FREQUENCY AND SEVERITY OF CRASHES INVOLVING VULNERABLE ROAD USERS – AN INTEGRATED SPATIAL AND TEMPORAL ANALYSIS

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Worldwide, it is estimated that every year 1.2 million road users lose their lives on road crashes. This situation has a huge impact in terms of health and economical development and costs to governments. Pedestrians and cyclists, often called vulnerable road users (VRUs), are more likely to be injured in road crashes as they are unprotected and more exposed to risk in the presence of motor vehicles. In 2015, 21% of the fatalities in European Union’s roads were pedestrians, while 8% were cyclists. The respective percentages in Portugal were 23% for pedestrians and 5% cyclists.

The objective of the paper is to developed a comprehensive study between motor vehicle and pedestrians or cyclists collisions occurrences integrating spatio-temporal data analysis with crash prediction models. Spatial analysis is the first step to identify the patterns between blackspots in three cities from Portugal (Aveiro, Porto and Lisbon). Blackspots were identified using ArcGIS and the Kernel Density Estimation function taking into account the level of injury severity. The second step is a temporal analysis that involves a temporal distribution of the crashes or injured people. Lastly, a crash prediction model was developed for each city that calculates the likelihood of VRUs to be involved in a crash taking into account injury severity.

The findings from the study highlighted target variables and specificities at a local level that may influence the number and severity of crashes between motor vehicle and VRUs. The identification of blackspots revealed that most injuries occurs surrounding high attraction places. Temporal analysis results showed a major percentage of crashes occurring during afternoon peak-hours (4-7p.m.). Comparison between the cities showed that Porto presents the worst scenario in terms of number of VRUs injuries per ten thousand inhabitants or kilometers squared. The developed Multinomial Logistic Regression models revealed that VRU gender and age, as well as weather conditions, are statistically significant for the prediction models. The spatio-temporal analysis of crashes taking into account the level of injury severity has the goal of establishing patterns between the different cities, which is important to understand risk factors. The outcomes of the study are valuable not only for VRUs awareness, but also for traffic planners and decision-makers.

KEYWORDS: road crashes, injury severity, multinomial logistic regression analysis, cyclists, pedestrians, vulnerable road users.

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