## Fatally Injured Off-road Vehicle Riders in Canada | 2000-2021

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## TRAFFIC INJURY RESEARCH FOUNDATION

# Key Findings

Casualties among off-road vehicle operators, specifically persons under 16 years of age, have increased substantially in the past two decades. Of note, decreases in fatalities of users of off-road vehicles have not corresponded with the decreases generally observed in fatalities and injuries from collisions on public roadways.

- More than half of snowmobile riders (57.9%) and almost two-thirds (64%) of ATV/dirt bike users under age 16 dying in a crash were lone vehicle riders.
- > There were 27 ATV/dirt bike riders aged 65 and older killed in a crash in 2021 compared to five in 2000.
- In 2021, there were 142 male off-road vehicle riders killed in a crash, compared to 94 in 2000. The number of female riders dying in a crash increased to 23 in 2021 which is a concerning increase from six female riders killed in 2000.

## Introduction

All-terrain vehicles (ATVs) and snowmobiles were initially developed for work purposes primarily in the agricultural, forestry, and transportation sectors in more remote or snowcovered areas. More recently, they have become popular off-road vehicles among Canadians who use them for off-road experiences (Vanlaar et al. 2015). In this report, the term off-road vehicle refers to snowmobiles, all-terrain vehicles (ATVs), and dirt bikes. It should be noted that ATVs include three-wheeled, four-wheeled and side-by-side models. Side-by-sides provide seating for passengers to sit beside the driver whereas passengers of three and four-wheeled ATVs sit behind the driver. Golf carts, dune buggies, and lawn tractors are excluded in this study.

Generally speaking, the decreases observed in fatalities of users of off-road vehicles have not corresponded with decreases in fatalities and injuries in collisions on public roadways (Public Health Ontario 2019). Among ATV and dirt bike riders, there was a 150% increase in the rate of serious injuries and an 85.7% increase in the rate of fatalities per 100,000 population in Canada between 1995 and 2010. During this same period, there was a downward trend in reported snowmobile serious injuries (38% decrease) and fatalities (34.9% decrease) per 100,000 population (Vanlaar et al. 2015). However, casualties among off-road vehicle operators have increased sevenfold in the past two decades among some subgroups, such as persons under 16 years of age (MacDougall et al. 2023).

This fact sheet, sponsored by **Desjardins Insurance**, examines the magnitude and trends of off-road vehicle fatalities in Canada from 2000 to 2021 using **TIRF's National Fatality Database**. Trends in off-road vehicle rider fatalities, the characteristics of fatally injured off-road vehicle riders (i.e., drivers), and characteristics of off-road vehicle fatal collisions are examined in this fact sheet to determine whether or not increases in fatalities involving off-road vehicles in Canada in past years have persisted.

# Off-road vehicle casualty trends over time compared to highway vehicle casualties

The number of off-road vehicle (snowmobile, ATV/dirt bike) and highway vehicle fatalities in Canada between 2000 and 2021 are shown in Figure 1. Highway vehicle fatalities are those in which a victim occupied a principal highway vehicle (e.g., automobile, light truck, van, motorcycle, or commercial vehicle) or was a pedestrian who was struck by one of these vehicles. They are represented by bars and plotted on the left axis. In 2021, there were 1,828 highway vehicle fatalities, a substantial decrease from 2,791 fatalities in 2000. Off-road vehicle fatalities are represented by the solid line and plotted on the right axis. On the other hand, the 184 off-road vehicle fatalities in 2021 were greater than the 133 fatalities in 2000.

Figure 2 shows the ratio of the number of fatalities per 100,000 population for highway vehicles, snowmobiles, and ATVs/dirt bikes. In 2021, there were 4.78 highway vehicle fatalities per 100,000 persons compared to 9.10 in 2000. Similarly, the 2021 ratio of snowmobile fatalities (0.14) was less than that in 2000 (0.23). However, the 2021 ratio of ATV/dirt bike fatalities (0.34) was greater than the 2000 ratio (0.21).



Figure 1 | Number of off-road vehicle vs. highway vehicle fatalities: Canada, 2000-2021







## **Characteristics of drivers in off-road vehicle collisions**

Based upon survey data, between 61.8% (Statistics Canada 2018) to 91% (Harry Cummings & Associates 2023) of operators/passengers of off-road vehicles are males. Figure 3 shows the number of fatally injured off-road vehicle operators that were male or female. Although not shown in the figure, close to 90% of off-road vehicle operators were male during this period (TIRF 2024). This corresponds with data from previous studies which showed a large majority of off-road vehicle fatalities were male (Gill et al. 2019, Vanlaar et al. 2015). In 2021, there were 142 fatally injured off-road vehicle operators who were male, compared to 94 in 2000. Although the 23 deaths among female riders in 2021 were fewer than those among males, this number still represents a significant increase from 2000 (six).

Figure 4 shows the number of fatally injured operators of off-road vehicles in each age group. The age groups are under 16, 16-19, 20-34, 35-49, 50-64, and 65 and older. In 2021, there were 20 fatalities under 16 years of age compared to eight in 2000. Similarly, there were 27 fatalities aged 65 and older in 2021 compared to only five in 2000. In contrast, there were 41 fatalities among 20-34-year-olds in 2021 which was slightly fewer than 44 in 2000.



#### Figure 3 | Number of fatally injured off-road vehicle drivers by sex: Canada, 2000-2021



Figure 4 | Fatally injured off-road vehicle operators by age group: Canada, 2000-2021

In Figure 5, the percentage of operators of snowmobiles, ATVs/dirt bikes, and highway vehicles who died in a collision and were positive for alcohol is shown. Fatally injured operators of highway vehicles have consistently been less likely to test positive for alcohol than drivers of other vehicle types. In 2021, 28.5% of highway vehicle drivers tested positive for alcohol compared to 34.7% in 2000. For most years, snowmobile operators were the most likely to test positive for alcohol. In 2021, 65.9% of these operators tested positive for alcohol compared to 62% in 2000. Among fatally injured operators of ATVs/ dirt bikes, 44.3% tested positive in 2021 compared to 40% in 2000.

In Figure 6, the percentage of operators of snowmobiles, ATVs/dirt bikes, and highway vehicles who were positive for drugs is shown. These include illegal drugs, cannabis, prescription drugs, and over the counter drugs but exclude alcohol. Among all three groups, there was an increase in the percentage of operators who tested positive for drugs. In 2021, more than half (52.9%) of drivers of highway vehicles tested positive for drugs compared to 34.3% in 2000. Among snowmobile operators, slightly less than half (46.2%) tested positive in 2021 which is double the percentage who tested positive in 2000 (23.3%). Similarly, 48.9% of ATV/dirt bike operators tested positive in 2021 compared to 25% in 2000.

#### Figure 5 | Fatally injured off-road vehicle operators positive for alcohol: Canada, 2000-2021







## **Collision characteristics of off-road vehicle fatalities**

Figure 7 shows the percentage of snowmobile and ATV/dirt bike fatalities by time of day, categorized in three-hour increments (e.g., midnight to 2:59 am). One-fifth (20.3%) of snowmobile fatalities occurred between 9 pm and 11:59 pm. Almost one-quarter of ATV/ dirt bike fatalities occurred between 6 pm and 8:59 pm. For both off-road vehicle types, fewer fatalities resulted from collisions which occurred during the two time slots between 3 am and 8:59 am.

Figure 8 shows the percentage of off-road vehicle fatalities according to the day of the week. For both fatally injured snowmobilers and ATV/dirt bike riders, the largest percentage of fatalities occurred on Saturdays (31% and 30.3%, respectively).



#### Figure 7 | Off-road vehicle fatalities by time of day: Canada, 2017-2021

Figure 8 | Off-road vehicle fatalities by day of week: Canada, 2017-2021



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Figure 9 shows the percentage of fatally injured snowmobile and ATV/dirt bike riders who were or were not wearing helmets at the time of the collision. Three-quarters of snowmobile riders (76.9%) compared to half (50.1%) of ATV/dirt bike riders were wearing their helmet.

In Figure 10, the percentage of off-road vehicle riders (driver and passenger) fatalities is shown based upon the number of vehicle riders. Among snowmobile fatalities, 82.4% of fatalities occurred when the victim was the sole vehicle rider and 16.9% occurred when there were two riders. Similarly, 75.1% of ATV/dirt bike fatalities occurred when the victim was the sole rider of their vehicle while 19.4% occurred when there were two riders; just 5.4% occurred when there were three or more vehicle riders.

#### 75.1% of ATV/dirt bike fatalities occurred when the victim was the sole rider.



Figure 9 | Off-road vehicle fatalities by safety equipment used: Canada, 2017-2021

#### Figure 10 | Off-road vehicle fatalities by number of riders: Canada, 2017-2021



In Canada, persons under 16 years of age cannot be fully licensed to operate motor vehicles on highways. Across Canada, there are different minimum ages for operating off-road vehicles. However, there are different regulations which govern where and with whom off-road vehicle riders under 16 years can operate these vehicles. Some examples of regulations unique to certain jurisdictions include:

- > no minimum age for persons to operate an ATV on private property in Alberta
- > operating an ATV on a public roadway with a passenger under eight years of age is prohibited in Ontario
- prohibitions on persons under 14 years of age operating ATVs which are not designed for their height and/or weight in British Columbia, New Brunswick, and Nova Scotia (Parachute 2023)

A substantial number of off-road vehicle fatalities were under 16 years of age. Figure 11 shows the percentage of fatally injured persons under 16 years of age who were:

- > lone vehicle riders
- > passengers on a vehicle with an adult driver
- > riders with an adult on board
- > riders with other children on board
- > passengers on a vehicle operated by a driver under 16 years of age

More than half (57.9%) of snowmobile riders and almost two-thirds (64%) of ATV/dirt bike riders under 16 years of age who died in a collision were lone vehicle riders.





In Figure 12, the percentage of off-road vehicle fatalities in single-vehicle collisions versus multiple-vehicle collisions is presented. Single-vehicle collisions accounted for 78.5% of snowmobile fatalities and 85.9% of ATV/dirt bike fatalities.

Off-road vehicle fatalities can also be examined by comparing the vehicle/object the rider's vehicle struck. These include collisions where the fatally injured rider's vehicle collided with a highway vehicle, off-road vehicle, fixed object, or submerged (i.e., in a body of water). Figure 13 shows the percentage of fatally injured off-road vehicle riders who collided with these vehicles/objects. Among fatally injured snowmobile riders, 71.4% collided with a fixed object, 11.3% collided with a highway vehicle, 9% died when their vehicle submerged, and 8.3% collided with another off-road vehicle.

Most ATV/dirt bike riders died in collisions with a fixed object (83%), while 11.1% collided with a highway vehicle, 3.1% died when their vehicle submerged, and 2.8% collided with a off-road vehicle.

Figure 12 | Off-road vehicle fatalities in single- versus multiple-vehicle collisions: Canada, 2017-2021



Figure 13 | Off-road vehicle fatalities by vehicle/object struck: Canada, 2017-2021



Lastly, Figure 14 shows the percentage of snowmobile and ATV/dirt bike fatalities that resulted from collisions occurring on highways, public roads, private property, and designated trails. Among fatally injured snowmobile riders, slightly more than half (52.2%) died in collisions occurring on private property, 20.3% died in crashes on public roads, and 10% died in crashes on designated trails. ATV/dirt bike riders were slightly more likely to die in collisions on public roads (42.8%) than on private property (41.8%).



Figure 14 | Off-road vehicle fatalities by collision location: Canada, 2017-2021



### **Conclusions**

The decline in the number of fatalities among occupants of highway vehicles between 2000-2021 is not evident in the numbers of snowmobile and ATV/dirt bike fatalities during the same period. In fact, there has been a general increase in the number of offroad vehicle fatalities during this 22-year period.

The increase in the number of off-road vehicle fatalities is mostly attributable to increases in ATV/dirt bike fatalities. There was a reduction in the number of snowmobile fatalities, but it was much smaller than the increase in ATV/dirt bike fatalities.

Among both males and females, the number of fatally injured off-road vehicle riders has risen steadily from 2000 to 2021. In terms of number of fatalities, the age groups with the greatest increase during this same period were riders under 16 years of age and those aged 65 and older. Further monitoring is needed to see if this trend continues.

A larger percentage of fatally injured riders of snowmobiles and ATVs/dirt bikes tested positive for alcohol compared to drivers of highway motor vehicles. In terms of drug use, a similar percentage of off-road vehicle drivers tested positive for drugs compared to drivers of highway vehicles. Year-by-year percentages were more volatile for snowmobile and ATV/dirt bike drivers, which is to be expected given the smaller number of these vehicles on our roads.

The largest number of fatal collisions involving off-road vehicles occurred between the hours between 6 pm and midnight. This may be due in part to reduced visibility or a lack of conspicuity (i.e., objects are harder to see or less noticeable because of their smaller size) in cases where these road users are struck by other vehicles.

As may be expected, many fatal collisions involving off-road vehicles occurred on weekends. For both snowmobiles and ATVs/dirt bikes, Saturday has the greatest frequency of fatal crashes. Although several users of both types of vehicles are engaged in work such as farming, trapping, and surveying, most users of snowmobiles and ATVs/dirt bikes would be off-road users who are most likely to operate these vehicles on weekends.

For both snowmobile and ATV/dirt bike fatalities, the majority of these persons died in crashes where they were the only rider. A larger percentage of ATV/dirt bike riders died in crashes with two or more riders than was the case for snowmobile fatalities. However, given the advent of side-by-side ATVs, there is a potential for more riders to be using ATVs.

In terms of fatalities among both categories of off-road vehicle riders under 16 years of age, three-fifths of fatalities were the lone vehicle rider. Although data do not reveal the degree of adult supervision, operator experience or physical strength, deficits in any of these areas may compromise operator safety. Whether off-road vehicles are operated on public roadways or private property, educational campaigns could include adult supervision of younger riders.

For both snowmobile and ATV/dirt bike fatalities, a large majority of them were involved in single-vehicle collisions, most notably due to crashing into a fixed object. Snowmobile riders were more likely to die in submersion in water incidents than ATV/dirt bike riders by virtue of operating their vehicles on bodies of water where the ice was not as thick as anticipated. Given the changes in not only weather conditions but overall climate, further awareness campaigns on the dangers of operating off-road vehicles on, or near, bodies of water should be considered. Special consideration could be given to a greater understanding of the relationship between vehicle weight, ice thickness and what to do if one's vehicle falls through the ice.

A larger percentage of ATV/dirt bike fatalities were more likely to occur on public roadways than snowmobile fatalities. This may be partially due to some provincial highway traffic acts that permit the use of ATVs on public roadways and highways. On the other hand, a lower percentage of ATV/dirt bike fatalities

occurred on designated trails than snowmobile fatalities. It remains to be seen whether collisions on designated trails are underreported or if ATV/dirt bike riders using the trail systems operate their vehicles more safely than riders who travel elsewhere.

Among fatally injured operators, snowmobile and ATV/dirt bike riders were more likely to have been drinking than highway vehicle drivers. Ideally, greater enforcement of existing impaired driving laws could reduce this problem. However, if off-road vehicle riders perceive that their chances of being caught are not substantial, they may be less likely to change their behaviour. In addition, some of these individuals may not realize that impaired operation of a vehicle in a location other than a public roadway is included in the Criminal Code. Further efforts are needed to educate the public about the impaired operation of a conveyance in the Criminal Code.

Education on the merits of helmet use could also reduce the number of deaths among this population. Some off-road vehicle users may be less inclined to wear helmets because they are operating their vehicle over a short distance, for a brief period, or in places where helmet use is not mandatory (e.g., private property). Perhaps the perceived odds of being apprehended for non-helmet use are slim enough that it is worth taking a chance to not wear a helmet. Nonetheless, the laws of physics still apply and a fall from the vehicle can still result in serious injury or death.



### References

Gill, P.J., McLaughlin, T., Rosenfield, D., Moore Hepburn, C., Yanchar, N.L., Beno, S. 2019. All-terrain vehicle serious injuries and death in children and youth: A national survey of Canadian paediatricians. Paediatrics & Child Health, 2019, e13-e18 doi: 10.1093/

Harry Cummings & Associates. (2023). The Economic Impact of Snowmobile Trails in Ontario: 2022-2023. Ontario Federation of Snowmobile Clubs.

MacDougall, W., Jiang, X., Sobhan, S., Balshaw, R., Haas, B., Moore, L., et al. (2023). Severity of all-terrain vehicle-related injuries by age in Canada, 2002-2019. JAMA Network Open, 6(5), e2316060. doi:10.1001/jamanetworkopen.2023.16060

Parachute. All-Terrain Vehicle (ATV) Canadian Legislation Chart. 2023. https://parachute.ca/en/professional-resource/policy/all-terrain-vehicles/

Chu, A., Orr, S., Moloughney, B., McFaull, S., Russell, K., Richmond, S.A. (2019). The epidemiology of all-terrain vehicle- and snowmobile-related injuries in Ontario. Toronto, ON: Ontario Agency for Health Protection and Promotion (Public Health Ontario).

Statistics Canada. (2018). Table 45-10-0030-01. Participation in outdoor activities in the past 12 months by age group, sex, current employment status, and perceived health, Canada, provinces and regions DOI: https://doi.org/10.25318/4510003001-eng

Traffic Injury Research Foundation (2024). TIRF National Fatality Database. Accessed April 8, 2024.

Vanlaar, W., McAteer, H., Brown, S., Crain, J., McFaull, S., Hing, M.M. (2015). Injuries related to off-road vehicles in Canada. Accident Analysis and Prevention, 75, 264-271.

### **Fatality Database Disclaimer**

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Registered Charity No. 10813 5641 RR0001 © Traffic Injury Research Foundation 2024 ISBN | 978-1-77874-044-2

#### Acknowledgements

Production of this fact sheet was made possible through the sponsorship of **Desjardins Insurance**. Data used in this fact sheet come from TIRF's National Fatality Database, which is also maintained with funding from Desjardins Insurance.

