

# INJURY RISKS IN VEHICLE-TO-PEDESTRIAN ACCIDENTS

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## Introduction

Pedestrians represent about 20% of the overall fatalities in road accidents in Europe.

Accident statistics reveal factors of risk and establish the dependencies of accident rates on the characteristics and parameters of road, cars, pedestrians, traffic and the environment of accident location [Eluru, 2008]. Through a statistical analysis of road accidents one can determine patterns and identify determinant factors in the occurrence and severity of accidents. Despite that a statistical analysis provides an evaluation of the measures applied for improving road traffic accidents, this phase lacks of fundamental information to increase the level of detail associated with pedestrian road accidents. So, it arises the need for an in-depth investigation in order to analyze and have access to important and fundamental aspects of an accident, absent in a mere statistical analysis, as detailed information about the injuries and injury causation mechanisms.

## Methods

When dealing with injury risk factors regarding road accidents involving pedestrians, an analysis of this phenomenon with significant proportions in statistical terms by a mere descriptive statistics is insufficient. Therefore, to identify possible associations between accidents and injuries, it was applied the Multinomial Logistic Regression model (MLR) to the gathered data from a total of 11366 pedestrian road accidents with victims between the years 2010 and 2011, in Portugal.

In a second phase, accident reconstruction computational techniques using pedestrian biomechanical models are used to evaluate the conditions of the accidents that lead to the injuries, as the speed and the impact location. For that biomechanical injury criteria's as the AIS (*Abbreviated Injury Scale*), the HIC (*Head Injury Criterion*) and other injury criteria based on the resulting accelerations in the pedestrian's body [Rautji, 2006] are used.

## Results

The obtained statistical model indicated that there were 14 predictors that significantly influence the pedestrian injury severity in the event of a road accident for instance

Pedestrian's age, Pedestrian's gender, Vehicle Design/Category or Driver's gender,.

Taking into consideration the police report, sketch with the victim's final position, vehicle damages and driver's statement, and checking the accuracy of this information based on the pedestrian's injuries from the autopsy report, various scenarios and parameters were tested in order to determine the accident dynamics by a computational reconstruction of the accident (Fig. 1). It was then achieved a good hypothesis of the accident's dynamics by verifying the presence and absence of the confirmed injuries through an evaluation of the injury criterions.



Figure 1: Reconstruction of a pedestrian accident with biomechanical multibody models.

## Conclusions

Mathematical statistical models applied to data information from road accident can provide important information about the risk factors. In addition biomechanical models can provide more accurate information about the injuries and the factors causing these injuries. Developing statistical and conceptual links between existing databases from different field areas (police, medical, coronary) can also provide new opportunities for crash injury analysis, aiding the development of special accident data sets. The use of injury scales and criterions in the study of causes of road accidents, such as AIS, can improve and help specify the development of road safety measures on pedestrian fatalities. Therefore, collaboration between engineers and doctors is important to understand the mechanisms of injury and for a more accurate determination of the causes and consequences of these accidents.

## References

- Eluru, *et al*, *Accid Anal Prev*, 40(3): 1033-1054, 2008.
- Rautji, *et al*, *Med Sci Law*, 46(2): 157-165, 2006.