Involvement of alcohol and drugs in crashes with vulnerable road users in Canada

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Abstract

Background
As walking, cycling, and motorcycling gain in popularity, the onus is on road safety professionals to ensure that safety measures keep pace with the public interest in these activities. In order to effectively address the needs of pedestrians, cyclists, and motorcyclists in Canada, an epidemiological profile of injuries for such vulnerable road users is required to inform prevention initiatives.

Aims
The Traffic Injury Research Foundation (TIRF) has partnered with the Public Health Agency of Canada (PHAC) to conduct a comparative analysis of injuries relating to vulnerable road users. The primary goal is to present an up-to-date overview of crashes and injuries related to vulnerable road users in Canada. A second goal is to present an assessment of the role of alcohol and drugs in these crashes.

Methods
TIRF maintains two databases from which information was drawn. First, the National Fatality Database is a comprehensive, pan-Canadian, multi-decade set of core data related to all fatal motor vehicle crashes. Second, TIRF also maintains the Serious Injury Database, which contains information on persons seriously injured in crashes and on all drivers involved in these crashes. These data were compared with those available to PHAC including PHAC’s own Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP), an injury surveillance system operating in the emergency departments of 11 paediatric and four general hospitals across Canada.

Results
Previous analyses have shown elevated instances of alcohol involvement among fatally injured pedestrians. Comparable results will be presented using the other data sources, both about alcohol as well as drug involvement.

Discussion and conclusions
While the evidence may be limited, it can be concluded that the involvement of alcohol and drugs in crashes with vulnerable road users must not be underestimated. The available data will be discussed with a special emphasis on informing prevention and mitigation initiatives.
Introduction

Protection for vulnerable road users on Canada’s roads fails to match the level of protection quickly becoming standard for those driving motor vehicles. The vulnerability of pedestrians, cyclists and motorcyclists is exemplified by their overrepresentation in the total number of road user injuries and fatalities: According to the World Health Organization’s most recent data, 46.0% of fatal road traffic injuries are sustained by vulnerable road users (WHO 2011).

Objectives

The goal of this paper is to investigate the injuries associated with vulnerable road users, and to gain a clear representation of the public health issue facing these road users, particularly as it is manifested in crashes and injuries on Canada’s roadways. In addition, this paper seeks to investigate the role of alcohol and drugs in fatal vulnerable road user crashes.

Methods

To ascertain the extent of vulnerable road user fatalities and injuries in Canada, trends in the number of vulnerable road user fatalities and the share of vulnerable road user fatalities of all motor vehicle fatalities have been investigated. This involved the analyses of data on vulnerable road users contained in two databases managed by the Traffic Injury Research Foundation (TIRF): the Fatality Database and Serious Injury Database. The Fatality Database includes information on persons fatally injured in collisions in Canada from both coroners/medical examiners files and police collision reports. The Serious Injury Database includes information on seriously injured persons in Canada and is based on police-reported data. Comparisons were made between vulnerable road user types and age and gender groups within these user types to determine when collisions occurred and whether or not the vulnerable road users were under the influence of alcohol or drugs.

Data from the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP) were also analyzed to ascertain the extent of vulnerable road user injuries in Canada. CHIRPP is an emergency department based injury surveillance system operated by the Public Health Agency of Canada, in which there are currently 11 paediatric and six general hospitals participating. Since most of the data come from the paediatric hospitals, which are located in major cities, injuries among older teenagers and adults (who present with injuries at general hospitals), and people who live in rural and Northern areas including First Nations, Métis and Inuit people, are underrepresented. Fatal injuries are also underrepresented in CHIRPP because many victims who die at the scene are not transported to hospital. CHIRPP only records fatalities for victims who are dead on arrival or during treatment in the emergency department.

Three CHIRPP narrative (free text) fields allow a detailed level of classification and identification of very specific injury circumstances. Records of injuries sustained by vulnerable road users were identified using the code for CHIRPP’s Injury Group variable, and an extensive bilingual (English and French) narrative-based search. Pedestrian and cyclist cases include those

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1 The data up to 2010 represent 15 hospitals.
involved in motor vehicle collisions (MVC) while motorcyclist cases include both MVC and non-MVC injury events that occurred on public roads.

**Results**

The authors analyzed trends according to victim type, among vulnerable road user fatalities in Canada between 1995 and 2010. According to TIRF’s national Fatality Database, there were 757 vulnerable road users killed in 1995. Of this total, 493 were pedestrians, 174 were motorcyclists, and 90 were cyclists. In 2010, there were 631 vulnerable road user deaths in Canada. Of those, 358 were pedestrians, 196 were motorcyclists, and 77 were cyclists. Between 1995 and 2010, there has been a reduction in the number of pedestrians killed, the number of cyclists killed has remained relatively stable, and there has been a general increase in the number of motorcyclists killed.

In addition to absolute figures, percentages of each vulnerable road user type as a total of all road user fatalities from 1995 to 2010 were also calculated. In 1995, pedestrians comprised 13.4% of all motor vehicle fatalities, and this rose to 14.1% in 2010. During this same period, the share of fatalities among cyclists attributable to motor vehicle collisions rose slightly from 2.4% to 3.0%. Among motorcyclists, there was a more pronounced increase from 4.7% in 1995 to 7.7% in 2010.

With respect to gender, among all vulnerable road user types, males are at a higher risk of fatality or serious injury than females. Among fatally injured pedestrians, 62.9% were male, whereas 37.1% were female. Among seriously injured pedestrians, 56.4% were male, while 43.4% were female. The only exception was among seriously injured pedestrians aged 56 or over, where females outnumbered males. Further investigation shows that pedestrians aged 56 or older are more likely to be fatally or seriously injured than younger pedestrians. To illustrate, among pedestrian fatalities, 42.7% (2,978 of 6,978) were aged 56 or older. This was particularly true among women as 50.2% (1,303 of 2,591) of all pedestrian fatalities between 1995 and 2010 were aged 56 or older. Among seriously injured pedestrians, 24.8% (6,212 of 25,056) were aged 56 or older. An even higher proportion of seriously injured female pedestrians (30.3% or 3,294 of 10,880) were aged 56 or older.

The overrepresentation of males among fatally and seriously injured vulnerable road users is more pronounced among cyclists and motorcyclists. Among fatally injured cyclists between 1995 and 2010, 89.8% were men while 10.2% were women. Among seriously injured motorcyclists, 83.8% were men compared to 16.2% who were women. Of the 3,016 fatally injured motorcyclists, 843 (28.0%) were aged 16-25. Motorcyclists from this age group also accounted for 782 (28.9%) of the 2,707 fatally injured males. Among the 309 fatally injured females, however, most were aged 46-55 (83 or 26.9%). Of
the 17,119 seriously injured motorcyclists, 4,501 (26.3%) were aged 16-25. The proportion of
14,345 seriously injured male motorcyclists in this age group was even higher as 3,936 (or
27.4%) were aged 16-25. Among the 2,774 females, however, the greatest number of seriously
injured motorcyclists (722 or 26.0%) was aged 36-45. Thus, female motorcycle crash victims
who are seriously or fatally injured tend to be from an older age bracket than male motorcycle
 unsuspcrash victims who are seriously or fatally injured.

Consistent with previous studies on the types of injuries commonly seen in vulnerable road users
involved in crashes, the most common injury types among vulnerable road users between 1990
and 2010, according to CHIRPP data, are superficial injuries, fractures, and head injuries.
Among cyclists and pedestrians, the most common type of trauma is the superficial injury
(32.6% and 32.0%, respectively). Fractures (39.6%) represent the injury type most commonly
found among motorcyclists.

With respect to alcohol use among road users, while the percentage of fatally injured drivers and
motorcyclists testing positive for alcohol decreased from 1990 to 2000 and then stabilized
throughout the beginning of the millennium, the same has not been true for fatally injured
pedestrians and cyclists. Alcohol consumption by pedestrians remains a contributing factor in a
large number of pedestrian fatalities, as 45.8% of fatally injured pedestrians had been drinking in
2010, a slight increase from 45.2% in 1990. The data for cyclists are less stable, since
comparatively fewer Canadian cyclists are fatally injured in any given year, and because testing
rates for cyclists (48.4%) tend to be lower than for motorcyclists (81.8%) and pedestrians
(58.2%).

A more detailed investigation of alcohol consumption on the part of vulnerable road users is
provided in Table 1. It reveals that, among fatally injured vulnerable road users, males are more
likely than females to have consumed alcohol prior to the crash among all three victim types.
This is particularly true among fatally injured male pedestrians where 45.9% had been drinking
compared to 28.5% of fatally injured female pedestrians. Almost one-third of fatally injured
male motorcyclists (32.2%) had been drinking compared to 17.9% of fatally injured female
motorcyclists. Among fatally injured cyclists, 24.0% of males had been drinking compared to
7.1% of females. It should be noted that many of the fatally injured victims had consumed well
over the legal limit of alcohol (which is a Blood Alcohol Concentration level or BAC of 0.08%
in Canada). Among fatally injured vulnerable road users who had been drinking, 87.7% of
pedestrians², 70.2%³ of motorcyclists, and 70.6%⁴ of cyclists had BACs over the legal limit.
Furthermore, among fatally injured drinking pedestrians, 67.6%⁵ had BACs over twice the legal
limit between 2000 and 2010.

The extent to which drug use may contribute to vulnerable road user crashes in Canada was also
investigated. Testing rates for drugs are low for fatally injured vulnerable road users - 37.0%
overall, compared to a testing rate of 65.1% for alcohol. Among fatally injured vulnerable road

² [212+713] ÷ [2,616-1,561]*100
³ [172+204] ÷ [1,700-1,164]*100
⁴ [20+40] ÷[393-308]*100
⁵ 713÷ [2,616-1,561]
users who were tested for the presence of drugs, 38.9% of pedestrians, 30.8% of cyclists, and 30.1% of motorcyclists tested positive.

The percentage of fatally injured road users who test positive for drugs between 2000 and 2010 was also investigated. It should be noted that these data are volatile, particularly with respect to cyclists who number fewer than the other road class users, and are tested for drugs less frequently. Between 2000 and 2010, the percentage of fatally injured pedestrians testing positive for drugs increased from 37.5% to 40.7%. In 2000, 36.7% of automobile drivers tested positive for drugs, compared to 36.8% in 2010. Motorcyclists have consistently been less likely to test positive than pedestrians and automobile drivers although there was an increase from 20.5% in 2000 to 29.2% in 2010. Cyclists have typically been the least likely to test positive for drugs. In 2000, none of the fatally injured tested cyclists were positive for drugs whereas 23.1% tested positive in 2010, which may reflect increase testing rates as opposed to an increase in actual drug use.

### Table 1

<table>
<thead>
<tr>
<th>Victim Type</th>
<th>Number of Victims*</th>
<th>Victims Tested (% of total)</th>
<th>Victims Grouped by BAC (mg%)</th>
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<tr>
<td></td>
<td></td>
<td>Negative</td>
<td>1-49</td>
</tr>
<tr>
<td>Pedestrians</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>2808</td>
<td>1781</td>
<td>964</td>
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<tr>
<td>Females</td>
<td>1656</td>
<td>835</td>
<td>597</td>
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<tr>
<td>All Pedestrians</td>
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<td>2616</td>
<td>1561</td>
</tr>
<tr>
<td>Males</td>
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<td>1622</td>
<td>1100</td>
</tr>
<tr>
<td>Females</td>
<td>99</td>
<td>78</td>
<td>64</td>
</tr>
<tr>
<td>All Motorcyclists</td>
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</tr>
<tr>
<td>Females</td>
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<td>56</td>
<td>52</td>
</tr>
<tr>
<td>All Cyclists</td>
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<td>393</td>
<td>308</td>
</tr>
<tr>
<td>Males</td>
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<td>4,709</td>
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</tr>
<tr>
<td>Females</td>
<td></td>
<td>4,709</td>
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</table>

* Excludes passengers of motorcycles and bicycles.

**Table 1:** Alcohol use among fatally injured vulnerable road users by victim type and gender: Canada 2000-2010, TIRF fatality database

### Discussion

A general downward trend in the absolute number of pedestrian fatalities from 1995 to 2010 has emerged; however no such downward trend is immediately apparent for cyclists and
motorcyclists. Of note, while the number of pedestrians killed on Canada’s roadways each year seems to be diminishing, the percentage of deaths among these victims as a percentage of all road user deaths does not show a similar decline. This suggests that while fewer Canadians overall are dying on the roadways, it is occupants of passenger vehicles who are benefiting the most from progress in road safety, and not vulnerable road users.

Furthermore, the data in this paper corroborate previous research from Canada and the United States, showing that child and teen cyclists are the most likely to suffer a serious or fatal injury, followed by cyclists aged 56 and older. Consistent with similar research, it was also found that motorcyclists aged 16-25 are overrepresented both in terms of serious injury and fatalities. Elderly pedestrians are overrepresented in both fatal and serious injury pedestrian crashes, with female pedestrians comprising a particularly high-risk group. As Canada’s population ages, the need to ensure the safety of elderly vulnerable road users will no doubt receive greater priority (Robertson and Vanlaar, 2008, p.1983).

Alcohol and drug use among vulnerable road users has been a relatively neglected issue compared with alcohol and drug use among drivers of passenger vehicles. While the percentages of fatally injured drivers and motorcyclists that test positive for alcohol are decreasing, the same cannot be said for pedestrians. The percentage of fatally injured pedestrians who tested positive for alcohol consumption was almost exactly the same in 2010 (45.8%) as in 1990 (45.2%). Motorcyclists are the only group of vulnerable road users among whom it seems real progress in reducing drinking and driving has been made. With respect to statistics for cyclists, these data are volatile and trends over the 20-year time frame studied are not obvious. More data are needed before we can conclude that cyclist alcohol-involvement is similar to, or different from, that of pedestrians, motorcyclists, or drivers of passenger vehicles. Drug use among vulnerable road users is another area of road safety research that has been largely neglected. While testing rates are again generally low, between 30% and 40% of fatally injured vulnerable road users test positive for drugs.

Conclusion

The safety of vulnerable road users is an issue that is only increasing in importance. The promotion of walking and cycling as forms of exercise, growing popularity of motorcycling, overall population increases, as well as predicted increases in the number of elderly road users means that action must be taken to ensure that the proper measures are in place to protect these road users. Advances have been made in recent years, most notably with respect to drinking and driving among motorcyclists and the total number of annual pedestrian deaths, but safety gaps exist for vulnerable road users. The issue of drug- and alcohol-impaired pedestrians who are fatally wounded in crashes is of particular concern. This issue has received limited attention and few efforts have been made to inform pedestrians about the dangers inherent in this behaviour.

References
