Measurement tools for traffic crash injury severity improving, study says

August 22 2011

Efforts to improve traffic safety have been aided by mathematical models that allow researchers to better assess those factors that impact the degree of injury suffered as a result of traffic crashes, a Wayne State University researcher says.

Peter Savolainen, associate professor of civil and environmental engineering in WSU's College of Engineering, recently conducted a comprehensive state-of-the-practice review of research in that area addressing a variety of methodological issues that can complicate analysis of injury severity data. He believes substantial progress has been made and will continue in the gathering of information that will yield ever more precise knowledge about crash outcomes.

Reducing the severity level of injury resulting from a crash is one of two primary emphases of traffic safety research; reducing crash frequency is the other. A separate state-of-the-practice paper was published last year on crash frequency models; collectively, those works assist researchers charged with providing decision makers and transportation agencies with supportable conclusions that enable them to better allocate resources aimed at improving traffic safety.

"Ultimately we're trying to determine what the impacts of specific factors are on injury severity," Savolainen said. "With that information, we can then make informed decisions as to policies and programs aimed at reducing crash severity."

However, a variety of issues complicate researchers' ability to analyze those factors. One is simply the quality of the injury severity data, which generally is obtained from crash reports. That data tends to be most thorough with respect to the driver, for whom complete information is uniformly collected.

Crash data tends to be of lower quality and less complete for injured passengers, and particularly for uninjured passengers. Reports also can prove problematic, Savolainen said, when details are omitted about things like occupant age and gender, alcohol consumption or the use of safety equipment. Some research also has demonstrated a tendency for similar injuries to be reported as more severe for females than males.

Complications also stem from the fact that crashes are random and rare events, Savolainen said, and because as many as half of all traffic crashes go unreported. Such underreporting is greatest among crashes resulting in less severe injuries, which may lead to either overstating or understating the true effects of various factors on injury outcomes.

Another issue for researchers is that injury data follows a natural ordering scheme (i.e., fatal injuries are more severe than minor ones, which are more severe than no injury, etc.). Some mathematical models introduce assumptions that constrain a specific factor to decrease unambiguously the likelihood of fatalities and increase the probability of no injury being suffered (or vice versa).

That holds true for many factors, including impact speeds, as higher speeds consistently increase the probability of a fatal injury and decrease the probability of no injury being suffered. However, factors like airbag deployment tend to reduce the number of crashes resulting in both fatal injuries and no injuries, instead increasing the likelihood of minor or moderate injuries. Introducing constraints may hide such trends from researchers. However, ignoring the ordinality of the data requires either more complex models or else a significantly larger crash data sample.

Another issue complicating development of crash severity models is endogeneity, which can be caused by not having specific data available to the researcher. For example, a recent study found that drivers who own vehicles with airbags also tend to drive less aggressively. However, if that fact is ignored, airbags' actual effectiveness will tend to be overstated.

Researchers are tasked with developing statistical models that take into consideration that broad range of issues. The analytical tools most widely used for such analyses are known as discrete outcome models. Such models allow for examination of how various factors impact injury severity, which can be classified into one of several discrete levels, or outcomes. They include fatal, incapacitating injuries (head trauma or severely broken bones), nonincapacitating injuries (minor scrapes, bumps and bruises), possible injury (complaints of pain) and property damage only (no injury).

"What we're trying to do is essentially develop models that will allow us to determine how factors —, whether they're driver-, weather- or roadway-related — affect the likelihood of crashes resulting in any of those injury severity levels," Savolainen said.

Those models provide powerful tools in transportation and other fields, he said. Recent advances in computer processing and in theory and methods for analyzing discrete outcomes have provided a robust toolbox for the traffic safety community. Data used to estimate those models also is improving; recent work successfully has linked police-reported crash data to hospital reports on crash victims, which allows for a more precise determination of injury level.

Savolainen is optimistic about researchers' abilities to develop models that can better assess injury severity and to use the results to recommend solutions using the "three E's" of traffic safety: engineering, education and enforcement.

"I think we're becoming more sophisticated in our data collection and in ultimately linking together these diverse data sources," Savolainen said. "We're seeing continued incremental advances in the body of knowledge."

"A lot of the tools are already there for us, it's just a matter of using them more efficiently."

Provided by Wayne State University

Citation: Measurement tools for traffic crash injury severity improving, study says (2011, August 22) retrieved 25 April 2024 from https://phys.org/news/2011-08-tools-traffic-injury-severity.html