

# Case-Control Study of Risk Factors for All-Terrain Vehicle (ATV) Injuries on Kentucky Farms

Jessica L. Wilson, PhD (c), ARNP  
University of Kentucky • College of Nursing

## Purpose

The purpose of this study was to identify risk factors for ATV-related injury to heads of farm households.

## Background

- KY ranks 4th in # farms in U.S. with 83,000 farms over 13,700,000 acres, 54% of the total acreage of the state (KASS, 2007)
- KY ranked 1st in ATV fatalities in 2007 and 2008, and 4th in cumulative deaths since 1982 (CPSC, 2008)
- 9.5 million ATVs in use in 2007, with an estimated 542 deaths and 146,500 injuries treated in ER (Risk estimate 153.9/10,000 4-wheel ATVs in use) (CPSC, 2008)
- Estimated ownership of ATVs on farms in the southern region in 2001 was 481 (± 27) per 1,000 farms (Goldcamp et al., 2006)
- Prior case-control study determined risk factors for ATV injury in the general population were age, gender, driving experience, monthly driving times, recreational use, number of wheels on the ATV, and ATV engine size (Rodgers and Adler, 2001).
- Little research on the prevalence of ATV use on farms or ATV-related injury among adult farmers.

## Design

- Cross-sectional mail survey to stratified random sample of farms in Kentucky
- Inclusion criteria: Head of household ≥ 18 years of age who live on a 10 acre or larger farm that is in active operation
- Cases were respondents who owned ATVs on their farm and had been injured while operating an ATV
- Controls were respondents who owned ATVs for use on their farm and had not had ATV-related injuries.
- Prevalence-based case/control study methods were used for the analysis in SAS 9.1.

## Results

- Response rate was 53% (N=1031).
- Case control analysis was based on 118 cases and 913 controls with complete data.
- The estimated risk was highest for the 18-29 age group of adult farmers riding ATVs and generally declined with age.
- After adjustment for covariates, the significant (p < .05) injury risks were younger age, riding the ATV on public roads, having a high score on the dangerous risk-taking attitudes scale, and more exposure time (hours/month) riding ATVs in this sample of farmers.

- Hosmer Lemeshow goodness-of-fit test results were ( $\chi^2 = 2.6952$ , df 8, p = 0.9520) indicating the difference between the observed probability of the event and the predicted probability.
- Linear regression was computed to determine the variance inflation factors of the variables which were all around 1 indicating there are no problems of multicollinearity.
- Other variables which were associated with ATV-related injury, but not statistically significant in the model or not included in the model because they are not modifiable: risk acceptance, risk propensity, prior farm machine injury, riding or carrying passengers, perceived behavioral control, perceived stress, and riding experience in years.

**Table 1. Demographics based on farm households with ATV ownership, Kentucky ATV Farm Safety Survey, 2009 (N = 1031)**

Demographic	Injured	Not Injured	Total <sup>1</sup>
<b>Age (Years)</b>	N %	N %	N %
18-29	7 (28)	18 (72)	25 (2.6)
30-45	36 (23)	122 (77)	158 (17)
46-64	52 (10)	483 (90)	535 (57)
65-88	15 (7)	213 (93)	228 (4)
<b>Gender</b>			
Male	103 (12)	744 (88)	847 (89)
Female	8 (8)	97 (92)	105 (11)
<b>Education</b>			
< High School	16 (15)	91 (85)	107(12)
≥ High School graduate	90 (11)	730 (89)	820(88)
<b>Race</b>			
Caucasian	111 (12)	837 (88)	948 (99.7)
Minority	0 (0)	2 (100)	2 (0.3)
<b>Farm Type</b>			
Livestock	57 (12)	430 (88)	487 (51)
Crop	29 (13)	186 (87)	215 (23)
Hobby	13 (8)	145 (92)	158 (17)
Dairy	2 (7)	28 (93)	30 (3)
Other	9 (16)	48 (84)	57 (6)
<b>Farm Size (acres)</b>			
10-65	22 (11)	171 (89)	193 (21)
66-126	23 (11)	178 (89)	201 (22)
127-278	26 (10)	223 (90)	249 (27)
279-10,000	36 (12)	254 (88)	290 (31)
<b>Income</b>			
<40K	17 (8)	197 (92)	214 (26)
≥40K	79 (13)	527 (87)	606 (74)

<sup>1</sup>Sum may not equal (N=1031) due to missing values

**Table 2. Selected Characteristics of Cases and Controls**

Variable	# of	# Injured Riders	Rate	Odds Ratio (95%CI)
<b>Age (Years)</b>				
18-29	27	9	33.3	6.86 (2.76-17.05)
30-45	169	37	21.9	3.85 (2.19-6.78)
46-64	635	60	9.5	1.43 (0.86-2.38)
65-95	324	22	6.8	*
<b>Ride on Public Roads</b>				
Yes	150	35	23.3	2.92 (1.90-4.52)
No	976	92	9.4	*
<b>Dangerous Risk-Taking</b>				
High Score	585	83	14.19	1.97 (1.32-2.93)
Low Score	516	40	7.75	*
<b>Gender</b>				
Male	1034	117	11.3	1.3 (0.70-2.42)
Female	134	12	9.0	*

\* Indicates reference group

**Table 3. Logistic Regression Model Predicting ATV injuries in Farmers Adjusted by Gender**

Variable	Coefficient (SE)	Wald $\chi^2$	Adjusted OR	95% CI
<b>Intercept</b>	-1.8550(0.2318)			
<b>Age group (Years)</b>				
18-29	0.7724 (0.3345)	5.33	4.91	(1.83-13.16)*
30-45	0.4792 (0.1946)	6.06	3.66	(1.94-6.91)**
46-64	-0.4332 (0.1732)	6.26	1.47	(0.83-2.61)**
65-95			--	
<b>Riding on Public Roads</b>				
Yes	0.3843 (0.1229)	9.77	2.16	(1.33-3.49)***
No			--	
<b>Dangerous Risk-Taking</b>				
High Score (>9)	0.2796 (0.1106)	6.40	1.75	(1.13-2.70)**
Low Score (≤9)			--	
<b>Exposure Time</b>	0.00646 (0.00262)	6.07	1.01	(1.00-1.01)**
<b>Gender</b>				
Male	0.1089(0.1820)	0.36	1.24	(0.61-2.54)
Female			--	

Model based on analysis of 118 cases and 913 controls

-- Reference Group  
\* p < 0.05; \*\* p = 0.01; \*\*\*p = 0.001

## Conclusions

- ATV injury risks on farms are related to a number of rider characteristics, most of which are modifiable.
- Community-based educational interventions for ATV riders need to be tailored to meet the needs of farmers.
- Male gender was not a predictor for injury in this sample as it was in the sample of ATV users in the general population. All members of the farm household with ATVs need to be included in educational interventions.
- There is strong evidence to support the need for state policy regarding the use of ATVs on public roadways, and to remove legislative loopholes that put workers, such as farmers, at risk by exempting them from following policy when using ATVs for work.
- 93% of farmers who used ATVs in this study never wear a helmet, even though helmet use has been shown to significantly reduce the severity of injuries and probability of death in ATV crashes.
- Future research should measure these rider characteristics in a national random sample of farmers to determine if these findings are generalizable, or if there are state-specific variations in ATV injury risk factors among farming communities. Prospective studies of farmers who experience ATV-related injuries are recommended so that more of the crash characteristics can be documented for educational and policy-relevant purposes. Surveillance studies of the occupational use of ATVs on farms need to be conducted to determine if farm jobs can be carried out more safely with the use of ATVs or other machinery.