual medium that would be usable by more people."

Branas and a team from the University of Pennsylvania Cartographic Modeling Laboratory (CML) proposed a solution using GIS technology to make the data available on a map. GIS would allow them to combine many kinds of information, such as helicopter and ambulance ranges of operation, trauma center locations, and population density, and view



The American Trauma Society Web site displays the resource allocation model results for the continental United States, Alaska, and Hawaii and allows users to also look at a single state and choose response time and transportation method parameters.

them together on a national, detailed map. The map would provide visualization of the current overall picture, and GIS analysis tools would eventually help them run what-if scenarios to investigate options and support planning.

“Having a rapid, Web-based GIS interface makes our mathematical model real for state and regional trauma systems planners,” says Branas. “We thought about other approaches to reach these planners but settled on the current Web site because it was our most efficient, centralized, and far-reaching option.”

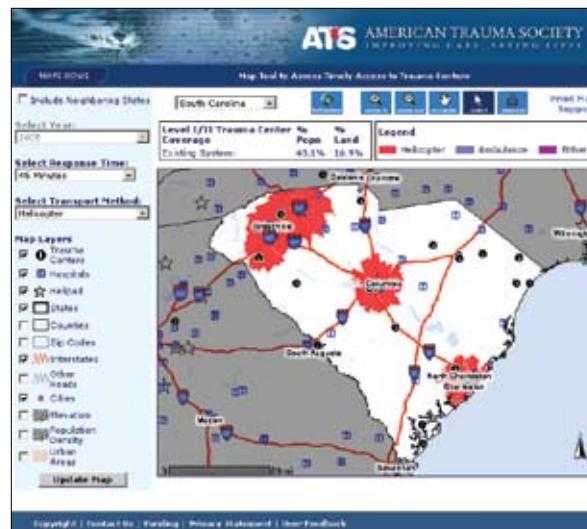
With funding from the Centers for Disease Control and Prevention (CDC) and Agency for Healthcare Research and Quality, leadership from TIEP, and support from CML, the team worked with ESRI business partner Avencia Incorporated to build the GIS system. Based on previous successful collaborations with Avencia, CML chose the company to do the programming work and set up the server and Web site. CML, under GIS director Marlen Kokaz, organized the datasets to ensure that geographic location information was correctly incorporated.

The Web site, active since 2006, enables users to specify time frame (access within 45 or

60 minutes) and transportation mode (ambulance, helicopter, or both) and provides a map and coverage information based on percentages of population and land covered by the existing system. It displays trauma center access based on the most current census, hospital, and helicopter data. TRAMAH is used by state trauma system regulatory authorities to optimize the sites of new trauma centers.

A second phase is now planned that will update data for 2007 and enable state regulators to test different what-if scenarios. “We are currently planning to continue utilizing ESRI software and build on what we established during the first phase of the project,” says Kokaz, adding, “The second phase will enable the end user to be more hands on with scenario development and mapping on the fly.”

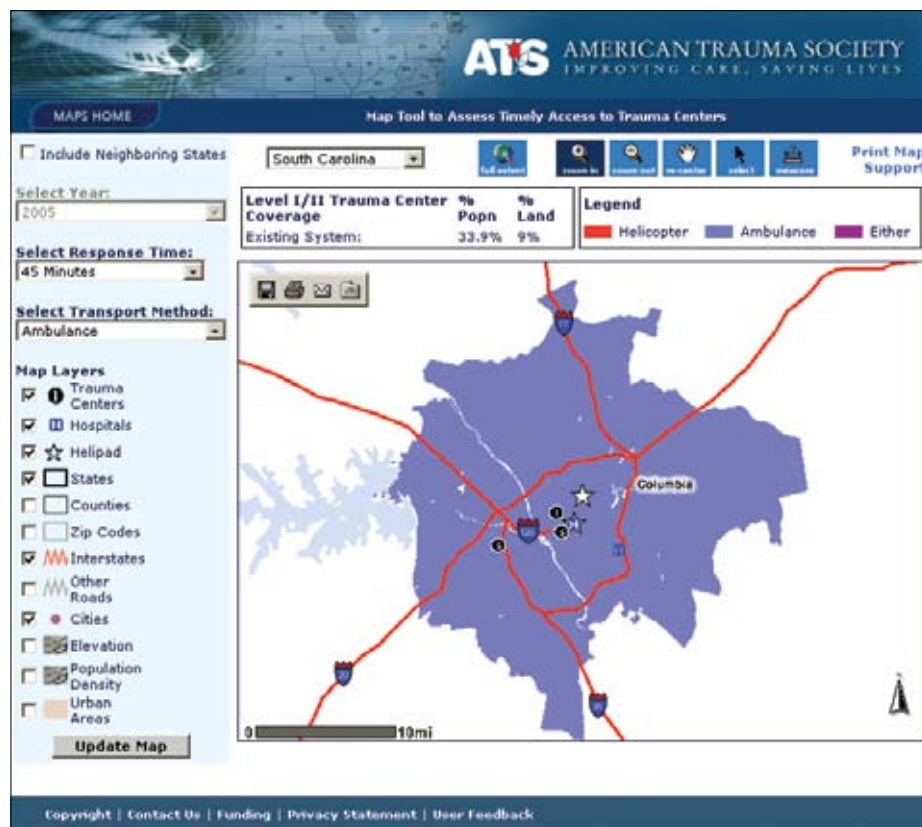
Many additional factors may need to be taken into consideration in choosing sites for trauma centers, and the TRAMAH system is best used alongside, rather than instead of,



This view of South Carolina’s TRAMAH model results shows the extent of helicopter access to trauma centers within 45 minutes (red) and displays trauma center coverage by population (48.1%) as well as area (16.9%).

the specialized knowledge of trauma systems planners. It does, however, demonstrate the very real value that GIS can add when dealing with limited, life-saving resources that must be allocated over large geographies.

For more information about the TRAMAH system, visit the project’s Web site at <http://maps.amtrauma.org> or contact Megan Heckert of Avencia Incorporated at [mheckert@avencia.com](mailto:mheckert@avencia.com) or Charles Branas at [cbranas@upenn.edu](mailto:cbranas@upenn.edu). For more information about Avencia, visit [www.avencia.com](http://www.avencia.com).



A view of Columbia, South Carolina, displays ambulance access to trauma centers within 45 minutes (purple) and the location of all hospitals, trauma centers, and helipads.



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