



Injuries related to off-road vehicles in Canada



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ABSTRACT

Off-road vehicles (ORVs; this includes snowmobiles, all-terrain vehicles or ATVs and dirt bikes) were once used primarily for work and travel. Such use remains common in Canada, although their recreational use has also gained popularity in recent years. An epidemiological injury profile of ORV users is important for better understanding injuries and their risk factors to help inform injury prevention initiatives. The Traffic Injury Research Foundation (TIRF) partnered with the Public Health Agency of Canada (PHAC) to analyze the epidemiology of ORV-related injuries. The primary aim was to assess crashes and injuries in Canada, including the extent of alcohol involvement. Secondly, the burden of injury among children and teen ORV drivers in Canada, as well as passengers, was investigated. Descriptive and inferential epidemiological statistics were generated using the following data sources: first, TIRF's National Fatality Database, which is a comprehensive, pan-Canadian, set of core data on all fatal motor vehicle crashes; second, TIRF's Serious Injury Database, which contains information on persons seriously injured in crashes; and, third, PHAC's Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP), a surveillance system currently operating in the emergency departments of some pediatric and general hospitals across Canada. Exposure data have been used in the analyses where available. Between 1990 and 2010, fatality rates increased among ATV and dirt bike operators. The fatality rate among snowmobilers declined during this period. Of particular concern, among fatally injured female ATV users, children aged 0–15 years comprised the highest proportion of any age group at 33.8%. Regarding alcohol use, among fatally injured snowmobile and ATV/dirt bike operators tested for alcohol, 66% and 55% tested positive, respectively. Alcohol involvement in adult ORV crashes remains an important factor. In light of the growing popularity of ORVs, prevention and mitigation measures are required to address this issue.

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1. Introduction

Off-road vehicles (ORVs) including all-terrain vehicles (ATVs), snowmobiles, and dirt bikes are popular in Canada for recreational and work-related use. ATVs were initially designed for farm work or as a means of transportation for people living in remote areas. Snowmobiles are land vehicles designed for travel on snow. Dirt bikes are lightweight motorcycles designed for use on unpaved roads, dirt roads or trails.

While ORVs typically come with a variety of safety warnings, when compared with automobiles, there is little legislation

concerning licensing, safety education and minimum age (Yanchar, 2013). There is no specific evidence to suggest why ORVs should be less regulated, compared to, for example, automobiles. However, ORV users are typically left to their own devices when determining the location and conditions under which the machine is used. Of particular concern, many of these ORVs are advertised as toys, which may encourage their use by children and teens under 18 years of age while simultaneously underemphasizing the need to consider safety when operating these vehicles. In this paper the term “ORVs” is used to denote all motorized vehicles intended for use off of public roadways such as ATVs, snowmobiles, and dirt bikes.

Males are more likely than females to sustain ORV-related injuries. There is some evidence to suggest that this is an exposure issue that can be partially explained by more males using ORVs

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than females (Mayercik et al., 2012; Lord et al., 2010; Balthrop et al., 2009; Krauss et al., 2010). The problem of ATV-related injuries in children is of growing concern, especially since children aged 15 and under are overrepresented in terms of the number injured compared to the number operating ATVs (Yanchar, 2013; Mayercik et al., 2012; Lord et al., 2010; Balthrop et al., 2009).

Fractures are a common injury among ATV crash victims (Balthrop et al., 2009). In particular, trauma to the head and/or brain is present in one-third of cases involving children. For adults, instances of head and/or brain trauma are almost as frequent as abdominal/chest trauma. Among children injured in ATV-related crashes, nearly 25% experience trauma to the abdomen and chest (Brown et al., 2002). Blunt force trauma includes crush injuries which occur when an ATV rolls on top of a person. Since ATVs can weigh up to 270 kg, these types of injuries are often very serious.

Musculoskeletal injuries including extremity fractures, most commonly associated with snowmobile crashes, are present in almost two-thirds of snowmobile crash victims in Canada (CIHI, 2007). A five-year study in Manitoba found closed head injuries (concussions, intracranial hematoma, etc.) in 13% of injured riders, while a Swedish study reported such injuries in almost half of all fatally injured riders (Stewart and Black, 2004; Öström and Eriksson, 2002). Blunt force trauma to the head, chest, and drowning are the principal causes of fatal injury in snowmobile crashes.

Information on dirt bike-related injuries is limited, as very few studies focus their attention on this type of vehicle. Of the limited information available, most of the studies focus on children and/or teens. Dirt bike use takes place in a variety of different settings. Official motocross racers are required to wear safety gear including a helmet, goggles, a chest guard, a kidney belt, trousers, boots, gauntlets, a vest, knee pads, and a knee brace. Non-competitive dirt bike riders may be less likely to wear this much safety equipment, thereby exposing themselves to a higher risk of internal, musculoskeletal, and blunt force injury. Extremity fractures are the most common type of injury (PHAC, 2012). In particular, lower body fractures and damage to ligaments in the knee and ankle often result from riders using one leg as a pivot point when negotiating sharp turns.

Alcohol use prior to the injurious ATV crash was common among adults, noted in about half of the cases reported (Mayercik et al., 2012; Lord et al., 2010; Krauss et al., 2010). A substantial majority of injured snowmobile riders had been drinking prior to their crash, and among these operators, most had BACs over the legal limit (Stewart and Black, 2004; Öström and Eriksson, 2002). Victims of dirt bike-related crashes are rarely tested for alcohol or illegal drug consumption. As such, there is limited information about the extent to which these factors influence crash rates and crash severity.

2. Objectives

Effective preventative measures and protective policy to increase the safety of users of ORVs must be founded on data reflecting the types of crashes and kinds of injuries that victims of ORV collisions typically experience. Thus, the objective of this paper is to provide a perspicuous representation of the public health issue presented by the popular use of ORVs in Canada. In addition to corroborating the results of previous studies (from Canada, the United States, Sweden, and Australia), using Canadian data this paper seeks to achieve two other, related objectives: first, to assess the risks associated with children using ORVs, and second, to explore the risk of ORV crashes with respect to the passengers of these vehicles.

3. Methods

3.1. Data sources

3.1.1. TIRF databases

This examination involved the analysis of data on ORV users contained in two databases managed by the Traffic Injury Research Foundation (TIRF). The Fatality Database includes information on persons fatally injured in on- and off-road 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. A more detailed description of the methodology of these databases is available in Mayhew et al. (2009). The Fatality Database contains toxicological data for fatally injured victims. The Serious Injury Database does not contain these toxicological data. The type of injury contributing to death is aggregated into general categories (e.g., head injury, spinal injury) in the Fatality Database. No parallel data are provided in the Serious Injury Database. One limitation is that data from ATVs and dirt bikes cannot always be disaggregated since some provincial collision datasets do not differentiate between these two vehicle types.

3.1.2. Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP)

Data from the CHIRPP were also analyzed. CHIRPP is an emergency department based injury surveillance system operated by the Public Health Agency of Canada (PHAC), in which there are currently 11 pediatric and 6 general hospitals participating (although for this study data from the 11 pediatric and only 4 general hospitals were available). Over two million records have been collected nationally since CHIRPP's establishment in 1990 (Mackenzie and Pless, 1999). Although not population-based, a number of studies have shown CHIRPP to be representative in some contexts (Macpherson et al., 2008; Pickett et al., 2000; Kang et al., 2013; Macarthur and Pless, 1999a,b).

3.1.3. Exposure data

Exposure data for ORVs is limited compared to exposure data for principal highway vehicles (e.g., automobiles, trucks, vans, motorcycles). To illustrate, mileage data and fleet size are not widely available for ORVs. Therefore, sales data were considered as a proxy for exposure. Information on snowmobile sales for the study period was available from the Canadian Council of Snowmobile Organizations Membership (CCSOM) (<http://www.ccsom.com/whoare2.html>). The information for ATVs is only available for the period 2003–2010 with no specific reference about dirt-bikes from the Motorcycle and Moped Industry Council (MMIC, 2013).

3.2. Data analysis

Data analysis involved trend analysis of the frequencies of fatalities and serious injuries, the characterization of the victims in terms of gender, age and type of ORV, the collision mechanism, the nature of the serious injuries and the level of alcohol impairment in fatal injuries. Descriptive findings in terms of frequencies are supported by regression models and significance tests (StataCorp., 2013). Results were considered to be significant if corresponding *p*-values were below 0.05.

4. Results

4.1. Trends in fatalities and serious injuries

Fig. 1 shows the number of ORV users in Canada killed annually between 1990 and 2010, by vehicle type. According to TIRF's

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