

Preventing injuries from all-terrain vehicles



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All-terrain vehicles (ATVs) are three- or four-wheeled motorized cycles (ATV injury literature pertains only to three- and four-wheeled vehicles but some newer models may have up to six wheels) with large, low-pressure tires, designed for a single operator riding in off-road areas. ATVs are widely used in rural Canada for occupation, recreation, and transportation. These vehicles are especially dangerous when used by children and young adolescents because they lack the knowledge, physical size and strength, and cognitive and motor skills to operate them safely (1-3). The magnitude of the risk to young riders is reflected in industry literature, vehicle manuals and standard labels on current models, which warn of an increased risk of severe injury or death to riders under the age of 16 years (4). However, these warnings are not reflected in current legislation (Table 1) and ATVs are frequently used by children and young teens. Helmet use is infrequent in this population and unsafe riding behaviours, such as riding double and driving on public roads, are common. ATVs are not designed for these activities. Restricting ridership among young operators and passengers, and improving compliance with established safety recommendations are essential for reducing the number and severity of ATV injuries in children.

ATV ACCESS AND USE

ATVs are available in a range of sizes, from 50 cc to 700 cc engine displacement, and weigh up to 273 kg (600 lb). As these vehicles require physical strength and mass for proper handling, children should not ride full-size vehicles. The Canadian ATV industry has endorsed a voluntary standard which recommends that children less than 12 years of age should not ride ATVs greater than 70 cc, and children less than 16 years of age should not ride ATVs greater than 90 cc (4). However, few of the smaller "youth" models are available on the market. ATVs are used by many children in rural and remote areas of Canada, including First Nations communities. Of the 335 rural Manitoba grade 6 children surveyed in 1996 (5) and 1997 (unpublished data), 32% reported having a family ATV and 75% reported ATV riding experience, including 96% of those with a family ATV and 65% of those without a family ATV. ATV experience was reported by 74% of children living on a farm and 75% of

children living in a town. Although data are unavailable, ATVs are frequently used as transportation for children of all ages in First Nations communities, as well as for family and farm work-related activities in many rural and remote communities. Hauling loads (eg, wood), directly and in trailers, and towing sleds is commonly seen but it is not recommended for young or inexperienced operators.

ATV SAFETY BEHAVIOURS

Few studies have documented helmet use and other safety behaviours in young ATV riders. In an observational study of 269 ATV riders of all ages in several American states with and without mandatory helmet use laws in the summers of 1988 and 1989, helmet use was 78.4%, with no significant differences between age groups (6). Those observed wearing helmets were also more likely to be wearing other types of protective equipment. Riders were 4.3 times more likely to wear a helmet if they had received formal ATV training. Self-reported safety behaviours were examined in the 1996/1997 survey of Manitoba grade 6 students (5). Of the students reporting ATV experience, 26% of females and 41% of males reported always wearing a helmet, and 46% of females and 33% of males reported never wearing a helmet. Forty-two per cent reported always or sometimes riding on public roads, contrary to provincial legislation. All new ATVs carry explicit warning labels stating never to carry a passenger and that passengers "affect balance and steering and increase the risk of losing control" (4), yet many children report riding as passengers, and a significant proportion of those injured on ATVs are passengers.

ATV CRASHES

Males are involved in 75% to 85% of ATV crashes leading to injury (7-11). Children less than 16 years of age account for almost one-third of ATV injury-related emergency department visits (12,13), and 30% or more of ATV injury hospitalizations (14-17). Almost half of all deaths occur in children 16 years of age or younger (10,18). Inexperience, inadequate physical size and strength, and immature motor and cognitive development contribute to the increased risk of injury seen in children. The majority of crashes involving children occur during daylight hours (8,9), on weekend days

TABLE 1
Summary of provincial and territorial all-terrain vehicle legislation: Age restrictions and helmet requirements*

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	Yes
British Columbia	None	None	No
Manitoba	None	Drivers less than 14 years of age must be supervised by an adult (residents in remote areas exempt)	Yes
New Brunswick	None	Drivers less than 14 years of age must be supervised by an adult over 19 years Driving on a highway: must be 16 years of age or older Driving across a highway: must be 14 years of age and meet certain conditions Drivers under the age of 16 are required to take an approved safety training course to operate an ATV	Yes
Newfoundland and Labrador	None	Drivers less than 16 years must be supervised by someone at least 19 years of age	Yes
Northwest Territories	None	Driving on a highway: must be 14 years of age or older Infants may be transported on an ATV when in an amauti or other device designed for carrying infants that is worn by the driver or passenger on an all-terrain vehicle	Yes
Nova Scotia	None	Private property: drivers under 10 years of age must be supervised by an adult Public property: must be 10 years of age; adult supervision required for <14 years	Yes
Nunavut		Adopting the Northwest Territories' All-Terrain Vehicles Act	
Ontario	None	Private property: drivers less than 12 years must be closely supervised by an adult Public property: must be 12 years of age or older Driving on or across a highway: must have a valid driver's license	Yes
Prince Edward Island	6 years	Drivers less than 14 years of age must be supervised by an adult Driving across a highway: must be 16 years and have a driver's license	Yes
Quebec	14 years	Drivers less than 16 years of age must carry a certificate of competence Drivers less than 14 years of age may operate off-road vehicles during competitions under certain conditions	Yes
Saskatchewan	None	Public property (and crossing a highway): drivers 12 to 15 years of age must have passed an approved ATV training course or be supervised by someone with a valid driver's license Driving on a highway: must be 16 years of age and have a valid driver's license	Yes
Yukon	None	Must be 16 years to operate an ATV without adult supervision	Yes [†]

*Data for this table were collected by contacting the Ministries of Transport from each province and territory and consulting their respective off-road vehicles acts. The Canadian ATV Distributors Council also provided a table titled "Operator Requirements: Off-Road Motorcycles and All-terrain Vehicles". Where data conflicted, the Ministry response is reported; [†]The City of Whitehorse ATV bylaw also mandates helmet use

or holidays (19), with a seasonal variation in injury rates by geographic region, as would be expected. Most nonfatal ATV crashes occur in a variety of off-road areas (7,15); however, fatal crashes occur most commonly on paved roadways and involve collisions with another motor vehicle (10,18). Driver error, particularly poor judgment and loss of control, is commonly cited as leading to ATV crashes (7-9,13,20). Three-wheeled vehicles have been shown to increase the risk of injury three-fold, and are not recommended due to their increased instability (21). Passengers are also commonly cited as a risk factor for ATV crashes and injury due to their deleterious effects on the balance and control of the vehicle. In studies of children hospitalized for ATV trauma, the driver was carrying a passenger in 15% to 30% of cases (7,8,13,15,22). In fatal crashes, 'doubling' is

frequently cited as a potential responsible factor. In a series of 11 paediatric and adult fatalities, five cases involved 'doubling'. In two cases, the driver was killed, and in three cases, the passenger (18).

ATV INJURY

The number of hospitalizations for ATV injury increased rapidly in the early to mid 1980s in North America, and it continues to climb. Although Canada-wide trends for this time period have not been compiled, in Manitoba, hospitalizations for off-road vehicle trauma increased from 13 cases in 1980 to 62 cases in 1985, with the greatest increase occurring in ATV injury hospitalizations (8). A recent analysis by the Canadian Institute for Health Information of the national trauma registry data documented

2535 hospitalizations in 2000/2001, an increase of 50% compared with 1996/1997. Children between the ages of five and 19 accounted for 36% of these injuries. The majority were fractures and dislocations; however, head injuries continue to occur despite mandatory helmet legislation in most provinces (Table 1) (23,24). For hospitalized children, the average length of stay for ATV injuries ranges from five to 15 days (12,13,15,17,19). ATV injuries often involve multiple body parts and are commonly severe (15,17,20). In a series of 233 Manitoba children admitted with orthopedic injury following off-road vehicle crashes, the average number of musculoskeletal injuries was 1.7 per patient and the average number of associated injuries was an additional 0.8 injuries per patient. Intensive care unit admission was required for eight patients (8).

ATV injuries among children presenting to the emergency department are summarized by the Canadian Hospitals Injury Reporting and Prevention Program, which collects emergency department data from 10 paediatric and five general hospitals across Canada. Between 1990 and 1996, 646 children and youth between the ages of one and 19 years old were treated for ATV injuries (25). These were more common in the summer months between 16:00 and 20:00, and on weekends. This series is notable for the young age of the drivers. Three were less than five years of age and in 32 cases the driver was between five and nine years of age. Many of the injured children were not wearing helmets.

HISTORY OF PREVENTION EFFORTS

In response to the epidemic of ATV injuries in North America in the 1980s, the Canadian Paediatric Society and the American Academy of Pediatrics issued a number of recommendations, including a ban on ATV use by children and more rigorous legislation, including a minimum age requirement, mandatory helmet use and compulsory licensing and insurance (1,2). Professional and public concern in the United States prompted a ban on the sale of three-wheeled vehicles in 1988, along with a number of other industry actions (development of a voluntary standard, training programs, warnings and age recommendations on vehicles and in advertising). These industry actions were mandated under a "consent decree" in the United States (which expired in 1998) and were followed by a steady decline in injuries in the early 1990's. However, recent trends demonstrate a resurgence of injuries, including injuries to children (26,27). The United States Consumer Product Safety Commission has documented statistically significant increases in ATV injuries every year for the most recent three-year study period (1998 to 2000). Children younger than 16 years continue to account for 40% to 50% of ATV injuries and more than 35% of ATV deaths, indicating a continuing and urgent need to reissue warnings about ATV use by children (3). In Canada, children less than 15 years of age continue to account for almost 25% of ATV deaths and more than one-third of serious injuries (24,28).

EFFECTIVENESS OF LEGISLATION

Between 1990 and 1999, the six states without ATV safety legislation had mortality rates twice that of states with some form of ATV safety legislation, consisting of either helmet or other safety equipment requirements (21 states) or machine-related requirements but no helmet requirements (23 states) (0.17 deaths per 100,000 versus 0.08 and 0.09 per 100,000, respectively) (29). In a subsequent study, the 26 states with the highest paediatric ATV mortality rates were compared with all other states (1982-1998). The states with the highest mortality rates had a two-fold increase in mortality compared with the national average, and 92% had no licensing laws compared with 73% for the comparison group (30). Although these data are crude estimates of the effectiveness of legislation, there is a suggestion that more rigorous laws are associated with reduced mortality.

RECOMMENDATIONS

The following recommendations are based on the available research evidence and are consistent with published recommendations of expert authorities (Level II-2, II-3 and III, Grades B and I) (31,32).

- Children younger than 16 years of age should not operate all-terrain vehicles.
- Children should never ride as passengers on all-terrain vehicles. The majority of ATVs are designed for a single rider. Never carry a passenger of any age on an ATV unless the manufacturer specifies that a passenger is allowed.
- All-terrain vehicle drivers should always wear a government-approved helmet (such as a helmet meeting the Canadian Standards Association, Department of Transportation/Federal Motor Vehicle Safety Standard, Snell or American National Standards Institute motorcycle helmet standards), eye protection, and appropriate clothing (boots, gloves, long pants).
- All-terrain vehicle drivers should not operate the vehicle after drinking alcohol or at night.
- All-terrain vehicle drivers should complete an approved training course, such as the Canada Safety Council's ATV Rider's Course.
- Provinces and territories should harmonize off-road vehicle legislation, including the following elements: minimum operator age of 16 years; restriction of passengers to the number for which the vehicle was designed; compulsory helmet use with no exemptions; mandatory training, licensing and registration; and ban the use of three-wheeled vehicles.
- All-terrain vehicle manufacturers should investigate potential improvements in vehicle design, including rollover protection, seatbelts, speed governors and other engineering modifications that could enhance the safety of these vehicles.

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The recommendations in this statement do not indicate an exclusive course of treatment or procedure to be followed. Variations, taking into account individual circumstances, may be appropriate. Internet addresses are current at time of publication.