

Using GIS to Analyze the Spatial Distribution
of Injury and Access to Trauma Centers

*A Review of “Evaluating potential spatial access to trauma
center care by severely injured patients”*

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Introduction

Modeling access to health facilities is one major application for GIS in health geography. Ambulances and hospitals are often strategically located in municipalities to better serve the general population. Interestingly, the spatial distribution of severe injuries may not directly correspond to the spatial distribution of the general population. This could suggest that treatment for people suffering from major trauma may be hindered due to accessibility. Fiona Lawson, Nadine Schuurman, Lisa Oliver, and Avery Nathens (2013) employed GIS to research the accessibility of trauma centers for people that suffered severe injuries between 2001 and 2006 in Canada. They found that 68.5% of the population that experienced major trauma in this window were within a one hour drive to a Level I or II trauma center.

Methodology and Applying GIS

First Lawson et al. (2013) defined relevant trauma centers for the study by whether or not the facilities provided twenty-four hour neurosurgical care. If such care was provided, then the facility was considered in their study because those facilities tend to have a much higher survival rate for major trauma victims. The location of each trauma center was then geocoded using Desktop Mapping Technologies Inc.

The spatial data used for injuries can be viewed as a major limitation of the study. First Lawson et al. (2013) defined major traumas for their study as injuries that resulted in death prior to hospitalization and hospitalized patients with Injury Severity Scores greater than 15 were considered. They gathered this information through Canada's Vital Death Database and the Hospital Morbidity Database and used the postal code cited for the deceased or hospitalized major trauma victim as the location data for the major trauma incidents.

After gathering data for all provinces except Quebec, Prince Edward Island and Territories, Lawson et al. (2013) used ArcGIS's Origin-Destination (OD) Cost Matrix tool to examine the proportion of cases that were within one hour of travel via car to trauma centers. They set the postal code as the origin, the trauma center as the destination, and "cost" as time. As

mentioned Lawson et al. found 68.5% of major trauma victims in Canada were within a one hour drive of a trauma center. However, split between the subpopulations Lawson et al. (2013) found that 70% of major trauma victims that were successfully hospitalized were within an hour drive of a trauma center, while 62.4% of major trauma victims that died outside of a hospital were within an hour drive of a trauma center.

Critique

It is intuitive that faster accessibility to trauma centers is beneficial to survival rates, but Lawson et al. (2013) claim no study had been conducted in Canada prior to theirs in quantitatively analyzing this assumption. Lawson et al. (2013) used GIS effectively in a spatial analysis that brought to light the effects accessibility to proper medical care has on major trauma victims. I would give this study a 7 out of 10 because Lawson et al. appropriately justified their parameters, applied an OD Cost Matrix to most of Canada as comprehensively as they could, and devoted a great deal of their discussion to potential limitations in their study. However, I find one major limitation of the study is using the major trauma victim's postal code as the origin location for the place of injury. First, Quebec could not be included in this because only the first three characters of the victim's postal code are included. Second, I speculate that places where incidents that cause major trauma might occur more often outside of the victim's postal code. Major trauma events likely occur in high speed traffic or at place of employment if the work includes higher risk of injury such as construction sites. Finally, the size of postal codes are highly variable and take up more space in rural areas, so there is more uncertainty with travel times to trauma centers where incidents originate in these larger postal codes. Nevertheless, the researchers were working with the data available. Lawson et al. (2013) essentially lay out a framework for how medical geographers with more privileged access to spatial information of major trauma incidents could utilize GIS to analyze the accessibility to trauma centers that major trauma victims have had.

Lawson et al. (2013) also compare their results to a similar study conducted in the U.S. that incorporated helicopter travel to trauma centers as well as ground transportation. Lawson et

al. could have expanded their OD Cost Matrix to also examine the trauma centers accommodate helicopters and determine potential surrounding areas where helicopter travel would likely be used.

Work Cited

Lawson, F. L., Schuurman, N., Oliver, L., & Nathens, A. B. (2013). Evaluating potential spatial access to trauma center care by severely injured patients. *Health and Place, 19*, 131-137. doi:10.1016/j.healthplace.2012.10.011