



October 2007

National Trauma Registry Analysis in Brief

ATV Injury Hospitalizations in Canada, 2004–2005

This analysis in brief provides a descriptive analysis of all-terrain vehicle (ATV) injury hospitalizations in Canada. The data sources are the National Trauma Registry Minimum Data Set (NTR MDS), the National Trauma Registry Comprehensive Data Set (NTR CDS) and the National Ambulatory Care Reporting System (NACRS). All databases are managed by the Canadian Institute for Health Information (CIHI).

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Introduction

Traumatic injuries represent a substantial public health problem that has the potential to result in long-term disability or death. As such, traumatic injuries have serious implications for individual Canadians and their families, as well as for the health care system. In 2004–2005, there were 196,865 hospitalizations due to trauma in Canada. These hospitalizations accounted for 1,943,660 days in hospital and 7,076 deaths in hospital.

ATVs are generally defined as three- or four-wheeled motorized vehicles (although newer models may have up to six wheels), with large, low-pressure tires designed for a single operator riding in off-road terrain. Snowmobiles are included in the definition of an ATV. As motorized activities, off-road vehicle (ORV) driving should be compared to driving other similar motorized vehicles used in powered sport activities, such as snowmobiling. Each of these motorized activities share similar risks, which differ from on-road motor vehicle use.

In Canada, ATVs have a variety of purposes, including occupational, recreational and transportation uses. ATVs are used as transportation, as well as for family and farm work activities in many rural and remote communities in Canada. Restrictions and legislation regarding the use of ATVs, including age restrictions and protective equipment requirements, vary between provinces and territories and are summarized in Appendix A.¹

The reporting year for this analysis (2004–2005) is the first year since 2000 that the sales of ATVs in Canada decreased (down 6.7% over one year).² There were 92,778 units sold in 2003, with a drop to 87,187 in 2004. The Canadian Safety Council reports that in 2004 approximately 850,000 Canadians owned an ORV.³

The aim of this analysis is to characterize the extent and nature of the injuries sustained by Canadians involved in ATV incidents who required hospitalization. The analysis explores where in Canada these injuries were most likely to be sustained, and who was most likely to require care at, or admission to, a hospital for ATV-related injuries. Additionally, the analysis looks at the severity of injury, specifically whether severity differs between the various ATVs. The analysis explores the outcomes of those who sustained an ATV-related injury and were admitted to a Canadian hospital. The analysis is supplemented by information from emergency rooms in Ontario.

Methods

The data sources for this study were the National Trauma Registry Minimum Data Set (NTR MDS), the National Trauma Registry Comprehensive Data Set (NTR CDS) and the National Ambulatory Care Reporting System (NACRS). The NTR MDS captures demographic, diagnostic and procedural information about hospitalizations due to trauma from all acute care hospitals in Canada. The NTR CDS provides an in-depth source of information on patients hospitalized with major trauma in participating hospitals (lead trauma facilities) in Canada. It includes information for those cases with an injury severity score (ISS) > 12. NACRS captures all emergency-department visits in Ontario only. Although NACRS is limited to one province, it provides important information on the proportion of cases that visit an ED for related injuries, but do not require admission. Data from 2004–2005 are reported from all databases.

Cases were identified as being caused by off-road vehicle and snowmobile incidents by the External Cause of Injury codes, and type of injury was identified via appropriate diagnosis codes. A list of the External Cause of Injury codes (both in International Classification of Diseases, Version 9 [ICD-9] and International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Canada [ICD-10-CA]) that are included in the definition of ORV and snowmobile incidents is provided in Appendix B. All rates presented in this report are age-standardized to allow for a more accurate comparison of rates across provinces and territories and across different years. Confidence intervals of 95% are also presented. Counts with fewer than five cases are suppressed.

The definition of all-terrain vehicles (ATVs) includes both snowmobiles and other off-road vehicles. Snowmobiles refer to off-road machines that are driven on the snow. ORVs (off-road vehicles) refer to all other ATVs, excluding snowmobiles. This may include three- and four-wheeled, as well as some two-wheeled, motorized off-road vehicles. The terms used in this analysis include “off-road vehicle” (referring to all-terrain vehicles), “snowmobile only” and “all ATV,” which includes snowmobiles and off-road vehicles.

Persons injured could be occupants of the ATV (passenger or driver) or pedestrians who may have been injured by an ATV collision.

Results

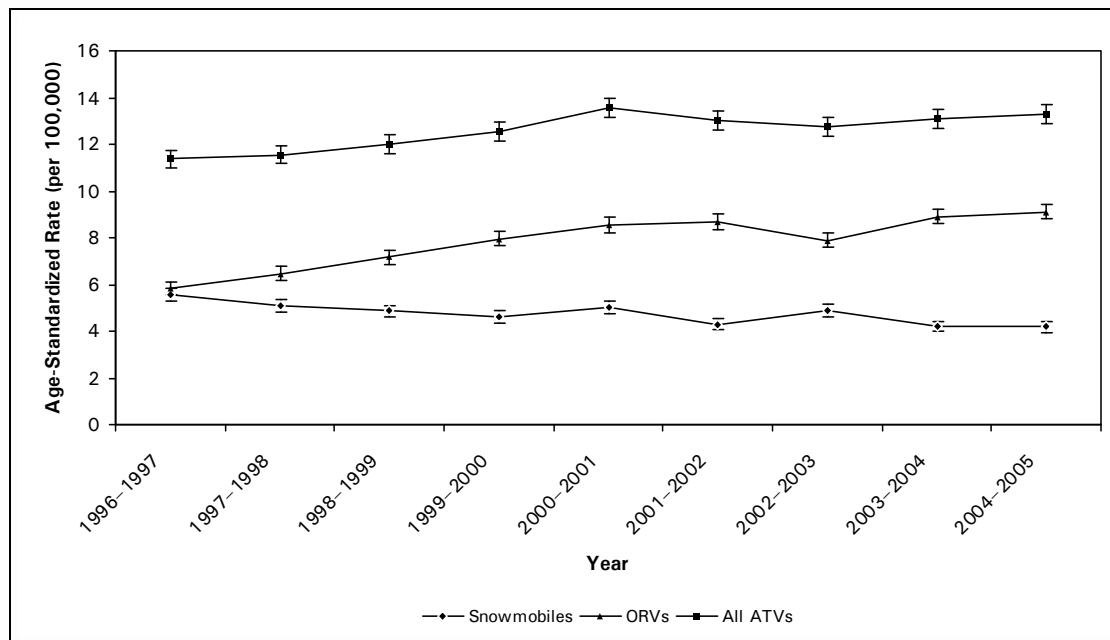
ATV injuries, while representing a small proportion of all trauma injury admissions in Canada, are important to examine for several reasons. When injuries are sustained, they have the potential to be severe and to result in serious lifelong sequelae. As motorized vehicles, there are differing requirements in each province for operating or riding on an ATV.

Trends Over Time

During the nine years studied, both the rate per 100,000 of injury admission (11.4 to 13.3) and the overall number of admissions (3,296 to 4,104) related to an incident with an ATV increased in Canada, despite a 6.7% decrease in the number of ATVs sold (from 2000 on).² When examined separately, the rate of snowmobile injury admissions decreased over the time period (from 5.6 to 4.2), while the rate of ORV-related admissions rose from 5.8 to 9.1.

When examined by age group, the largest change was seen in the 20-to-24-year age group, which experienced a 41.1% increase in the number of admissions for an ATV-related injury in the nine years of study.

Figure 1. Age-Standardized Rate (per 100,000) of ATV Injury Hospitalizations in Canada, 1996–1997 to 2004–2005



Source: NTR MDS, 1996 to 2004, CIHI.

ATV Injury Hospitalizations in Canada (2004–2005)

In 2004–2005, there were 4,104 admissions to Canadian hospitals for injuries related to an incident involving an ATV (Table 1). Of these, more than two-thirds were related to ORVs. The rate of injury admission for ORV (9.12) was more than double that seen for snowmobiles.

The mean age of those injured was 31.5 years of age, considerably younger than the average age for overall trauma admission in Canada for the same year (52.9 years). Similar to other trauma admissions, the majority of cases involved males.

Table 1. Summary of All ATV Injury Hospitalizations in Canada, 2004–2005

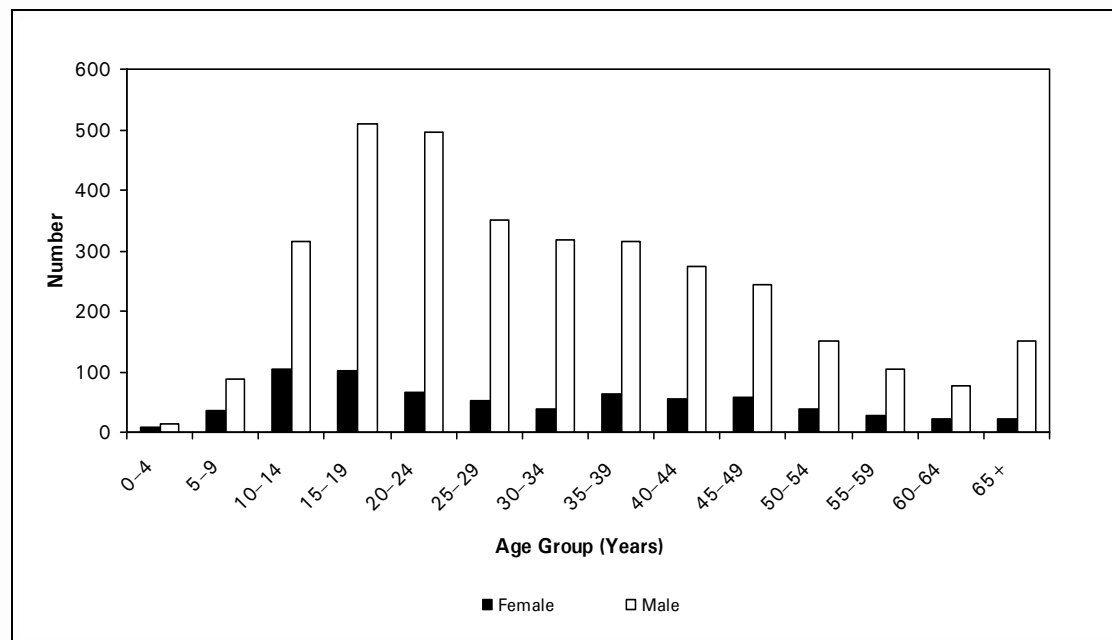
| | |
|---|------------------|
| Number of hospitalizations | 4,104 |
| ORV, N (%) | 2,808 (68.4) |
| Age-standardized rate per 100,000 population | |
| ORV | 9.1 |
| Snowmobile | 4.2 |
| Age (years) | |
| Mean (standard deviation) | 31.5 (16.5) |
| Median (inter-quartile range) | 28.0 (18–42) |
| Male, N (%) | 3,413 (83.2) |
| Most common months of admission | |
| ORV | July to August |
| Snowmobile | January to March |

In developing a profile of those who require admission to hospital for an ATV-related injury, some clear patterns emerge. As noted previously, overall, and in each age group, males account for the majority of injury admissions. The highest representation of females is seen in the 10-to-14- and 15-to-19-year age groups. The smallest representation of females is seen at both ends of the age spectrum; birth to 4 years and 60 plus years of age (Figure 2).

There is an association between an ATV-related injury admission and age group, with the largest proportion of injuries seen in the 15-to-19-year age group, followed by the 20-to-24-year age group. These two age groups have substantially higher numbers than the other age groups and account for 28.6% of all injury admissions.

When examined separately for ORV and snowmobiles, the age pattern differs between them. For ORV injury admissions, those aged 15 to 19 years, followed by 20 to 24 years have the highest number of admissions. For snowmobile-related injury admissions, the 25-to-29-year age group has the highest number of admissions, followed by the 20-to-24-year age group.

Figure 2. Number of ATV (Including Snowmobile) Injury Hospitalizations in Canada by Age Group and Sex, 2004–2005



Source: NTR MDS, 2004, CIHI.

In about three-quarters of all ATV admissions in 2004–2005, the driver was most likely to be injured (73.5% and 78.3% of admissions for snowmobile- and ORV-related injuries, respectively) (Table 2). The only situation where we observe more injuries among females is the category of ORV passenger, where slightly more than half of the injuries are to females.

Table 2. ATV Occupant Injury Hospitalizations in Canada, 2004–2005

| Occupant | N (%) | Age (Mean: Median) | Days in Hospital (Median) | Males (N %) | Died in Hospital (N %) |
|-------------|--------------|--------------------|---------------------------|--------------|------------------------|
| ORVs | | | | | |
| Driver | 2,191 (78.3) | 31.2: 27.0 | 3 | 1,960 (89.5) | 20 (0.9) |
| Passenger | 240 (8.6) | 21.8: 16.0 | 2 | 115 (47.9) | < 5 |
| Other | 362 (12.9) | 27.5: 21.0 | 2 | 262 (72.4) | < 5 |
| Pedestrian | 6 (0.2) | 32.0: 24.5 | 2.5 | < 5 | < 5 |

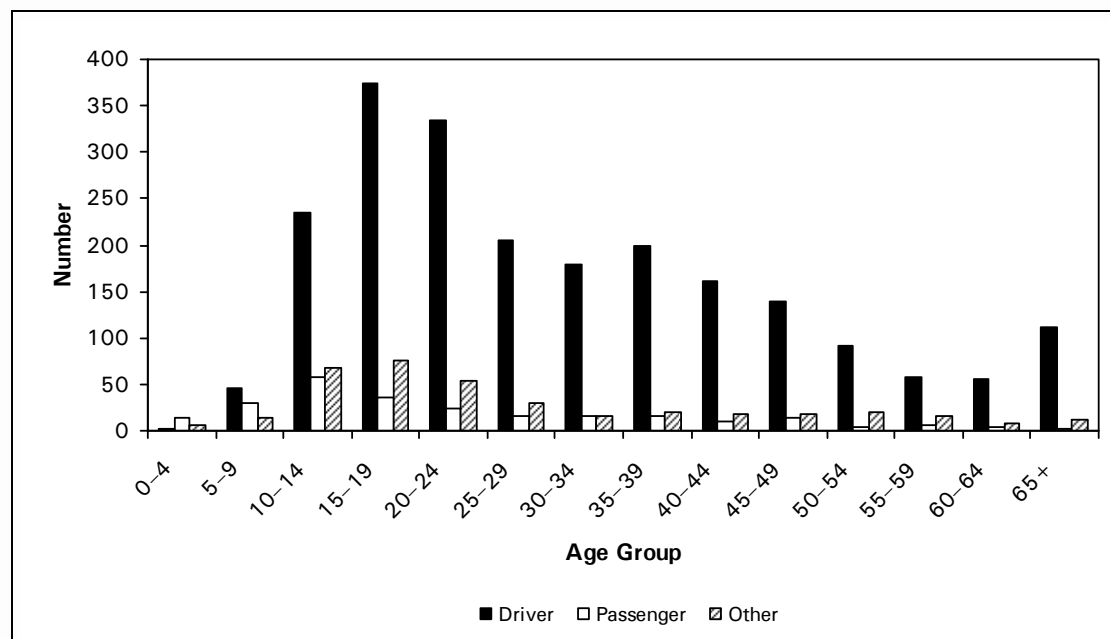
Table 2. ATV Occupant Injury Hospitalizations in Canada, 2004–2005 (cont'd)

| Occupant | N (%) | Age (Mean: Median) | Days in Hospital (Median) | Males (N %) | Died in Hospital (N %) |
|--------------------|------------|--------------------|---------------------------|-------------|------------------------|
| Snowmobiles | | | | | |
| Driver | 952 (73.5) | 35.6: 35.0 | 3 | 851 (89.4) | 8 (0.8) |
| Passenger | 147 (11.3) | 28.9: 24.0 | 4 | 73 (49.7) | 0 |
| Other | 191 (14.7) | 35.1: 33.0 | 2 | 135 (70.7) | <5 |
| Pedestrian | 6 (0.5) | 23.7: 21.0 | 6 | 5 (83.3) | 0 |

Notes:

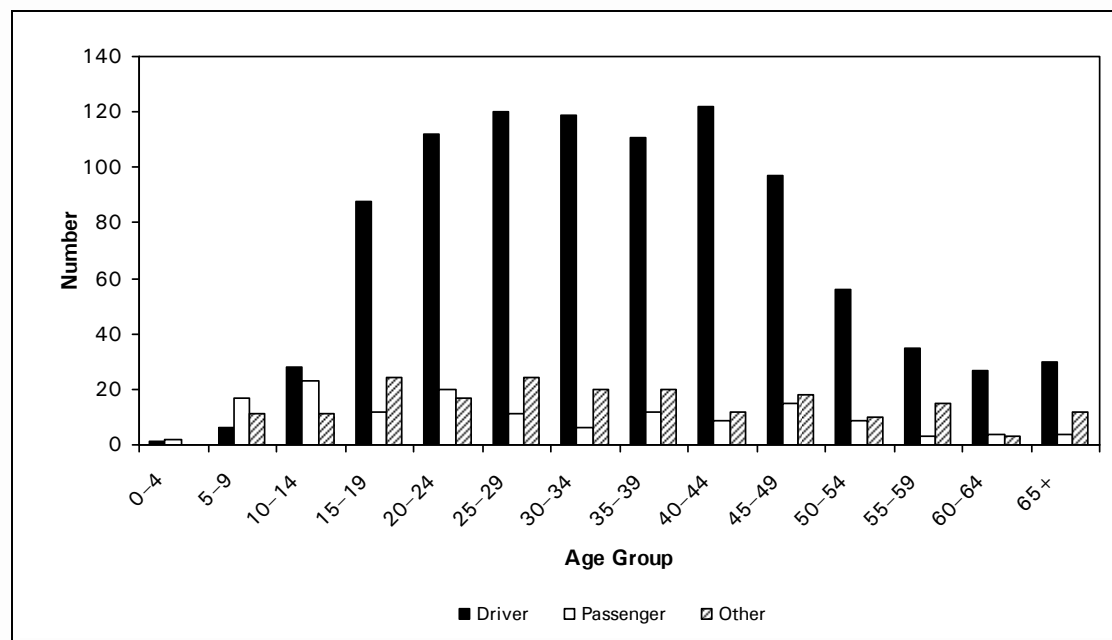
Death information includes only those individuals who died in hospital. NTR does not have information on deaths at the scene of an ATV incident.
Occupant status was not available for 9 cases.

Figure 3. ORV-Related Injury Hospitalizations in Canada by Age Group and Person Injured, 2004–2005



Source: NTR MDS, 2004, CIHI.

Figure 4. Snowmobile-Related Injury Hospitalizations in Canada by Age Group and Person Injured, 2004–2005

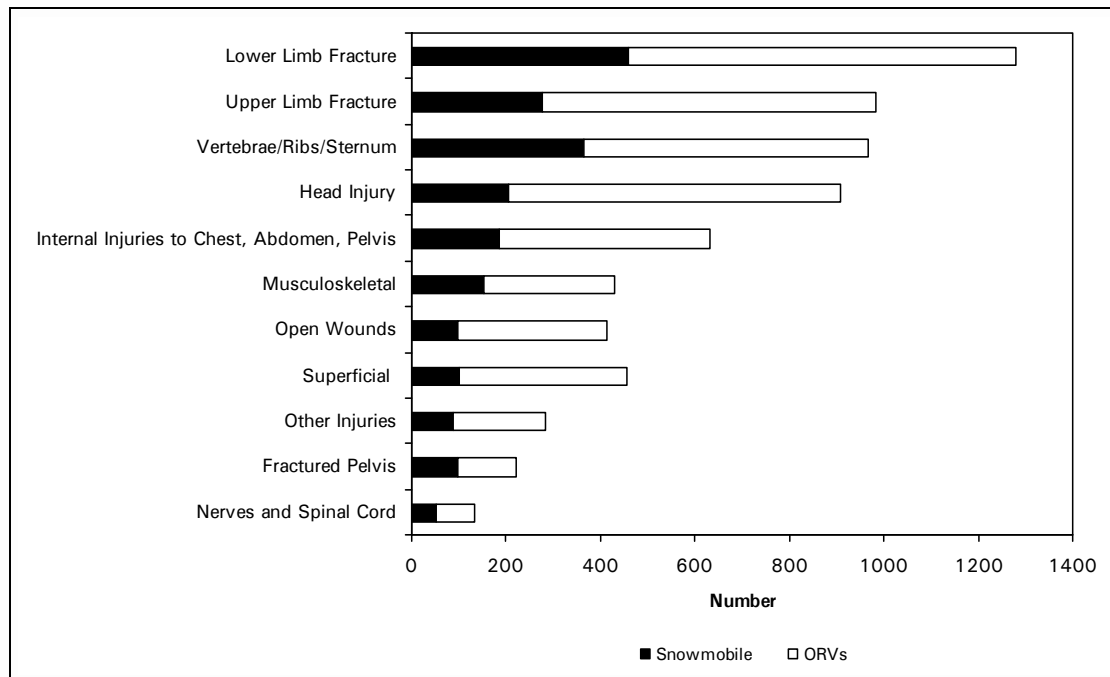


Source: NTR MDS, 2004, CIHI.

Injuries Sustained

The majority of those admitted for an injury related to an ATV have multiple injuries. Orthopedic injuries are the most common injuries sustained in both ORV- and snowmobile-related incidents. Of these, lower limb fractures are the most common injury, with 35.5% of snowmobile-related injury hospitalizations sustaining a lower limb fracture and 29.2% of those with an injury admission related to an ORV. For ORVs, the next most common injury is an upper limb fracture (25.2%). For snowmobile-related injuries, the second most common injury was fractures of the vertebrae, ribs or sternum (28.1%). The proportion of head injuries was considerably higher in ORV admissions (25.0%) compared to snowmobile admissions (15.8%) (Figure 5).

Figure 5. ATV Hospitalizations in Canada by Type of Injury, 2004–2005



Note:

Most admissions have multiple injuries, so the number of injuries in the figure will add up to more than the total number of cases.

Source: NTR MDS, 2004, CIHI.

Outcomes

Overall, there are similar outcomes observed for those injured in any type of ATV, with the majority being discharged home (with or without support services) after treatment (83.6% and 87.4% for snowmobile and ORVs, respectively). Those injured in a snowmobile-related incident had a slightly higher proportion of transfers to another acute care or rehabilitation facility, as compared to ORV-related incidents (3.5% more), suggesting that while there was a smaller number of injuries, those injured sustained more serious injuries and required more extensive support after discharge.

Table 3. Hospital Length of Stay and Discharge Status Among ATV Injury Hospitalizations in Canada, 2004–2005

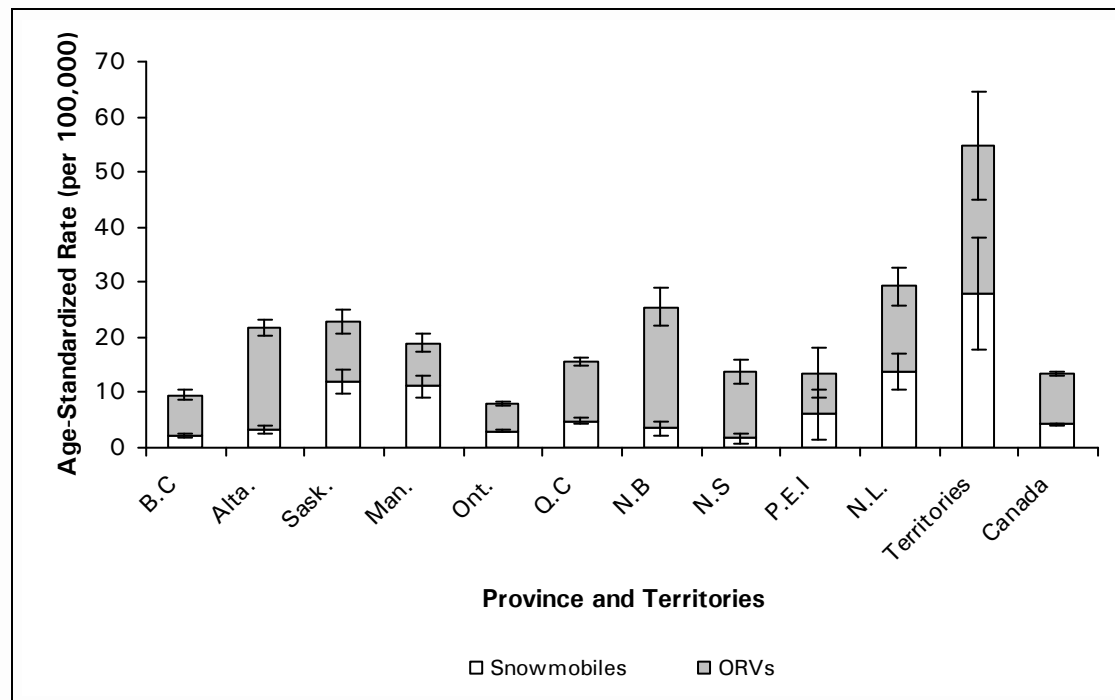
| | Snowmobiles | ORVs |
|--|-----------------|-----------------|
| Days in hospital | | |
| Mean (standard deviation) | 5.6 (9.0) | 5.3 (10.2) |
| Median (inter-quartile range) | 3.0 (1–6) | 3.0 (1–5) |
| Discharge status N (%) | | |
| Discharged home | 1,000 (77.2) | 2,307 (82.2) |
| Discharged to home setting with support services | 83 (6.4) | 145 (5.2) |
| Transferred to another acute care or rehabilitation facility | 178 (13.7) | 287 (10.2) |
| Died in hospital | 9 (0.7) | 25 (0.9) |
| Other | 26 (2.0) | 44 (1.6) |

Geographic Profile of ATV Injury Admissions

There are regional and provincial differences in the legislation surrounding the operation of ATVs (see Appendix A). Similarly, there are differences in the use of ATVs in various areas, with some rural or remote areas in particular being more likely to rely on ATVs for transportation and work-related use, as opposed to recreational use only.

Given this, it is not surprising that there are differences in the rate of ATV-related injury admissions in Canada when examined by province and territory. There is likely a wide range of factors influencing the differences, including, but not limited to, the frequency of use of ATVs in an area, the pattern of use (recreational, work, transportation), legislation, geography, rural/urban setting and weather.

Figure 6. Age-Standardized Rate (per 100,000) of ATV Injury Hospitalizations in Canada by Province and Territory, 2004–2005



Source: NTR MDS, 2004, CIHI.

ATV Major Injury Hospitalizations in Canada

Major traumatic injury admissions are determined by the use of the ISS, an internationally recognized severity of injury measurement. These admissions are to specialized trauma facilities across the country and many of these injury admissions require specialized health care in intensive care settings.

For 2004–2005, there were 11,112 major injury admissions with an ISS > 12 reported to the NTR CDS. The overall mean ISS for all cases was 24. When considering ATV-related severe injuries, the ISS indicated that snowmobile-related injuries requiring admission to a specialized trauma facility were more severe than ORV-related injuries (mean ISS 25.4 versus 23.3).

Snowmobile incidents were the number-one cause of winter sports and recreation-related injuries treated in specialized trauma facilities in 2004–2005, accounting for 40% of injuries, compared to snowboarding (24%), skiing (19%), hockey (11%), tobogganing (7%) and ice-skating (3%). ORVs were the second leading cause of summer sports and recreation-related injuries, following cycling (43%), accounting for 25% of major trauma admissions in 2004–2005.

Table 4. Summary of ATV Major Injury (ISS > 12) Hospitalizations in Canada, 2004–2005

| | |
|---|------------------|
| Number of hospitalizations | 422 |
| ORV, N (%) | 285 (67.5%) |
| Age-standardized rate per 100,000 population | 1.4 |
| Age (years) | |
| Mean (standard deviation) | 32.1 (15.5) |
| Median (inter-quartile range) | 30.0 (20–43) |
| Male, N (%) | 362 (85.8) |
| Most common months of admission | |
| ORV | June to August |
| Snowmobile | January to March |

Not unexpectedly, there are a much lower proportion of cases that are discharged to a home setting after treatment when compared to all ATV hospitalizations, regardless of ISS. When compared to ATV-related injury admissions overall, a larger proportion of those hospitalized with an ISS > 12 require transfer to another facility after discharge. There are also a higher proportion of those who do not survive their injury (Table 5).

Table 5. Hospital Length of Stay and Discharge Status Among ATV Major Injury Hospitalizations in Canada, 2004–2005

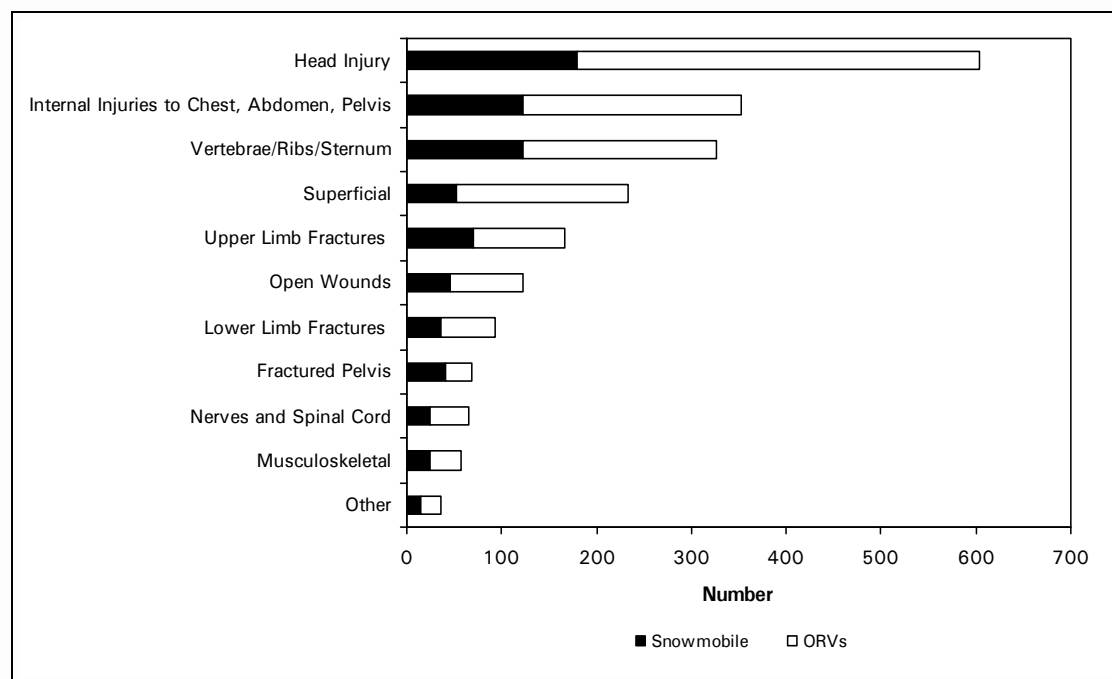
| | Snowmobiles | ORVs |
|--|----------------|----------------|
| Days in hospital | | |
| Mean (standard deviation) | 13.0 (12.2) | 13.8 (20.1) |
| Median (inter-quartile range) | 9.0 (6–15) | 8.0 (4–15) |
| Discharge status N (%) | | |
| Died in hospital | 11* (8.0) | 14 (4.9) |
| Discharged home | 68 (49.6) | 158 (55.4) |
| Discharged home with support services | 16 (11.7) | 22 (7.7) |
| Transferred to acute care facility | 19 (13.9) | 31 (10.9) |
| Transferred to general rehabilitation facility | 13 (9.5) | 41 (14.4) |
| Transferred to a special rehabilitation facility | 6 (4.4) | < 5 |
| Other | < 5 | 15 (5.3) |

Note:

* Four deaths occurred in the emergency department.

All patients admitted to a specialized trauma facility with an injury relating to an ATV had multiple injuries. Injuries most often sustained among admissions to specialized trauma facilities were head (100%) and internal injuries (80.7% and 89.8% for ORV and snowmobile, respectively). This differs considerably from all ATV-related injury admissions (regardless of ISS), among which the highest proportion of injuries seen were fractures or other orthopedic injuries.

Figure 7. Serious ATV Injuries Treated in Specialized Trauma Units by Type of Injury, 2004–2005



Note:

Most admissions have multiple injuries, so the number of injuries in the figure will add up to more than the total number of cases.

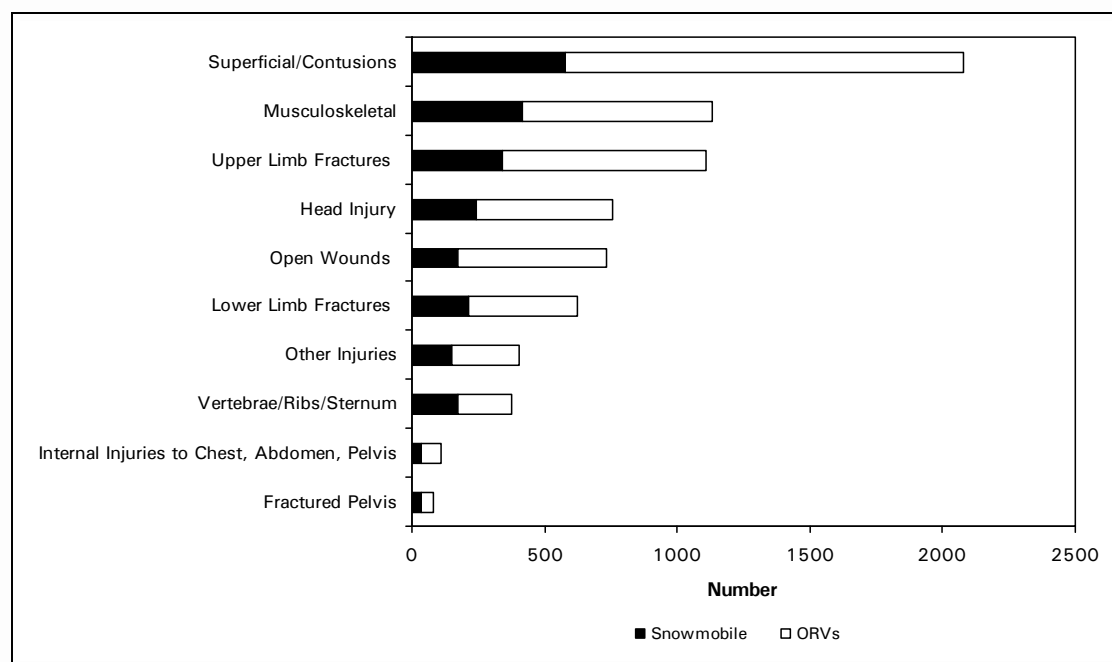
Source: NTR CDS, 2004, CIHI.

Among admissions for severe trauma where blood-alcohol concentration was recorded, 38.7% of cases tested positive for alcohol consumption; 27% of cases involved alcohol levels above the legal limit of 17.4 mmol/L. Alcohol use above the legal limit was a factor in 23% of admissions for snowmobiling incidents and 28% of incidents involving ORVs. Of those injured with alcohol levels above the legal limit, 93.5% were the drivers.

ATV-Related Emergency Department Visits in Ontario

While those admitted to hospital represent injuries that are more severe in nature, it is important to understand the continuum of care required for ATV-related injuries. In 2004–2005, there were 7,109 emergency department (ED) visits in Ontario EDs for injury related to ATVs, translating to more than 19 Ontarians a day. Of these, 4,843 (68.1%) were due to injury resulting from ORVs. The age-standardized rate for all ATV injuries seen in an Ontario ED in 2004–2005 was 60 per 100,000. The majority of all ED visits were by male patients (79.7%) and occurred during the months of January to March for snowmobiles and July to September for ORVs. Injuries most often sustained for both snowmobiles and ORVs were superficial injuries (Figure 8).

Figure 8. ATV ED Visits in Ontario by Type of Injury, 2004–2005



Note:

Most admissions have multiple injuries, so the number of injuries in the figure will add up to more than the total number of cases.

Source: NACRS, 2004, CIHI.

Conclusion

This analysis in brief draws information from three databases to assess the continuum and severity of ATV-related injury visits and admissions to both general hospitals and specialized trauma facilities in Canada.

Only sound evidence, formulated through comprehensive information, has the potential to influence prevention, treatment and policy decisions. Therefore, this analysis has aimed to examine trends over time and provide a comprehensive picture of ATV injury hospitalizations. This analysis establishes that the number and rate of ATV-related hospitalizations increased over the nine years of study, but that when snowmobile-related injuries and ORV-related injuries are analyzed separately, there was actually a decrease in the number and rate of snowmobile injuries, with the increase being seen only in ORV injury admissions.

In addition, the analysis revealed that there are different injury profiles for snowmobiles and ORVs, with snowmobiles resulting in a smaller number of hospitalizations, but with a higher injury severity, as determined by the ISS. There are distinct provincial differences, likely reflecting different usage patterns, and other local factors. Alcohol continues to play an important role in hospitalizations for ATV-related injuries.

Findings related to age indicate that there is a high proportion of those under the age of 25 years admitted for an ATV-related injury. This information provides useful context for those designing injury-prevention strategies.

Injuries have significant impacts on the Canadian health care system, but more importantly on the lives of thousands of Canadians, as well as their caregivers and families. Many of the findings in this study are related to specific age groups, and as such, each age group requires specific strategies to address continuing or growing areas of concern.

Appendix A: Restriction and Legislations Regarding the Use of ATVs, Canada

| Jurisdiction | Minimum Driver Age | Age-Related Driver Restrictions | Mandatory Helmet Use |
|---------------------------|--------------------|---|----------------------|
| Alberta | None | Highways: must be 14 years of age or older Public property: drivers less than 14 years must be supervised by an adult | No |
| British Columbia | None | None | No |
| Manitoba | None | Drivers under 14: must be supervised by an adult (residents in remote areas exempt) | Yes |
| New Brunswick | None | Drivers under 14: must be supervised by an adult over 19 years On highway: must be 16 years old Crossing highway: must be 14 years and meet certain conditions Drivers under 16: required to take an approved safety training course to operate an ATV | Yes |
| Newfoundland and Labrador | 14 years | Under 16: supervised by an adult on child-sized ATVs | Yes |
| Nova Scotia | None | 14 and under: must be supervised by an adult and on a closed course (none available to date) 15 to 16: must be supervised by an adult Under 16: must take an approved safety course | Yes |
| Nunavut | None | Adopting the NWT's <i>All-Terrain Vehicle Act</i> | Yes |

Analysis in Brief

Taking health information further

| Jurisdiction | Minimum Driver Age | Age-Related Driver Restrictions | Mandatory Helmet Use |
|----------------------|--------------------|--|----------------------|
| Ontario | None | Private Property: drivers under 12 years must be closely supervised by an adult Public Property: 12 years and older On or across highway: must have a valid driver's licence | Yes |
| Prince Edward Island | 6 years | Under 14: supervised by an adult Across highway: 16 and valid driver's licence | Yes |
| Quebec | 14 years | Under 16: certificate of competence Under 14: competitions under certain conditions | Yes |
| Saskatchewan | None | Public property (and crossing highway): 12–15 years and passed approved training or supervised by someone with a driver's licence On highway: 16 and valid driver's licence | Yes |
| Yukon | None | 16 years to operate an ATV without adult supervision | Yes |

Note:

This table has been adapted and updated from the CPS position statement.³

Appendix B: ICD-10-CA and ICD-9 Codes Used to Capture ORV and Snowmobile Cases

| Description | Codes |
|-------------|--|
| Snowmobiles | <p>ICD-10-CA : V8600, V8610, V8630, V8650, V8651, V8660, V8661, V8690, V8691</p> <p>ICD-9 : E820</p> |
| ORVs | <p>ICD-10-CA : V860, V8608, V861, V8618, V862, V863, V8638, V864, V865, V8658, V866, V8668, V867, V869, V8698</p> <p>ICD-9: E821</p> |

References

1. Canadian Paediatric Society, "Preventing Injuries From All-Terrain Vehicles," *Paediatrics and Child Health* 9, 5 (2004): pp. 337–340.
2. Canadian Off-Highway Vehicle Distribution Council, *2006 All-Terrain Vehicle Annual Industry Statistic Report* (for the model year January 1, 2006, to December 31, 2006), (North York, Ontario: COHV, 2006), [online], cited August 31, 2007, from <<http://www.cohv.ca/atvstats2006.html>> .
3. Canadian Safety Council, *The All-Terrain Vehicle Boom*, [online], cited September 24, 2007, from <<http://www.safety-council.org/info/sport/atv.html>> .