Population only part of tornado casualty story

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Tyler Fricker near tornado damage in McLean, TX. Credit: Florida State University

New research out of Florida State University shows that the strength of a tornado has a significantly larger effect than population on the number

of casualties.

"It's somewhat surprising because we're led to believe it's just a problem with exposure—the more people in the way, the more casualties," said James Elsner, chair of the FSU Department of Geography and Earl & Sofia Shaw Professor.

That's not the case, according to this latest study.

Using a regression model, researchers found that on average a doubling of the population under the path of a tornado leads to a 21 percent increase in the casualty rate, while a doubling of the energy dispersed by the tornado leads to a 33 percent increase in the casualty rate.

"We brought in external data and estimated tornado energy based on tornado area, median wind speeds and the magnitude of those storms," said lead author Tyler Fricker, a doctoral student in the Department of Geography.

Fricker and Elsner collaborated on the study recently published in *Geophysical Research Letters* with adjunct professor Thomas H. Jagger. Their team examined all tornado casualties, meaning death or injury as a direct consequence of a tornado, in the contiguous United States from 2007 to 2015.

The research team also noted population density within the tornado path usually decreases with stronger storms. A possible reason for this inverse relationship is likely due in part to the fact that the stronger the tornado, the larger its area, making it more likely that the storm will pass through undeveloped or underdeveloped landscapes.

In addition, the strongest tornadoes with the potential for producing the most damage tend to occur in the western United States where

population density is lower.

Tornado in the distance in McLean, TX. Credit: Florida State University

Although the study is a starting point, Fricker said, the research can begin to inform emergency managers today.

"Emergency managers can look at results like this," Fricker said. "For instance, a county manager could look at this model and get some kind of estimate of the percent increase in casualties they could see, based on an increase in population."

The team also recognizes how climate change can potentially impact future storms. Elsner said the warming atmosphere could lead to fewer storms, but when they come, they could come in bunches or be much stronger.

"It's not just about human activity and the exposure problem," Elsner said. "It's also about the problem that these storms might change in the future. Through this research, we'll have some way of understanding if they do change, how many more casualties we can expect."

Casualties on a per person basis are going down according to Elsner. The chance of being killed in a tornado today is less than it was 30 years ago. That's largely due to better warnings and increased awareness of the threat.

Still, Fricker plans to conduct further research to identify certain parts of the United States where higher rates of casualties can be expected.

"If we can identify certain areas that are more susceptible to casualties the next step is to think about what's actually happening at the surface," Fricker said. "What are the socio-economic and demographic variables that are present in those areas that are affecting tornado casualties?"

Poverty levels, education levels and even race might be determinants of casualties according to researchers.

"We want to try to understand this," Elsner said. "I think the National Weather Service does a great job in warning people, but perhaps some people need to be warned a different way, at a different time of day. There are different ways to communicate the threat. In the future, I think the weather service will able to use that information to pinpoint their watches and warnings even better."

More information: Tyler Fricker et al. Population and energy elasticity of tornado casualties, *Geophysical Research Letters* (2017). DOI: 10.1002/2017GL073093