THE UNIVERSITY OF TEXAS AT AUSTIN
CENTER FOR TRANSPORTATION RESEARCH

On Identifying Engineering and Behavioral Countermeasures to Reduce the Occurrence and Severity of Pedestrian Injuries in Vehicle-Pedestrian Crashes

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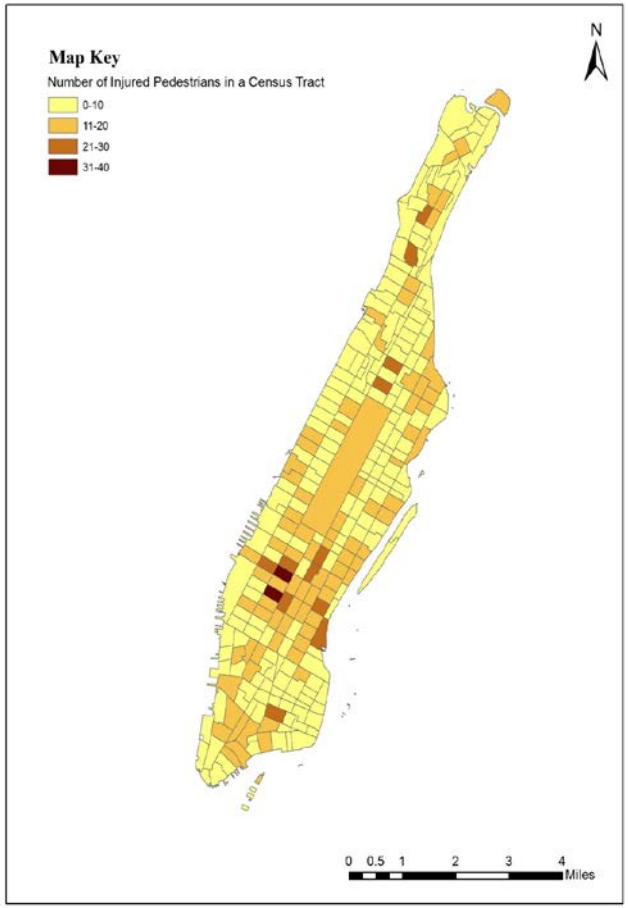
Motivation

- **Walking** is an active transportation mode that **can contribute** to:
  - lower traffic congestion levels,
  - reduced mobile-source emissions and energy consumption,
  - improved public health, and
  - vibrant social cohesion opportunities.

- Pedestrians are a vulnerable road-user group
  (~5000 pedestrian fatalities; 65,000 pedestrian injuries in 2014)
- Efforts to promote walking need to be coordinated with strategies that enhance safety.
- A good understanding of the risk factors associated with pedestrian injuries in crashes is required.
- **Objective:** formulate a macro-level multivariate model to jointly analyze the **count of pedestrians involved in traffic crashes** by injury severity level.

Data

- All **pedestrian crashes** in the **year 2009** in the **Manhattan area** of New York City
- **Spatial level:** Census tract.
- Four injury severity levels:
  - possible injury,
  - non-incapacitating injury,
  - incapacitating injury, and
  - fatal injury.
- Crash data from the **CrashStat website** (maintained by New York City's Transportation Alternatives organization).
- Additional data:
  - Socio-demographic information
  - Land-use and road network data
  - Activity intensity data
  - Commute mode shares and transit supply data



Methodology

- **Proposed model:** comprehensive spatial random coefficients multivariate count model.
  - **Accommodates excess zero data;**
  - Allows variation in the effects of determinant exogenous variables because of **unobserved location-specific factors**;
  - Accommodates **spatial dependency** in the count of pedestrian injuries **based on location proximity**, and
  - Captures **spatial drift effects** through the spatial structure on **constant and slope heterogeneity effects**.

Key Findings

- Census tracts with a
  - high population density,
  - high proportion of Hispanic residents,
  - high proportion of the population over 19 years old, and
  - with low education levels

  are particularly vulnerable to pedestrian injuries.
- Financially challenged segments of the population face higher injury risk.

Key Findings (cont.)

- Higher population density → higher risk propensity for all injury levels.
- However, presence of sidewalks and buffers, traffic lights at intersections as well as low speed limits can moderate the effect for the risk of low-level injuries.
- In 15% of the Census tracts, an increase in population density is associated with a decrease in the propensity of possible injuries (lowest level of severity).
- Census tracts with high built-up commercial and residential land-use → high risk propensity
- Dangerous situation: combination of distraction and pre-occupation with high pedestrian activity.
- Need for information campaigns.

Key Findings (cont.)

- Presence of schools and universities increases the long term risk propensity of non-incapacitating injuries.
- School are localized in high exposure pedestrian areas because the volumes of pedestrians around are significantly larger than average.
- However, since speeds are controlled and there is abundant signaling, severe pedestrian crashes are not commonly observed.
- Need for the continuation of programs such as the Safe Routes to School.

Implications for Practice

- Our macro-level model has the aim of **identifying relatively longer-term planning and behavioral modification solutions**.

- For example:
  - More equitably channeling resources for pedestrian facility investments if inequities are identified,
  - land use design reconfigurations, or
  - targeting specific demographic groups with information campaigns.

- Risk factors for different types of pedestrian injuries can be very different.
  - Critical to the identification and prioritization of planning, educational, and enforcement safety countermeasure efforts.
  - Financial and other costs of crashes vary substantially based on the nature and extent of injuries sustained.