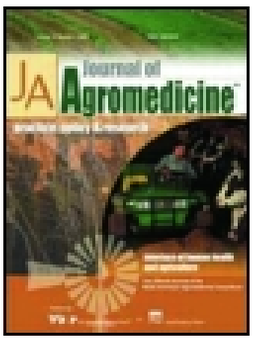

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Youths Operating All-Terrain Vehicles—Implications for Safety Education

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ABSTRACT. All-terrain vehicle (ATV) use has increased in recent years. ATV injuries and deaths have also increased, particularly among youth. The authors administered a survey at a National FFA convention to identify safety-related behaviors, injuries, and effects of ATV safety training. There were 624 participants aged 12 to 20 with a median age of 16; 56% were male and 69% lived on a farm. The median age for first riding an ATV was 9. ATV size recommendations were rarely observed; nearly all ATVs operated by youth less than 16 years of age were over 90 cc. Safety-related behaviors were reported as follows: always wearing a helmet (24%), never taking passengers (12%), never riding as a passenger (16%), and never riding on paved road (19%). A small percentage (22%) had participated in ATV safety training; 41% were willing, but 46% said such training was not available. ATV training was positively associated with always wearing a helmet (odds ratio [OR]: 1.72, 95% confidence interval [CI]: 1.12–2.63), never taking passengers (OR: 2.31, 95% CI: 1.36–3.91), never riding as a passenger (OR: 3.02, 95% CI: 1.90–4.79), and never riding on paved road (OR: 1.57, 95% CI: 0.99–2.50). However, training was also associated with an increase in injuries (OR: 1.96, 95% CI: 1.31–2.94), although this effect was not found in multivariable models. It was not known if the injuries occurred before or after the training and no exposure time data were available. Gender differences were found in behaviors and injury rates (males 37%, females 20%). The results suggest ATV safety training improved behaviors. Gender differences in operation, behaviors, and injuries should be considered in training.

KEYWORDS. All-terrain vehicle, ATV, helmet, injury, safety behaviors, youth

INTRODUCTION

Whether used to check cattle in the pasture, haul feed to the horses, spray pesticides in fence lines, or get to a favorite fishing hole, all-terrain vehicles (ATVs) have become the transportation of choice on many farms. As ATVs have gained popularity, the risk of injury has become evident whether ATVs are used for work, recreation, or both.

From 1997 to 2001, the number of ATVs in the United States rose by 40%, ATV riders

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increased by 36%, ATV riding hours increased by 50%, and the estimated number of ATV-related injuries treated in emergency rooms increased by 104%. ATV riders with less than 1 year of riding experience had the highest risk of injury.[1] ATV sales increased 316% in the decade prior to 2003 and reported deaths nationally increased from 183 to 357, representing a 95% increase.[2]

Several studies have documented that children and adolescents are at risk when using ATVs. Youth less than 16 years of age represented 37% of the total ATV-related fatalities from 1985 to 2001.[3] The same age group accounted for 33% of the estimated ATV-related injuries in 2004.[4] The majority of youth (97%) that were injured in ATV-related incidents were riding an ATV larger than recommended for their age.[5] ATV operators less than 16 years of age were nearly four times more likely to experience an injury requiring emergency department treatment compared to youth 16 and older.[6] Over 2500 children were hospitalized in 2000 due to ATV-related incidents, a 79% increase from 1997. Approximately 1% of ATV-related hospitalizations resulted in death.[7] The majority (2/3) of pediatric ATV-related injuries involved children who were 14 or less and approximately 1/5 were less than 9 years of age.[7] From 2001 through 2003, an estimated 108,724 children aged 15 or less were treated in hospital emergency departments for nonfatal injuries sustained while riding ATVs. ATV-related injuries increased by 25% over that 3-year period.[8]

ATVs have increased in size and youth are riding faster and heavier machines. Emergency room injuries caused by ATVs over 400 cc increased 567% within a 4-year time span from 1997 to 2001.[5] The ATV Safety Institute, a national nonprofit organization dedicated to reducing injuries due to improper ATV operation, recommends the following guidelines for riding the correct sized ATV: ATVs under 70 cc—minimum age 6 years; ATVs 70 to 90 cc—minimum age 12 years; and ATVs over 90 cc—minimum age 16 years.[9]

Factors such as age, gender, use of three-wheeled rather than four-wheeled vehicles, on-road use, and helmet usage influence risk of injury and death. A higher percentage of farm youth than nonfarm youth operate ATVs, but injury numbers among farm youth are not significantly higher. This may be attributed to the use of ATVs for farm work instead of recreation.[10]

Most youth indicate they are competent riders, but admit to occasional risk taking behavior. Youth indicate they do at times show off, do stunts, and exhibit other risky behavior in front of peers. Many youth ride with passengers while socializing and feel larger vehicles with prominent seats invite multiple riders. Youth using ATVs for farm work report they are less likely to have passengers.[11]

This paper presents the results of a survey administered among youth attending the 2005 National FFA Convention. FFA, formerly known as Future Farmers of America, changed their name officially in 1988 to reflect the expanding career field of agricultural education. The purpose of this project was to describe safety-related behaviors when using ATVs, prevalence of riding ATVs as an extra rider, perception of hazards while operating an ATV, participation in ATV safety training, and the frequency of ATV-related injuries among youth. This information can be useful when developing future education, training, and media campaigns directed at preventing ATV injuries among youth.

METHODS

The National FFA Convention in Louisville, Kentucky, was selected as the location for obtaining ATV information from youth. This yearly event attracts over 50,000 FFA members, advisors, and supporters. Out of the FFA student membership, 27% live on farms, 39% live in rural nonfarm homes, and 34% live in urban and suburban areas. Currently, 38% of the FFA membership is female.[12] This event provided access to a large youth population representing both rural and urban residents aged 12 to 20. The survey was administered at a booth within the Career Show, which is part of the FFA Convention. The booth focused on ATV safety and included a life-sized cut-out of a

male adolescent on an ATV holding a sign saying "Got PPE" (personal protective equipment). An adolescent female was also standing beside the ATV. Students could have a Polaroid picture taken with the characters as a souvenir.

A 15-question survey was developed by Farm Safety 4 Just Kids and the Great Plains Center for Agricultural Health addressing characteristics of youth using ATVs, their safety behaviors, and ATV-related injuries. Youth attending the FFA Career Show could fill out the questionnaire at the booth staffed by research team members. The one-page questionnaire took approximately 5 minutes to complete. No personal identifiers were included in the questionnaire and the respondents received no monetary compensation. The first questions addressed demographics. Additional questions addressed use of ATVs, helmet use, passengers, riding on paved surfaces, safety training, and ATV-related injuries. The University of Iowa's Institutional Review Board approved the research protocol.

The associations of operator/rider characteristics and safety-related outcomes (helmet use, riding with passengers, riding on paved surfaces, and injuries) were evaluated using the chi-square test and logistic regression. Statistical analyses were performed using SAS version 9.1.[13]

RESULTS

Respondents. A total of 624 youth ages 12 to 20 filled out and returned the questionnaire (median and mean age 16). Some questionnaires had missing data and the number of usable responses to the questions ranged from 584 to 613. The majority of respondents were male (338 out of 602; 56%). The majority lived on a farm (414 out of 604; 69%). The majority reported that their family owns an ATV (466 out of 602; 77%). Nearly all (594 out of 613, 97%) indicated they ride ATVs. The median age when participants started riding ATVs was 9 (mean 9.5). The median size of ATV that the family owned and the respondent usually rode was 350 cc. Few (7%) indicated they used ATVs for work only, 23% indicated they used ATVs for recreation only, and 70% stated they used ATVs for both work and recreation purposes. The respondents represent 43 states, with 49% of them coming from the states of Kentucky (13.7%), Indiana (7.9%), Iowa (7.7%), Ohio (7.2%), Wisconsin (6.2%), and Missouri (6.0%).

Safety Behaviors

Questions related to safety behaviors addressed wearing a helmet, taking passengers, riding as a passenger, and riding on paved roads. The responses are presented in Table 1. The responses indicate low compliance with best safety practices as suggested by the ATV Safety Institute[9]; only 24% always wore a helmet, 12% never allowed passengers, 16% never rode as a passenger, and 19% never rode on paved roads.

ATV Safety Training

The percentage of respondents participating in ATV safety training was 22%. When asked why they had not participated in ATV training, 46% indicated that training was *not available* in their area, 5% said they *didn't know about any training*, and 4% said *they didn't know where the training was held.* Among the respondents who were not interested in training, 24% said they *did not need* training and 16% said they were *already safe riders.*

ATV Behavior Associations

The associations of operator/rider characteristics and ATV safety behaviors are presented in Table 2. The significant associations include (1) helmet use was more common among males (48% versus 38%; $p = .02$); (2) allowing a passenger was more common among females (37% versus 25%; $p = .002$); (3) riding as a passenger was more common among females (23% versus 12%; $p < .0001$); (4) riding on paved surfaces was more common among males (16% versus 7%; $p = .001$); (5) riding as a passenger was more common among those whose family did not own an ATV (26% versus 15%; $p = .004$); (6) helmet use was more common among those who had ATV safety training (60% versus

TABLE 1. Reported ATV Safety Behaviors and Injuries (n = 624)

	Number	Percentage
Helmet use		
Helmet usage when riding an ATV	605	100
Always	144	23.8
Most of the time	118	19.5
Sometimes	188	31.1
Never	155	25.6
Reasons for not wearing a helmet	436	100
Didn't think one was necessary	153	35.1
Did not have a helmet that fits	87	20
ATV passengers		
Allow passengers on an ATV	603	100
Always	85	14.1
Most of the time	102	16.9
Sometimes	343	56.9
Never	72	11.9
Concern for ATV passenger safety	528	100
It's not my concern	62	11.7
Nothing bad will happen	66	12.5
I worry that someone will get hurt	217	41.1
I'm a safe ATV operator so no will get hurt	182	34.5
Ride an ATV as a passenger	605	100
Always	45	7.4
Most of the time	57	9.4
Sometimes	405	66.9
Never	97	16
Riding on paved surfaces		
Ride an ATV on paved surfaces	606	100
Always	18	3
Most of the time	57	9.4
Sometimes	418	69
Never	112	18.5
ATV training		
Participated in ATV safety training	605	100
Yes	131	21.7
No	474	78.4
Would like to participate in ATV safety training	584	100
Yes	237	40.6
No	345	59.1
ATV-related injuries		
Injured in an ATV incident	606	100
Yes	176	29
No	430	71

39%; $p < .0001$); (7) helmet use was more common among those who wanted to have safety training (50% versus 39%; $p = .007$); and (8) riding on paved surfaces was more common among those who had an injury (18% versus 10%; $p = .006$). Significant associations are bolded within Table 2. Age and whether youth lived on farms were not significantly associated with safety-related behaviors.

Effects of Training

The associations of training and safety-related behaviors and injuries were examined using univariable logistic regression models. The results are presented in Table 3. Training had a significant positive association with wearing a helmet. Never allowing passengers, never riding as a passenger, and never riding on paved roads also showed positive associations with training. However, ATV training was associated with an increase in injuries. Our survey did not indicate if the injuries occurred before or after the training, and exposure hour data were not available. Therefore, we could not determine the differences in injury rates (injuries per exposure time).

The effects of training differ in Tables 2 and 3 due to different outcome variable classifications. In Table 2, the safety-related outcomes (helmet use, allowing passengers, riding as a passenger, riding on paved surfaces) were coded to be present when the responses were "always" or "most of the time" and absent when the responses were "sometimes" or "never." In Table 3, the safety-related outcomes were present when the responses were "always" wearing a helmet and "never" allowing passengers, "never" riding as a passenger, and "never" riding on paved surfaces. In Table 2, only helmet use was associated with training, whereas in Table 3 several outcomes were associated.

Injuries

A total of 176 respondents reported having one or more ATV-related injuries in the past. The overall lifetime injury rate was 29% (176 out of 606 respondents). Of those injured in an ATV-related incident, 105 indentified the injured body part: 28% indicated their *arm* was hurt, 27% said their *leg* was hurt, 13% said they received *scratches or bruises*, 12% said they hurt their *back*, and 11% said they hurt their *head*. Injuries were more common among (1)

TABLE 2. ATV Operator/Rider Characteristics and ATV Safety Behaviors

	N	Wore a helmet			Allowed passengers			Rode as a passenger			Rode on paved surfaces		
		Yes	%	*p*	Yes	%	*p*	Yes	%	*p*	Yes	%	*p*
Age ≥16 years old													
Yes	396	170	43.8	.825	114	29.5	.636	68	17.6	.489	51	13.1	.507
No	207	84	42.9		61	31.4		30	15.3		22	11.2	
Gender													
Female	264	**97**	**38.3**	**.021**	**92**	**36.7**	**.002**	**58**	**22.9**	**<.0001**	**18**	**7.1**	**.001**
Male	338	**158**	**47.9**		**82**	**25.0**		**39**	**11.9**		**54**	**16.4**	
Live on farm													
Yes	414	167	40.8	.273	127	31.2	.745	64	15.6	.157	52	12.7	.793
No	190	80	45.7		57	32.6		36	20.5		21	11.9	
Family has ATV													
Yes	466	195	42.1	.633	146	31.7	.766	**68**	**14.7**	**.004**	58	12.5	.798
No	136	53	44.5		36	30.3		**31**	**25.8**		14	11.7	
Had ATV training													
Yes	131	**78**	**59.5**	**<.0001**	35	26.9	.243	18	13.8	.296	16	12.2	.943
No	474	**183**	**38.7**		152	32.3		84	17.7		59	12.4	
Would like ATV training													
Yes	239	**119**	**49.8**	**.007**	66	27.8	.191	39	16.3	.656	33	13.8	.492
No	345	**133**	**38.7**		113	32.9		61	17.7		41	11.9	
ATV injury													
Yes	176	82	46.6	.296	57	32.6	.608	29	16.6	.904	**32**	**18.2**	**.006**
No	430	180	42.0		130	30.4		73	17.0		**43**	**10.0**	

Note. Safety-related behavior (helmet use, allowing passengers, riding as passenger, riding on paved surface) was coded to be present when the response was "always" or "most of the time" and absent when the response was "sometimes" or "never."

TABLE 3. Univariate Associations of Training and Safety-Related Outcomes

Model	Response variable	Independent variable	OR	95% CI
1	Always wearing a helmet	Training, yes vs. no (ref.)	**1.72**	**1.12–2.63**
2	Never taking passengers	Training, yes vs. no (ref.)	**2.31**	**1.36–3.91**
3	Never riding as passenger	Training, yes vs. no (ref.)	**3.02**	**1.90–4.79**
4	Never riding on paved road	Training, yes vs. no (ref.)	1.57	0.99–2.50
5	ATV injury (ever)	Training, yes vs. no (ref.)	**1.96**	**1.31–2.94**

those who had ATV safety training (40% versus 26%; $p = .001$); (2) males (37% versus 20%; $p < .0001$); (3) those who started operating ATVs before age 12 (38% versus 13%; $p < .0001$); and (4) those whose family owned an ATV (34% versus 10%; $p = .0005$). In a multiple logistic regression model, risk factors for injury included male gender (OR: 1.62, 95% CI: 1.05–2.50), family owning an ATV (OR: 4.04, 95% CI: 2.08–7.86), and starting to operate/ride ATVs before age 12 (OR: 4.08, 95% CI: 2.43–6.86). Age, living on a farm, ATV safety training, and safety-related behaviors were not significantly associated with injury in multivariable analysis.

DISCUSSION

With the increasing use of ATVs and the rise in numbers of injuries, research is needed to evaluate injury risks and interventions to prevent injuries from occurring. Recent attention to youths' ATV injuries has produced several studies and publications on this subject.[2,14,15]

Findings suggest that gender, type of residence, age, ATV size, and ATV use characteristics are associated with ATV safety behaviors.[4,6,7]

Our survey results are in accordance with many previous findings.[5,10,11] Youth often operate an ATV with a passenger and only a small proportion always ride solo. Our results confirm that youth riding on paved surfaces are more likely to experience injury. Unique findings in this study include females were more likely to allow passengers and were more often ATV passengers.

Only about one-fifth of the youth had received ATV safety training. Helmet use was more common among those who *had taken training* or *would like to take training*. In the logistic regression analyses, training also had positive associations with wearing a helmet and other safe behaviors. This appears to indicate that training is effective in encouraging helmet use, riding solo, and other safe behaviors. Alternative explanations include preexisting safety culture, mindset, or attitude among those individuals who participate in safe behavior and training. The type and quality of the training received was not known from our survey. Two-fifths of the participants stated that they would like to receive training, but nearly half indicated that training was not available to them. These findings, along with almost one-third of the participants having been injured in an ATV incident, indicate the need for providing effective ATV safety education, and making it available to those who are interested in participating. Various forms of safety training may be needed, including initial training for beginning operators and more advanced continuing education for those who already operate ATVs. Our results indicate that education and training should be specialized to reflect gender differences. Females were especially receptive to the idea of training, with half of them reporting that they would like to receive ATV safety training. This is important because females were more likely to be passengers on ATVs and less likely to wear helmets. Males were more likely to ride on paved surfaces, more likely to ride larger ATVs, and more likely to be injured, but less receptive to attending ATV safety training. Therefore, gender-targeted awareness campaigns and educational programs could be implemented to consider the gender-specific issues. Examples: importance of helmet use, training availability, and allowing no passengers should be focused on female audiences. Operating size-appropriate ATVs, operating on nonpaved surfaces, and the importance of training should be emphasized with the male population. It is a concern that nearly all ATVs were over 90 cc, and nearly all respondents under the age of 16 reported riding ATVs larger than the recommended 90 cc engine size.

Unsafe ATV-related behaviors such as not wearing a helmet, riding with passengers, and riding on paved road surfaces are individual choices made by youth. Over one-third of the respondents said they did not think an ATV helmet was necessary. This statement leads the authors to believe that more persuasive information is needed to help youth understand the protection that a helmet provides. Over 40% of the youth that allowed ATV passengers stated that they worry about their passengers. This information can be useful for ATV education program developers, safety instructors, and those developing programs and media campaigns. A focus on the safety of passengers instead of the operator may be more powerful in changing behavior. Differences found between the genders should influence training outlines, as well as media campaigns to increase safe behavior while using ATVs.

The association of ATV safety training and injury was unexpected, although the evidence from intervention studies is weak in the field of agricultural health and safety. Only two intervention studies so far have shown positive effects in the most recent systematic review.[16] In our survey, we were not able to establish whether the injuries occurred before or after the training and therefore it is not clear whether the training could have increased injuries. The exposure hour data were also unavailable, and it is possible that those who have taken training are more active ATV operators and more at risk due to longer exposure hours. It is also possible that those who take safety training become more aware of injuries and therefore report them more readily. Multivariable analysis identified male gender, family owning an ATV, and

starting to operate/ride ATVs at a young age as risk factors for ATV injury. The negative effect of safety training became insignificant after adjusting for these risk factors. This finding also suggests that training in itself may not be a risk factor but those who take ATV safety training may have other demographic or ATV use characteristics that increase their risk for ATV injury. Regardless, this unexpected finding would need further study.

Limitations

One limitation of this study is that the respondents (FFA members) are likely not representative of youth in the United States. FFA provides education (including safety education), and membership in FFA may influence the members' attitudes and behaviors. As participation in this study was voluntary, a convenience sample, this population may not be representative of the convention attendees or FFA membership at large. Our sample has a relatively high proportion of farm residents (69%), indicating that nonfarm residents are likely underrepresented. These factors limit the generalizability of this study. Also, the questionnaire was a lifetime survey that could lead to misinterpretations based on different exposure durations. The timing of training was not identified in relation to injuries or behaviors.

CONCLUSIONS

Understanding the behavior of youth operating and riding ATVs can help direct educational efforts that influence safe practices leading to a reduction in ATV-related injuries. Survey results identified a variety of safety concerns when using ATVs for recreational and work use: (1) low percentage of youth having participated in ATV safety training, (2) high percentage of youth indicating training was not available to them, (3) infrequent helmet use, (4) frequent extra riders, and (5) frequent riding on paved roads. These findings can be considered when designing future ATV safety programs and educational materials to include concepts that encourage safe behavior. Gender specific emphasis on helmet usage, not allowing passengers, and riding off-road surfaces need to be incorporated into educational programs that aim to impact positive change. Concern for the safety of those riding as passengers should be emphasized. The unexpected association of training and increased injury risk should be studied further. Future surveys should also include questions about how training influences specific behaviors to more thoroughly understand the association between training and behavior change.

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