

Scoring system can help trauma centers improve care during surges in trauma cases

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A scoring system that can identify periods of high activity and increased trauma patient deaths in hospital emergency rooms may help hospitals better prepare for surges in trauma patient volume that come with catastrophic events like the Boston Marathon bombing (April 2013) or disasters like the Amtrak train crash (May 2015) in Philadelphia.

Trauma surgeon Peter C. Jenkins, MD, MSc, and a team of investigators from Indiana University and multiple centers developed the scoring system, called the Trauma Surge Index (TSI). They reported their observations and results with the TSI in a study published as an ["article in press"](#) on the *Journal of the American College of Surgeons* website in advance of print publication later this year.

"Overall, hospitals are poorly equipped to recognize these events," said Dr. Jenkins, assistant professor of surgery, Indiana University. "People identify events that are renown, like 9-11 or the Boston Marathon bombing, but there are other periods of high-capacity strain on [hospital](#) trauma centers that often just fly under the radar, especially if the hospital concurrently receives [patients](#) from multiple events—a bus accident over here, a fire over there, and a shooting."

The TSI represents two variables: the severity of each patient's injury, and the time and date of each patient's admission to the hospital. It ranks surge activity on a scale from 0 to 8 (including "greater than 8" as the highest score), and is unique for each hospital that uses it.

The study is the first attempt to statistically evaluate trauma surges at hospitals in North America. Study investigators noted that existing efforts to measure trauma surges have relied mostly on expert opinion rather than objective data, and did not consider the severity of injuries to the trauma victims nor the differences in the sizes of varying hospitals. "To say 10 patients over a 12-hour period is a surge is arbitrary," Dr. Jenkins said. "That might be true for a low-volume community hospital, but for a high-volume [trauma center](#), that's an average day."

The TSI is scaled to the hospital's profile. It accounts for the severity of patients' injuries by using the Injury Severity Score—a scoring system doctors use to evaluate patient injuries. To draw on quality medical data, the study investigators used data from the Trauma Quality Improvement Program (TQIP®) of the American College of Surgeons.

Dr. Jenkins explained that a broad range of hospitals can use the TSI because it tracks annual volume and the severity of injury to the [trauma patients](#) treated in each hospital. The TSI is a retrospective measure—it collects information on trauma episodes within the hospital after the fact. The intent is for physicians and hospital administrators to use the measure to evaluate patterns of trauma surges and the nature of patient injuries over time and then prepare accordingly.

The TSI determined that trauma patients admitted to the hospital during high-surge periods died at almost twice the rate of patients entering the hospital at other times. For patients with gunshot wounds, the risk was even more acute: a death rate more than seven times higher in high-surge periods. When the authors of this study applied the long-established definition of mass casualty events, they found no differences in death rates between trauma surges and normal hospital activity.

The increased death rate of shooting victims was "one interesting and unexpected result" of the study, Dr. Jenkins said. "We hypothesize that

because treatment of firearm injuries is extremely resource intensive—these patients often go to the operating room, the intensive care unit, and require high volumes of blood transfusion—all of those things can be compromised when the hospital is already pushed to its capacity."

The study included 233,623 patients admitted to 156 TQIP-participating trauma centers in 2010 and 2011. Overall, it calculated in-hospital mortality at 6.3 percent, but found that it increased to 9.9 percent during high-surge periods. In all, 332 patients—only 0.14 percent of the entire study population—had a TSI score of 3 or higher at 33 different hospitals.

For shooting victims, the death rate was 15.5 percent during normal hospital activity and 42 percent during high-surge periods. The variation for non-shooting trauma victims was not as drastic: a death rate of 5.8 percent during normal periods and 8.5 percent in high-surge periods. Nonetheless, the increased mortality for both shooting and non-shooting trauma patients was significant, the study authors reported.

"This study could not have been possible without ACS TQIP data," said study coauthor Avery B. Nathens, MD, PhD, FACS, surgeon-in-chief, Sunnybrook Health Sciences Centre, Toronto, Ont., and ACS TQIP Medical Director. "Our investigation required data of extremely high quality that is representative of the experience of trauma centers across the United States. The latter is critical for ensuring the findings are generalizable, meaning the Trauma Surge Index is applicable to all Level I and II trauma centers. The only source of trauma data available that meets the criteria of high quality and generalizability is ACS TQIP."

Going forward, the study findings could help policy makers explore how much of a public health issue [trauma](#) surges are and help physicians and hospitals identify best practices during surge periods. "That's really the

cornerstone of any quality improvement project," Dr. Jenkins said.

The findings can also help hospital networks and health systems to better distribute patients and resources during surge periods—"to see whether or not we are effectively spreading the health care demand across the system," Dr. Jenkins said. "It's not just a neat theoretical model that we developed; there's potential for application to better prepare for something that can affect any of us."

More information: Trauma Surge Index: Advancing the Measurement of Trauma Surges and Their Influence on Mortality. Journal of the American College of Surgeons. DOI: [dx.doi.org/10.1016/j.jamcollsurg.2015.05.016](https://doi.org/10.1016/j.jamcollsurg.2015.05.016)

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