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# All-Terrain Vehicle–Related Nonfatal Injuries Among Young Riders: United States, 2001–2003

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**ABSTRACT.** *Background.* All-terrain vehicles (ATVs) have gained in popularity in recent years, and this rise in use has been accompanied by increases in the number of ATV-related injuries. Because children often lack the physical strength, cognitive abilities, and fine motor skills to operate ATVs properly, their risk for injury is greater. Furthermore, most children ride adult-sized ATVs.

*Objectives.* To estimate the numbers and rates of ATV-related nonfatal injuries to riders aged  $\leq 15$  years who were treated in hospital emergency departments (EDs) in the United States from 2001 through 2003.

*Methods.* Estimates of ATV-related injuries were obtained from the US Consumer Product Safety Commission's National Electronic Injury Surveillance System–All Injury Program. The database is a nationally representative, stratified probability sample of 66 US hospitals with  $\geq 6$  beds and a 24-hour ED. ATV-related nonfatal injuries to riders aged  $\leq 15$  years who were treated in hospital EDs were examined by age group, gender, primary body part injured, diagnosis, and hospital admission status.

*Results.* From 2001 through 2003, an estimated 108 724 children aged  $\leq 15$  years were treated in hospital EDs for nonfatal injuries sustained while riding ATVs. The number of ATV-related injuries increased by 25% over the 3-year period. Males aged 11 to 15 years accounted for 52% of all ATV-related ED visits and hospitalizations among young riders. Children aged 0 to 5 years were more likely than the older children to have facial injuries, whereas the older children were more likely to sustain lower trunk and leg or foot injuries. Fractures were the most common diagnosis, accounting for 27% of ED visits and 45% of hospitalizations.

*Conclusions.* Current legal and regulatory standards have been ineffective in reducing injuries among young ATV riders. Renewed efforts by health care providers to counsel parents about the injury risk to children who ride ATVs and advocate for more stringent state-level minimum age requirements may help reduce the escalating rates of ATV-related injuries among young riders. *Pediatrics* 2005;116:e608–e612. URL: [www.pediatrics.org](http://www.pediatrics.org)

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ABBREVIATIONS. ATV, all-terrain vehicle; CPSC, Consumer Product Safety Commission; ED, emergency department; NEISS, National Electronic Injury Surveillance System; CI, confidence interval.

All-terrain vehicles (ATVs) are motorized, gasoline-powered vehicles that generally weigh between 300 and 600 lb, with oversized, low-pressure tires, a seat designed to be straddled by the user, and handlebars for steering. These vehicles are designed for use by riders on off-road, nonpaved terrain. ATVs have gained in popularity in recent years, and this rise in use has been accompanied by increases in the number of deaths and injuries.<sup>1,2</sup> A recent report by the US Consumer Product Safety Commission (CPSC) noted that the number of ATV-related injuries treated in hospital emergency departments (EDs) has risen annually for the past 11 years from 49 800 in 1993 to 125 500 in 2003.<sup>3</sup> Children aged  $\leq 15$  years accounted for 31% of ATV-related ED visits in 2003. The current report describes the ATV-related nonfatal injuries to riders aged  $\leq 15$  years who were treated in hospital EDs during 2001–2003.

## METHODS

National estimates for ATV-related injuries were obtained from the CPSC's National Electronic Injury Surveillance System (NEISS)–All Injury Program. This database is a nationally representative, stratified probability sample of 66 US hospitals with  $\geq 6$  beds and a 24-hour ED. The data are abstracted from medical charts for initial ED visits related to injuries, consumer products, or both. We reviewed the narrative portion of each record to exclude cases in which the patient was not injured while riding on an ATV (eg, patient injured while unloading an ATV from a truck or while being pulled on a sled behind an ATV) and cases in which the medical record did not clearly indicate whether the child had been riding an ATV at the time of the injury ( $n = 258$ ). Data from the included cases were weighted by the inverse of the probability of selection to produce national estimates.<sup>4</sup> We calculated annualized estimates of injuries on the basis of weighted data for 1563 ATV-related injuries among young riders treated in EDs during 2001–2003 using US Census Bureau population estimates for the corresponding years.<sup>5</sup> A direct variance estimation procedure was used to calculate 95% confidence intervals (CIs) and account for the complex sample design.<sup>4</sup> The diagnosis and primary body part injured were classified according to the most severe presenting injury.<sup>6</sup> The distributions of diagnosis and primary body part injured by age presented in Table 2 and the distribution of hospitalization by age and primary body part injured presented in the results are based on the unweighted data, because some of the cell counts were  $< 20$ .

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## RESULTS

### Estimates and Rates

From 2001 through 2003, an estimated 108 724 children aged  $\leq 15$  years were treated in hospital EDs for nonfatal injuries sustained while riding ATVs. The number of ATV-related injuries increased from 32 280 (95% CI: 21 418 to 43 142) in 2001 to 40 403 (95% CI: 31 144 to 49 662) in 2003 overall, which reflects an increase of 12% in both 2002 and 2003. The age and gender of the children treated, the characteristics of their injuries, and the rates of hospitalization were similar for all 3 years of the study period. The annualized ATV-related injury rate was 56 per 100 000 persons (95% CI: 42 to 71) (Table 1). The injury rate was higher among males (77 per 100 000 males; 95% CI: 57 to 98) than females (34 per 100 000 females; 95% CI: 26 to 42). Injuries among riders aged 11 to 15 years accounted for 71% of ATV-related injuries among children; 74% of the injured riders aged 11 to 15 years were male. Eighty-seven percent of children with ATV-related injuries were treated and released from the ED.

### Diagnosis

Fractures and contusions or abrasions were the most common injuries, together accounting for 52% of all ED visits for ATV-related injuries among young riders (Table 1). Based on the unweighted data, fractures were more common among the older age groups, accounting for 29% of ED visits among children aged 11 to 15 years, 26% of visits among children aged 6 to 10 years, and 22% of visits among children aged 0 to 5 years. Lacerations were most common among children aged 0 to 5 years, accounting for 29% of their ED visits (Table 2). The distribution of diagnosis was similar for both genders.

### Primary Body Part Injured

The body part with the most severe injury varied by age (Table 2). Based on the unweighted data, children aged 0 to 5 years were twice as likely as children aged 6 to 10 years and nearly 5 times as likely as those aged 11 to 15 years to injure their face or mouth. Lower trunk and lower extremity injuries were more common in the 2 older age groups. The distribution of body part injured was similar for both genders.

### Disposition

Twelve percent of children with ATV-related injuries who were treated in EDs were admitted to a hospital. Males aged 11 to 15 years accounted for 52% of all hospital admissions for ATV-related injuries among children. Compared with ED visits for all injuries among children aged 0 to 15, those with ATV-related injuries were  $\sim 5$  times as likely to be hospitalized (12.3% vs 2.4%;  $P < .001$ ). Seventeen percent of children aged 0 to 5 years were hospitalized, compared with 14% of children aged 6 to 10 years and 11% of children aged 11 to 15 years. Children diagnosed with a fracture accounted for the largest proportion of hospitalizations (45%), followed by children with internal injuries (24%). Inju-

ries to the head, face, or neck accounted for 38% of hospitalizations, and injuries to the leg or foot accounted for 27% of hospitalizations. Based on the unweighted data, hospitalization for injuries to the head, face, or neck was more common among children in the younger age groups (0–5 and 6–10 years), accounting for approximately half of the hospitalizations in each age group, compared with 38% of hospitalizations for children aged 11 to 15 years.

## DISCUSSION

From 2001 through 2003 in the United States, the estimated number of children aged 0 to 15 years who sought care at hospital EDs for nonfatal injuries sustained while riding ATVs increased by 25% from 32 280 to 40 403. Males aged 11 to 15 years accounted for more than half of all ATV-related injuries among children. Fractures were the most common diagnosis, accounting for 27% of ED visits. Children aged 0 to 5 years were more likely than those aged 6 to 15 years to have facial injuries, whereas the older children were more likely to sustain lower trunk and leg or foot injuries.

Each year,  $\sim 4450$  (12%) of the children treated in hospital EDs for ATV-related injuries were hospitalized. Compared with ED visits for all types of injuries among children in this age group, those with ATV-related injuries were  $\sim 5$  times as likely to be hospitalized. Males aged 11 to 15 years accounted for 52% of the hospitalizations for ATV-related injuries among children. Fractures were the most common diagnosis, accounting for 45% of hospitalizations.

The estimates presented in this report include only children who were injured while riding an ATV. In each of the 3 study years,  $\sim 2500$  children were injured by an ATV that they were not riding or that the medical record did not clearly indicate that they were riding. Common scenarios for injuries to nonriders included being struck by an ATV ridden by someone else, being injured while loading or unloading an ATV, or being injured by a stationary ATV (eg, injuring the foot while trying to kick-start an ATV). The occupant status of the injured child was missing for a substantial number of cases in which a child was run over by an ATV. These cases were excluded from this report. It is likely, however, that some of these children had been riding the ATV before it ran over them.

The estimates presented here differ somewhat from the estimates provided by the CPSC in its 2003 annual report of ATV-related deaths and injuries.<sup>3</sup> For example, for 2003, the CPSC estimated that 38 600 children aged  $\leq 15$  years were treated in hospital EDs for ATV-related injuries, compared with our estimate of 40 403 injured ATV riders of the same age. This difference in estimates is possible for several reasons. The CPSC estimates include all ATV-related injuries regardless of whether the child was operating the ATV.<sup>3</sup> The CPSC estimates are derived from reports of a probability sample of 100 NEISS hospitals, whereas the estimates presented in this report are derived from a subsample of 66 hospitals that participate in the NEISS-All Injury Program.<sup>4</sup> In addition, the CPSC adjusts its estimates downward

**TABLE 1.** Estimated Average Annual Number, Percentage, and Annualized Rate per 100 000 Population of ATV-Related Injuries Among Riders Aged 0–15 Years Presenting to Hospital EDs According to Age, Gender, and Selected Injury Characteristics: United States, 2001–2003

Characteristic	Male			Female			Total					
	No.	%*	Rate	95% CI	No.	%*	Rate	95% CI	No.	%*	Rate	95% CI
Age, y												
0–15	25 643	100	77.4	56.6 to 98.3	10 598	100	33.5	25.5 to 41.7	36 241	100	56.0	41.9 to 70.1
0–5	1494	5.8	12.5	7.9 to 17.0	822	7.8	7.2	4.3 to 10.1	2316	6.4	9.9	6.9 to 12.9
6–10	5203	20.3	50.1	34.4 to 65.7	3091	29.2	31.2	20.5 to 41.9	8294	22.9	40.9	28.8 to 53.0
11–15	18 946	73.9	176.4	129.7 to 223.1	6685	63.1	65.4	48.8 to 82.0	25 631	70.7	122.3	92.1 to 152.4
Diagnosis												
Fracture	7087	27.6	21.4	15.3 to 27.5	2847	26.9	9.0	6.5 to 11.6	9933	27.4	15.4	11.2 to 19.5
Contusion/abrasion	6371	24.8	19.2	12.9 to 25.6	2692	25.4	8.5	6.0 to 11.1	9063	25.0	14.0	10.1 to 17.9
Laceration	4300	16.8	13.0	9.7 to 16.3	1431	13.5	4.5	2.8 to 6.3	5732	15.8	8.9	6.7 to 11.0
Strain/sprain	2739	10.7	8.3	5.1 to 11.5	1680	15.8	5.3	3.6 to 7.0	4419	12.2	6.8	4.9 to 8.8
Internal injury	2017†	7.9	—	—	876†	8.3	—	—	2893†	8.0	—	—
Concussion	842	3.3	2.5	1.4 to 3.7	292†	2.8	—	—	1134	3.1	1.8	1.0 to 2.5
Burn (thermal)	320†	1.2	—	—	252†	2.4	—	—	572†	1.6	—	—
Other	1966	7.7	5.9	3.7 to 8.2	528†	5.0	—	—	2494	6.9	3.9	2.4 to 5.3
Primary body part injured												
Arm/hand	6924	27.0	20.9	15.4 to 26.5	2982	28.1	9.4	7.0 to 11.9	9906	27.3	15.3	13.8 to 16.8
Head/face/neck	6633	25.9	20.0	13.0 to 27.1	3093	29.2	9.8	6.3 to 13.3	9726	26.8	15.0	11.3 to 18.7
Leg/foot	7138	27.8	21.6	14.9 to 28.2	2510	23.7	7.9	5.3 to 10.6	9647	26.6	14.9	13.9 to 15.9
Upper trunk	2958	11.5	8.9	6.1 to 11.7	954	9.0	3.0	2.0 to 4.1	3912	10.8	6.0	1.0 to 2.5
Lower trunk	1362	5.3	4.1	2.5 to 5.7	542	5.1	1.7	0.8 to 2.6	1904	5.3	2.9	–1.1 to 7.0
Other	444†	1.7	—	—	438†	4.1	—	—	881†	2.4	—	—
Unknown	185†	0.7	—	—	80†	0.8	—	—	265†	0.7	—	—
Disposition												
Treated/released	22 027	85.9	66.5	48.8 to 84.2	9381	88.5	29.7	24.7 to 34.7	31 408	86.7	48.5	36.5 to 60.6
Hospitalized	3377	13.2	10.2	6.5 to 13.9	1072	10.1	3.4	1.9 to 4.9	4449	12.3	6.9	4.5 to 9.3
Other	211†	0.8	—	—	144†	1.4	—	—	356†	1.0	—	—
Unknown	28†	0.1	—	—	—	—	—	—	28†	0.1	—	—

\*Some percentages do not total 100% because of rounding.

† Estimates are unstable because the coefficient of variation is >30% or the unweighted number of sample cases is <20. Rates and CIs were not calculated on unstable estimates.

**TABLE 2.** Unweighted Percentage\* of ATV-Related Injuries Among Riders Aged 0–15 Years Presenting to Hospital EDs According to Age and Selected Characteristics: United States, 2001–2003

	0–5 y (n = 119), %	6–10 y (n = 380), %	11–15 y (n = 1064), %	Total (n = 1563), %
Primary body part injured				
Head	19.3	16.8	16.8	17.0
Face/mouth	31.1	15.5	6.7	10.7
Neck	1.7	1.6	3.1	2.6
Arm/hand	17.7	23.4	25.5	24.4
Upper trunk	7.6	9.2	11.4	10.6
Lower trunk	1.7	8.7	4.8	5.5
Leg/foot	18.5	23.2	28.4	26.4
Other	0.0	1.1	2.9	2.2
Unknown	2.5	0.5	0.5	0.6
Diagnosis				
Fracture	21.9	26.3	29.4	28.1
Contusion/abrasion	18.5	23.4	23.1	22.9
Laceration	28.6	20.0	12.7	15.7
Strain/sprain	2.5	6.1	13.2	10.6
Internal injury	14.3	12.4	10.7	11.4
Concussion	1.7	3.4	3.4	3.3
Burn (thermal)	4.2	1.6	1.1	1.5
Other	8.4	6.8	6.4	6.5

\* Based on 1563 cases. Some percentages do not total 100% due to rounding.

by ~8% to account for cases that are coded incorrectly as being ATV related,<sup>3</sup> whereas we reviewed each record and made exclusions on a case-by-case basis.

There are several limitations to the findings in this report. The NEISS provides national estimates and does not allow for estimates by region, state, or local jurisdiction. Furthermore, some geographic regions with relatively high ATV injury rates may not be adequately represented in the NEISS. For example, Alaska and West Virginia, states with high ATV-related pediatric mortality rates, are not represented.<sup>7,8</sup> The NEISS includes information about only the most severe injury based on the physician's assessment. Information about the rider's position on the ATV (eg, driver, passenger) was not available for 71% of riders, and there was no information on the size of the ATV or the rider's frequency of ATV use, level of experience, or helmet use. Finally, because the NEISS does not include children treated in physician offices or clinics, the actual annual number of ATV-related injuries among young riders is likely to be higher than the estimates presented here.

The most recent national survey of ATV riders estimated that in 2001, 7.2 million children aged ≤15 years had ridden an ATV at least once in the previous year. Eighty-five percent of the children who had driven ATVs drove ones with engines >90 mL (ie, adult-sized ATVs).<sup>2</sup> Furthermore, 87% of the children who were injured while driving ATVs were driving adult-sized ATVs. This pattern of children operating adult-sized ATVs persists despite recommendations by the CPSC and some ATV distributors that children aged ≤15 years not ride adult-sized ATVs.<sup>9</sup>

Because children often lack the physical strength, cognitive abilities, and fine motor skills to operate ATVs properly, their risk for injury is greater.<sup>10</sup> A national case-control study estimated that ATV drivers aged ≤15 years were nearly 4 times as likely as older drivers to be injured.<sup>11</sup> Because of the increased

risk of injury to children, coupled with the propensity for children to ride adult-sized ATVs, some medical and consumer advocacy organizations, including the American Academy of Pediatrics, the American Academy of Orthopaedic Surgeons, and the Consumer Federation of America, recommend prohibiting all use of ATVs by children ≤15 years old.<sup>12–15</sup> In August 2002, the Consumer Federation of America filed a petition with the CPSC requesting that the commission ban the sale of adult-sized ATVs for use by children ≤16 years old.<sup>16</sup> In February 2005, the CPSC staff recommended that the commission deny the petition, citing that the impact of such a ban would be limited because major ATV distributors already require dealers not to sell adult-sized ATVs for use by children. Moreover, the ban would not apply to sales of used ATVs, which account for 37% of all ATV sales.<sup>17</sup> The commission heard testimony regarding the petition on March 22, 2005. In June 2005, CPSC Chairman Hal Stratton directed the staff to review all existing ATV safety standards, particularly as they relate to young riders (H. Stratton, CPSC, memorandum to review ATV standards, personal communication, June 8, 2005).

Most states have some laws or regulations governing the use of ATVs. According to the Specialty Vehicle Institute of America, 28 states have minimum age requirements.<sup>18</sup> These regulations apply to young riders aged 10 to 18 years and include a wide variety of qualifiers such as where ATVs can be operated and exceptions for age requirements if the child is supervised by an adult or has a safety certificate. The effectiveness of state-imposed requirements for operating ATVs in reducing serious injuries and deaths among young riders is unclear. Upperman and colleagues<sup>7</sup> examined the issue and found no difference in ATV-related mortality rates among children between states with and without minimum age requirements and safety certification. Keenan and Bratton<sup>19</sup> compared the characteristics of seriously injured ATV riders aged ≤15 years from a

state with ATV regulations versus one without and found that children from the state without regulations were younger and less likely to have been wearing a helmet. Finally, Helmkamp<sup>8</sup> found that the presence of some level of ATV regulation and helmet-use requirement is associated with lower ATV-related mortality rates in the overall population.

Despite placement of decals with safety warnings on all new ATVs and recommendations for restricted use by children from the CPSC and medical associations, parents continue to obtain ATVs for their children's use. Most children ride adult-sized ATVs, and there is currently no federal mandate restricting the sale of adult-sized ATVs for use by children. Renewed efforts by health care providers to counsel parents about the injury risk to children who use ATVs and advocate for more stringent state-level minimum age requirements may help reduce the escalating numbers of ATV-related injuries occurring among young riders.<sup>7,10,19–21</sup>

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