

# North Carolina All-Terrain Vehicle (ATV) Safety Legislation: An Assessment of the Short-Term Impact on ATV-Related Morbidity and Mortality

Stephanie K. Beidler, MD; Sharon Kromhout-Schiro, PhD; Christelle D. Douillet, PhD; Paul J. Riesenman, MD; Preston B. Rich, MD

## Abstract

**Objective:** All-terrain vehicle (ATV)-related morbidity and mortality has increased in the US, and states have attempted to combat this trend with ATV-specific safety legislation. The objective of this study was to examine the short-term changes in ATV-related injuries and deaths following the enactment of legislation regulating the operation and sale of ATVs in North Carolina.

**Study Design and Data Collection:** The study is a retrospective analysis comparing ATV collisions during the six month pre and post period of the effective date of legislation. Demographics, medical outcomes, passenger seat position, helmet use, and alcohol use were analyzed.

**Data:** Subjects were identified through the North Carolina Trauma Registry and data from the Office of the Chief Medical Examiner.

**Findings:** A total of 102 (51 in both pre- and post-legislation) subjects required medical treatment or were declared dead secondary to ATV collisions in North Carolina. Children under the age of eight years, who were forbidden from using ATVs under the new legislation, had significantly fewer total medical evaluations and deaths in the post-legislative time period. There was no association between legislative time period and ATV-related passenger, helmet, or alcohol use.

**Conclusions:** In the six months following the enactment of North Carolina's ATV bill, children under the age of eight years were seriously injured or died less often due to ATV-related crashes. No other significant changes in ATV riding patterns were seen between the two time periods, and the morbidity and mortality of all ATV riders did not change.

**Limitations:** The examined data sets do not include data from all North Carolina hospitals.

**Keywords:** all-terrain vehicle (ATV), legislation, pediatric trauma

The United States Consumer Product Safety Commission (CPSC) reported that 7,188 all-terrain vehicle (ATV)-related deaths occurred nationally between the years 1982-2005; 30% of the deaths were children under the age of 16. North Carolina was the 10th highest state in the number of ATV-related fatalities. In 2005, 136,700 ATV-related injuries were evaluated in emergency rooms across the United States, compared to 10,100 in 1982.<sup>1</sup> The escalating morbidity and mortality associated with ATVs is directly linked to the increasing use of these vehicles.<sup>2</sup>

Risk factors for ATV injury include driver age under 16 years, male gender, operator inexperience, alcohol or drug influence, helmet absence, recreational driving, and three-wheeled ATV use.<sup>3-5</sup> Based on risk factor data, the CPSC entered into a consent decree agreement with ATV manufacturers in 1988. This decree, which expired in 1998, implemented a nationwide ATV driver training program, ceased production and sales of three-wheeled ATVs, imposed stringent driver age requirements, and developed voluntary safety standards.<sup>6</sup> Presently, several manufactures

Stephanie K. Beidler, MD, is a PGY-8 plastic and reconstructive surgery resident at the University of North Carolina at Chapel Hill. She can be reached at sbeidler (at) unch.unc.edu.

Sharon Kromhout-Schiro, PhD, is a research assistant professor of surgery at the University of North Carolina at Chapel Hill.

Christelle D. Douillet, PhD, is a research assistant professor of surgery at the University of North Carolina at Chapel Hill.

Paul J. Riesenman, MD, is a PGY-7 general surgery resident at the University of North Carolina at Chapel Hill.

Preston B. Rich, MD, is an associate professor of surgery and anesthesiology. He is also the chief of the Trauma and Critical Care Division and trauma medical director at the University of North Carolina at Chapel Hill.

have continued many elements of the decree on their own initiative.

Forty-four states have responded to escalating ATV-related morbidity and mortality by instituting safety legislation.<sup>7</sup> Helmets and other safety equipment are now required by almost half of the states.<sup>3,8</sup> Many states also impose limits on vehicle size and restrict ATV use to off public roadways. According to an article published in the *American Journal of Public Health*, ATV-related death rates in states without ATV helmet or machine safety regulations were twice that of states with safety measurements in place.<sup>8</sup> A study comparing injury rates and helmet use between Pennsylvania, which has ATV regulations, and North Carolina (prior to the passage of the ATV bill) showed that those living in Pennsylvania had decreased risk factors for ATV injury.<sup>9</sup> State laws have reduced ATV-related injuries and death; however, the time course of the impact of these laws has not been studied.

The North Carolina legislature passed Senate Bill 189 in August 2005 and North Carolina Governor Michael F. Easley signed this bill into law. This legislation regulates the sale and operation of ATVs and took effect on December 1, 2005. Prior to the passage of this bill, North Carolina did not have any ATV safety requirements. The objective of this study was to assess the effectiveness of this legislation in the first six months after the law went into effect. We hypothesized that in the initial period following the enactment of this bill, the ATV-related collision data would show a reduction in the following areas compared to an equivalent pre-legislation time period:

1. The number of patients less than eight years of age assessed at Level I/II trauma centers and killed secondary to ATV crashes. *Rationale:* The North Carolina law forbids the use of ATVs by persons under the age of eight years.
2. The morbidity and mortality of victims involved in ATV accidents between the ages of 8 and 15 years. *Rationale:* The law restricts the operation of ATVs by persons 8 to 15 years old based on engine capacity. Children must also operate ATVs under the direct supervision of an adult.
3. The number of people involved in ATV accidents not wearing helmets. *Rationale:* According to the new law, all people operating an ATV must wear a safety helmet.
4. The number of ATV-related deaths secondary to head injury. *Rationale:* The increased use of helmets has been shown to reduce mortality due to head injuries.
5. The detection or suspicion of alcohol use in ATV accident victims. *Rationale:* The legislation mandates that no person is to operate an ATV under the influence of alcohol.
6. The number of ATV passengers. *Rationale:* The law states that ATV passengers are not allowed, except on those vehicles specifically designed by the manufacturer, to carry passengers in addition to the operator.

## Methods

The Institutional Review Board at the University of North Carolina at Chapel Hill granted approval for the study. Data was obtained from the North Carolina State Trauma Registry (TR) and the Office of the Chief Medical Examiner (OCME). Subjects were then placed into either pre-legislation (December 1, 2004-May 1, 2005) or post-legislation (December 1, 2005-May 1, 2006) categories based on the date of the ATV-related injury evaluation or death.

Patients included in the TR data were assessed at North Carolina Level I and II Trauma Centers and were either admitted to the hospital, died in the emergency department, or transferred to the operating room or another hospital. Subjects involved in ATV collisions occurring outside of North Carolina (but were transferred to North Carolina hospitals for treatment) were excluded.

The TR registry was queried for E-codes (External Causes of Injury) specific to ATV injuries (821.0, 821.1, 821.8, and 821.9) and reviewed for unexpected results. The OCME files were queried for all ATV-related deaths. The OCME patients' cause of death was coded using the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM).

Data was assessed using chi-squared and Fisher exact (two-tailed) statistics, and clinical significance was set at  $p < 0.05$ . The data is presented as means  $\pm$  standard deviations.

## Results

Both the pre- and post-legislation data had 51 subjects involved in ATV collisions resulting in either medical intervention or death. The majority of the ATV-crash subjects were white males in their mid-20s who were using ATVs for recreational or sporting activities.

The data are presented in Table 1. Children under eight years of age had significantly fewer ( $p=0.0267$ ) medical evaluations ( $n=5$ ) and deaths ( $n=1$ ) related to ATV collisions compared to an equal pre-legislative period. No other comparisons reached statistical significance. The TR injury severity scores (ISS) of the pre-legislation group was  $13.7 \pm 12.9$  compared to  $8.6 \pm 8.8$  (mean  $\pm$  standard deviation) in the post-legislation group (where  $ISS \geq 1$ ). There were a total of 10 deaths in each set per the OCME data.

## Discussion

The North Carolina ATV safety bill was created to reduce the morbidity and mortality related to ATV use. An examination of the immediate impact of the bill indicates significant reduction in the collisions requiring medical evaluation and/or deaths of children eight years or younger riding ATVs. This is an encouraging change; however, the law did not further impact overall ATV riding behavior. Several aspects of the North Carolina law may limit its effectiveness: the present penalties may not be stringent enough to encourage behavioral changes in all users;

**Table 1.**  
**ATV-Related Collision Subjects in Pre- and Post-Legislative Time Periods**

<b>Assessing Hypotheses</b>	<b>Pre-</b>	<b>Post-</b>	<b>Significance</b>
Subjects less than eight years of age requiring medical assessment or dying secondary to ATV-crashes	6	0	p=0.0267
Subjects ages 8-15 years requiring medical assessment or dying secondary to ATV-crashes	14	12	NS
All ATV subjects not wearing helmets	11	18	NS
All ATV deaths secondary to head injury (ICD-9 codes)*	5	4	NS
All ATV subjects with alcohol use measured or suspected	9	10	NS
All passengers on ATV*	1	0	NS

\*OCME data only.  
NS = Not significant.

farmers, hunters, and trappers in North Carolina are exempt from the law; children already using an ATV who were born before August 15, 1997 do not have to abide by the engine capacity limitations; and ATV safety training certification was required starting October 2006, which was after the post-legislative period examined in this study, but which only included ATV operators born after 1990.

The importance of effective legislation and risk prevention cannot be emphasized enough. People with a history of ATV/motorcycle injury are less likely to use a helmet or protective equipment and are more likely to continue to have patterns of persistent high risk behavior.<sup>10</sup> For example, despite severe injuries, the majority of children injured by ATVs continue to operate these vehicles with no modification to safety behaviors.<sup>11</sup>

Although the North Carolina ATV legislation might have a greater impact in the future, it may not be sufficient. Many children continue to suffer serious morbidity and mortality despite ATV regulations. Over a 16-year period, the pediatric ATV mortality rates were compared between the 26 states with the highest ATV mortality rates and all other states. There was no difference between groups with regard to minimum age requirements and safety certification.<sup>12</sup> For example, Utah legislation prohibits children who are younger than eight years old from driving an ATV. Despite these safety measures, 25% of all injured children in Utah who were driving an ATV when injured were younger than

eight years of age.<sup>13</sup> The American Academy of Pediatrics strongly suggests the passage of legislation in all states prohibiting the use off-road vehicles by children younger than 16 years.<sup>14</sup> Studies confirm that four-wheel vehicles are likely to be dangerous in the hands of immature or unskilled operators less than 16 years of age.<sup>15</sup> Focus groups report engine size restrictions, such as those used in the North Carolina law, are ineffective.<sup>16</sup> Licensing, training requirements, improved law enforcement, parental liability, and messages emphasizing the consequences of ATV use may be effective strategies for pediatric injury prevention.<sup>16</sup>

Although the Trauma Registry and Medical Examiner data captured those who were significantly injured and sought medical attention or were killed by ATV collisions, the data did not include non-trauma center medical evaluations or patients seen at the one North Carolina Level III Trauma Center. Future studies may be more encompassing and extend our understanding of the impact of state ATV legislation by following the time course of morbidity and mortality associated with ATV use. **NCMJ**

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