

Algorithm can improve guidance of crash victims to most appropriate place for care

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This flow chart outlines the information the Occupant Transportation Decision Algorithm collects and analyzes to determine whether a person injured in a motor vehicle crash should be sent to a trauma center or hospital emergency room. Credit: American College of Surgeons



Important information on a motor vehicle crash can help ambulance personnel and hospital staff better direct crash victims to the most appropriate care, but getting that information into a meaningful format for those personnel to use has been an ongoing challenge. Recently, a team of biomechanical specialists and clinicians at Wake Forest University, Winston-Salem, North Carolina, developed a computer algorithm that's capable of providing that information through a novel method using data from electronic data recorders (EDRs) on board cars and trucks today.

The research team reported on the Occupant Transportation Decision Algorithm (OTDA) they developed in an "article in press" published online in the *Journal of the American College of Surgeons* in advance of print publication.

The OTDA is an Advanced Automatic Crash Notification (AACN) algorithm that uses vehicle telemetry measurements, such as those from an EDR, to predict risk of serious injuries in vehicle crashes. The algorithm is a computer-based program that collects and utilizes information, such as occupants' use of seatbelts, airbag deployment, vehicle speed and the point of impact—side, head-on, rear or rollover—all measures which hospital staff and first responders can use to determine the location and severity of injuries.

"This algorithm has the potential to inform the risk of severe injury for people in a crash, and their risk is different depending on whether they're properly belted in a crash or have the benefit of an airbag; that's what emergency medical services personnel are looking for at a <u>crash</u> <u>scene</u>," said lead study author Joel D. Stitzel, PhD, of the Virginia Tech-Wake Forest University Center for Injury Biomechanics. "That's what automobile manufacturers and scientists really need to be thinking about: Does the patient need to be cared for at a Level I or Level II trauma center or can they go somewhere else, to a regional hospital, for



example?"

The OTDA differs from other AACN algorithms because it can aid in the triage of crash victims using their risk of injuries associated with the need for trauma center treatment based on crash characteristics from the vehicle telemetry. Other algorithms use measures such as Injury Severity Score (ISS), a system to grade the extent of injuries, and the Maximum Abbreviated Injury Scale (MAIS) to predict overall risk of injury in a crash. The OTDA uses injury severity, but also time sensitivity—that is, how quickly the injuries need to be addressed—and predictability factors. J. Wayne Meredith, MD, FACS, director of surgical sciences and professor of trauma surgery at Wake Forest, and other Wake Forest trauma specialists provided key input into the algorithm.

The researchers used two measures for determining the utility of the algorithm to direct crash victims to the correct care setting: overtriage, which means a patient goes to a care setting, such as an emergency room or trauma center, that offers services beyond what that patient needs; and undertriage, which means the opposite—the patient goes to a setting that doesn't have the services needed to treat those injuries.

"The best data we have says that the current system for motor vehicle crashes overtriages crash victims at a rate of around 60 percent, and the American College of Surgeons guidelines call for around 50 percent," Dr. Stitzel said. "So we're currently sending a lot of crash victims to the trauma center who don't necessarily need to go there at a rate higher than what experts would recommend."

In a model the researchers used, the OTDA achieved an overtriage rate of below 50 percent in all crash types, and undertriage rates below 5 percent in side-impact crashes and ranging from 6-16 percent in other types of crashes. The researchers estimate that nationwide implementation of this algorithm would correct triage decisions for 44



percent of those who are undertriaged and 38 percent of those who are overtriaged. That scenario would translate into more appropriate care for more than 2,700 seriously injured crash victims annually, and avoid sending more than 162,000 people who don't need trauma-level care to trauma centers.

"Undertriage is probably the worst thing you can do for a patient because you're sending someone to a lower level of care when they need a higher level of care," Dr. Stitzel said. "It can result in delayed care and missed injuries as a result."

Sending all crash victims to a trauma center is not a solution, Dr. Stitzel said. "You would have thousands of people who are not injured and fairly healthy people being cared for in trauma centers, and trauma centers are not set up to do that; they really need to be receiving the most severely injured patients," he said. Flooding trauma centers with non-trauma injuries would force them to divert needed resources and personnel away from the most critically injured patients.

Dr. Meredith explained what this algorithm can mean for trauma physicians and critically injured crash victims. "Our hope is this work will improve our chances of getting the right patients to the right place at the right time and help preserve precious minutes of the golden hour," he said. The trauma community defines the "golden hour" as a window of time to evaluate and stabilize the patient to prevent the likelihood of death.

Dr. Meredith's vision is that the algorithm would quickly provide information about the nature of a crash victim's injuries to trauma center staff. "That implementation would alert us to be prepared for a patient's arrival in a way we might not otherwise," Dr. Meredith said.

More information: Joel D. Stitzel et al, An Injury Severity, Time



Sensitivity, and Predictability Based Advanced Automatic Crash Notification Algorithm Improves Motor Vehicle Crash Occupant Triage, *Journal of the American College of Surgeons* (2016). <u>DOI:</u> <u>10.1016/j.jamcollsurg.2016.03.028</u>

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