The severity of pedestrian crashes in Lisbon

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Background:

Spatial organization in cities has often taken a special attention to motor vehicles requirements, and neglecting pedestrians and cyclists’ needs. Current emphasis in city planning for health and sustainable development has led to shifting local transport policies emphasis to the promotion of active transport modes and to the reassignment of urban space to these modes. However, to increase the share of active transport modes while meeting road safety policy means improvements in the safety of vulnerable road users are needed.

Accident occurrence in urban environments represents a critical safety issue for all countries in the world, as the opportunities for crashes involving pedestrians or cyclists and motorized vehicles increases with urbanization growth and those occurrences tend to involve severe injuries. According to the CARE database (the European Union’s injury road accident database), in 2015 21% of European road accident fatalities were pedestrians, of which 69% occurred inside urban areas and only 31% occurred in rural areas.

In the same year, in Portugal pedestrian fatalities corresponded to 24% of all road accident deaths, a percentage that is slightly below the corresponding European value. However, when analysed in detail, 76% of these pedestrian fatalities occurred in urban areas, which highlights a higher relative importance of the pedestrian road safety challenges in Portugal than in Europe.

A safe environment is indispensable to promote walking and cycling. However, motorized vehicle priority urbanization created a built environment unfriendly for pedestrians, making walking activities too much vulnerable, even in developed countries.

Improved knowledge on the underlying factors involved in crash occurrence and elements influencing the severity of resulting injuries are needed to improve pedestrian safety. The consideration of variables describing build environment in explaining crashes and injury outcomes may help to improve urban planning and street environment design. Several studies have examined the relationship between built environment factors and pedestrian crash frequency and risk.

Aim:

This study aimed at investigating factors associated with injury severity levels that pedestrians experienced in the city of Lisbon, Portugal, such as urban infrastructure, population and other exposure indicators, and urban characteristics. To accomplish this analysis, a geocoded database on road accidents and victims that occurred in Lisbon between 2008 and 2011 was used. The analysis was conducted using the multinomial logit (MNL) model to estimate pedestrian and driver injury outcomes, by severity level.

Method or methodological issues

In crash severity analysis, several models can be applied; MNL being a frequently used one. MNL models are traditional discrete outcome models that may consider several outcome levels and that do not explicitly consider the ordering that may be present in these outcomes. These models require the assumption that the unobserved terms are independent of the injury severity level. If there are
injury severity levels that share unobserved terms (so being correlated), coefficients and severity probabilities would be erroneously estimated; in this cases, these models should not be used.

The data collected for this study concerns Lisbon municipality. This study uses four data sets, namely pedestrian crash data, land use information, population census data, and pedestrian exposure proxies. Land use information is disaggregated by area type: industrial, green, residential, historical, services, special uses, mixed-use, railways, roads, and buildings. Census data includes the number of housing units, number of families, and number of inhabitants per gender, age group, and main activity. Finally, pedestrian exposure proxy data were calculated using a numeric scale conversion of the pedestrian potential maps (MAPPe) developed within the Pedestrian Accessibility Plan of Lisbon.

Results obtained or expected:

A MNL model was fitted to identify the possible street geometric, road user, environmental, vehicle, and land use predictors of pedestrian injury severity in Lisbon. In the analysis, data were used, from 2006 pedestrian crashes that occurred in Lisbon in the period 2008 to 2011.

Altogether, 19 variables were calibrated and used to identify the potential effects of different factors related to the categories listed above.

Conclusions:

Significant severity predictors from the model included driver injuries, drivers’ maneuvers before crash, driver gender, pedestrian age, crosswalk type, land use characteristics, lighting conditions, and time of day.

Several factors were found to influence the probability of pedestrians’ injuries in motor-vehicle crashes, by severity class. For instance, business areas and drivers’ abrupt maneuvers were found to increase the pedestrian’s fatality probability by 350% and 1750%, respectively. Pedestrians severe injuries were 44% less likely for female drivers, compared to male drivers. It was also found that residential areas are associated with a modest increase in pedestrian’s minor injury probability (1%).