Pedestrian Serious Casualty Risk in Victoria, Australia: A Logistic Regression Analysis of Road, Environmental and Human Demographic Factors

Amir Sobhani[a], Chris Jurewicz[a], Hafez Alavi[b], Michael Nieuwesteeg[b]

[a]ARRB Group Ltd; [b]Transport Accident Commission

Abstract

Pedestrian safety is securing more and more support from the Victorian Government. This paper investigated the effect of road, environmental and human demographic characteristics on the likelihood of pedestrian fatal and serious injuries in Victoria, Australia. Pedestrian injury data was obtained from Transport Accident Commission (TAC) dataset, where the injury data are validated using TAC hospitalization data. A binary logistic regression model was developed to identify factors influencing the likelihood of pedestrian serious casualty. This study will assist TAC and VicRoads in formulation of pedestrian programs and selection of treatments which effectively target pedestrian serious casualty risk factors.

Background:

Pedestrian injury and mortality are a global issue, with more than 270,000 pedestrians killed worldwide each year (World Health Organization 2013a), and this represents approximately 22% of all global road trauma. In Victoria, 249 road fatalities were reported in 2014 from which 18% were pedestrian fatalities. These statistics convinced the Victorian Road Safety Partners to develop a number of major programs to reduce number and severity of pedestrian serious casualties.

Although research were conducted to understand crash attributes contributing to pedestrian casualty crashes in Victoria (Corben et al. 1996; Oxely et al. 2013; Senserrick et al. 2014), these studies were limited and did not adequately concentrate on pedestrian serious casualties. This article outlines the effect of road, environmental and human factors on pedestrian serious injuries and fatalities.

Method:

This study performed a comprehensive literature review of past studies conducted in Victoria to investigate crash attributes affecting pedestrian serious injury problem. Chi-square test was conducted to identify the crash parameters which have a statistically significant effect on pedestrian injury severity. Then, the identified variables entered into a binary logistic regression model to understand the relative importance of the factors. Change in the value of the model likelihood function was used to indicate the relative effect of each variable on the model outcome. The relative importance of levels of variables was indicated using the value of odds ratio.

Results:

The literature review of factors influencing the pedestrian serious injury problem in Victoria highlighted the following gaps in knowledge:

- Most of the studies used simple statistical analysis to understand factors affecting the number and severity of pedestrian fatalities and serious injuries. Very few studies utilised multivariate statistical analysis method to better understand the relative importance of these factors (Alavi, 2013; Senserrick et al. 2014).

- Different types of databases were used to conduct pedestrian injury/crash analyses. The majority of studies used Road Crash Information System (RCIS) data to conduct their

analysis. Alavi (2013) revealed that the relative importance of different parameters was different if the same analysis was carried out using police and hospital data. Therefore, more accurate understanding could be achieved using a combined database.

- Limited studies focused on understanding the effect of crash factors on pedestrian fatality and serious injuries.

The results showed that:

- 'speed zone', 'age', 'crash time', 'location type', 'pedestrian movement', 'atmospheric condition' and 'gender' were the significant parameters affecting pedestrian injury severity level.

- Higher speed limit was associated with higher possibility of being involved in a pedestrian FSI. This possibility was substantially increased if the speed limit was 70 km/h or more.

- Age of the pedestrian significantly influenced the likelihood of being involved in a pedestrian fatal and serious injury. Pedestrians aged more than 65 years old were associated with higher possibility of being involved in pedestrian serious casualties. This possibility is almost equal for other age groups.

- Crash time was also found to be a significant factor affecting the number of pedestrian fatal and serious injuries. 'Dark AM off-peak' and 'PM off-peak', which are dark times of the day, significantly increased the likelihood.

- Mid-blocks were associated with more pedestrian serious casualties than intersections

- Pedestrian movement defined by DCA was the other significant factor affecting injury severity. 'Crossing carriageway', 'working/playing/lying or standing on carriageway' and 'not on carriageway' were the most problematic movements in fatal and serious injury pedestrian crashes.

- In terms of gender, males were more likely to die or be seriously injured than females. However, this difference was very marginal.

The model also revealed that three variables, which had the most effect on the model results, are 'age', 'speed zone' and 'pedestrian movement'.

Conclusions:

This study confirmed and improved the current understanding of pedestrian serious injury problem in Victoria, Australia. The findings pointed to the need to focus future programs and treatments on road crossings.

In future studies, it is recommended to use random parameter logistic regression modelling technique for this analysis. This method improves understanding of the factors influencing pedestrian injury severity since it accounts for unobserved heterogeneity in the data.

References

Alavi, H 2013, 'Assessing pedestrian crash risk and injury severity in concentrated urban environment', PhD thesis, Monash University, Clayton, Vic.

Corben, B & Diamantopoulou, K 1996, 'Pedestrian Safety Issues for Victoria', report 80, Monash University Accident Research Centre, Melbourne, Australia.

Oxley, J, Yuen, J, Corben, B, Hoareau, E & Logan, D 2013, 'Reducing pedestrian collisions in Melbourne's Central Business District', Australiasian Road Safety Research, Policing & Education Conference, Brisbane, Queensland.

Senserrick, T, Boufous, S, De Rome, L, Ivers, R & Stevenson, M 2014, 'Detailed Analysis of Pedestrian Casualty Collisions in Victoria, Australia', Traffic Injury Prevention, vol. 15, no.1, pp. S197-S205.

World Health Organization 2013a, 'Pedestrian safety: A road safety manual for decision-makers and practitioners', World Health Organisation, Geneva, Switzerland.