



# A Pilot Study of Fatal ATV-Related Incidents Involving Passengers

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## Executive Summary

U.S. Consumer Product Safety Commission (CPSC) staff has received reports of 2,454 ATV-related fatalities from 2005 through 2007. Of these, 536 fatalities were identified as related to an ATV with more than one rider. These fatalities represent 502 incidents.<sup>1</sup> In this pilot study, CPSC staff analyzed these 502 incidents for passenger location on the ATV, rider characteristics, and incident characteristics. This report summarizes the results of this passenger pilot study. Highlights of the results include:

### Scenario 1:

The most common scenario of multi-rider fatal incidents was where two riders (a driver and a passenger) were involved in an incident involving one ATV. Of the 502 incidents, 419 (83.5%) fell into this category.

- A majority of passengers may have been on the seat behind the driver, but this cannot be concluded from the fatality reports.
  - In 45.6 percent of incidents, the passenger was reported to be on the seat behind the driver.
  - In 29.6 percent of incidents, the location of the passenger was not reported.
  - In 68 incidents (16.2%), the passenger was behind the driver, but it was unknown if the passenger was on the seat with the driver.
  - In 36 incidents (8.6%), the passenger was on the back of the ATV, but not on the seat; was in front of the driver; was held by the driver or on the driver's lap; was in a passenger seat; or was standing on the ATV.
- The driver was most likely to be the fatally injured party in these incidents (52.7% of incidents). Additionally, the driver and passenger both died in 7.4 percent of incidents.
  - When the passenger was not on the seat, was held by driver/on the driver's lap, or was on the seat in the front of the driver, it was more likely that the passenger was the fatally injured rider.
- There was an association between the age of the driver and passenger, as well as the sex of the driver and passenger.
  - The age of the passenger and driver were similar for ages through 25 years of age. When the driver was older than 25 years, the passengers were most frequently younger than the driver.
  - The sex of the passenger most often matched the sex of the driver.

### Scenario 2:

The second most common scenario of multi-rider fatal incidents consisted of incidents with more than two riders (a driver and 2 or more passengers) involved in a single ATV incident. Of the 502 incidents, 53 (10.6%) fell into this category.

- In this scenario, most incidents involved three riders on an ATV (81.1%).
  - A passenger was more likely than the driver to be the fatally injured rider (67.4% of incidents resulted in a passenger's death; 27.9% of incidents resulted in the driver's death; and 4.7% in the driver and a passenger's deaths). This differs from the two-rider scenario.
  - The distribution of incidents across the driver's age group showed higher proportions of drivers in younger age groups than in the two-rider scenario.
  - Three on the seat (multiple configurations) and unknown locations were the most common passenger locations.
    - In 16 incidents, the location for both passengers was unknown.

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<sup>1</sup> Thirty-four incidents involved two fatalities, *i.e.*, the driver and passenger both died as a result of the incident.

- In 16 incidents, the passengers were on the seat with the driver (11 incidents had both passengers behind the driver, and five incidents had one passenger in front of the driver and one behind the driver).
  - In seven incidents, neither passenger was on the seat. In all seven incidents, one passenger was on the left rear fender, and one passenger was on the right rear fender.
  - In one incident, one passenger was on the seat in front of the driver, and one passenger was held by driver or in the driver's lap.
  - One incident had a passenger in front of the driver, but it is unknown where the second passenger was located.
- When the number of riders was four, five, or six, there were several different riding configurations, with passengers on and off of the seat, and several passengers with an unknown riding location.

Riding and Hazard Pattern Characteristics Comparison for Single Rider Versus Multi-Rider Incidents:

To understand how passengers might affect fatal ATV incidents, CPSC staff compared the results of Scenarios 1 and 2 incidents to fatalities involving only one rider and only ATV.

- The driver's age group was associated with carrying a passenger in reported fatal incidents. Younger age groups were represented in larger proportions as the number of riders increases from one to two to more than two riders (p-value < 0.0001, excluding unknown ages and driver's <6 years of age).
- The driver's sex was associated with carrying a passenger in reported fatal incidents. Female drivers were seen in larger proportions as the number of riders increases from one to two to more than two riders (p-value < 0.0001, excluding unknowns).
- Overturning events were not more or less prevalent in scenarios with one, two, or more than two riders (p-value=0.10), while overturning events remain the most significant hazard pattern in all ATV-related fatalities.
- The proportion of reported, fatal incidents on different types of terrain and types of roads did not change from one, to two, to more than two rider scenarios (p-value=0.055 and 0.22, respectively).
- The proportion of traffic-related, fatal incidents did not change from one, to two, to more than two rider scenarios (p-value=0.72).

Possible Further Study

- It cannot be concluded from this study that a passenger's absence would prevent a fatality from occurring. The driver was most likely to be the fatally injured rider in this data set. In incidents that resulted in only a passenger's death, it is possible that the driver would have died instead of the passenger in the event that the passenger was not present. Further study is required to reach any conclusions.
- The rate at which passengers are injured or killed is also unknown. That is, CPSC staff does not have current exposure data to know how often passengers are riding on ATVs, which would enable risk calculations.
- To understand the effect of passengers on ATVs better, additional data<sup>2</sup> required includes, but is not limited to, the following:
  - Mechanism of driver and passenger injuries,
  - Disposition of all riders (injury severity),
  - Interactions between driver and passenger(s),
  - Weight of all riders,
  - Helmet use of all riders, and
  - The sequence of events in the incident.

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<sup>2</sup> Note that if this additional data are collected, there may or may not be enough information to understand how a passenger's absence would affect fatal, ATV-related incidents.

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## Introduction

As a part of the U.S. Consumer Product Safety Commission's (CPSC) Fiscal Year 2014 Operating Plan,<sup>3</sup> CPSC staff has studied various characteristics of passenger use of all-terrain vehicles (ATVs). CPSC staff conducted a retrospective study of the currently available data as part of this. Thus, CPSC staff initiated a pilot study of ATV-related fatalities where at least one passenger was involved in the incident, with the goal to understand how passengers' age, sex, and location on the ATV were associated with ATV-related fatalities.

## Background

CPSC staff maintains a database of all reported ATV-related fatalities called the All-Terrain Vehicle Deaths (ATVD) database. Every ATV-related fatality reported to the CPSC since the early 1980s is recorded in the ATVD. An update of the database is published each year. The most recent publically available version of the ATVD at the time of this analysis was ATVD 2011, which contains all ATV-related fatalities reported to the CPSC on or before December 31, 2011. As resources allow, each ATV-related fatality reported to CPSC staff is a candidate for an In-Depth Investigation (IDI) by CPSC field staff, which involves an attempt to gather additional information about the incident and the victim through official reports, such as police and medical examiner reports. Several pieces of data are recorded in the ATVD regarding the victim and the incident. Additional information contained in the IDI can be recorded and analyzed through special studies.

Due to reporting variability, the years 2008–2011 are considered years of ongoing reporting; CPSC staff expects to receive additional reports of ATV-related fatalities for these years. These additional reports will be included in future releases of the ATVD. For this study, the most recent year where reporting was considered complete was 2007. Thus, this study focuses on the three most recent years of completed reporting, 2005, 2006, and 2007.

Note that reported fatal incidents may not reflect the population of fatal, ATV-related incidents because reported incidents are not all incidents that have occurred. Additionally, reported, fatal incidents are not a statistical sample. Thus, reported, fatal incidents are not representative of all ATV-related incidents, including those resulting in an injury and those not resulting in an injury. Reported, fatal ATV-related incidents can be used only to analyze what occurred in the set collected; no further extrapolations are possible.

In this pilot study, CPSC staff analyzed reported, ATV-related fatalities where at least one passenger was involved in the incident. All fatalities involving an ATV with more than one rider were pulled from ATVD, which contains a variable that records the number of riders on the incident ATV. [1] All official reports pertaining to this set of fatalities were reviewed, and CPSC staff recorded additional information for each person involved in the incident. Additional information includes the age, sex, location on the ATV, and disposition (death versus not) for each person on the ATV at the time of incident. This was joined with the data already available in ATVD. Note that some data are repeated, but some was added to the data available in ATVD. The data recorded for this study, along with the data available in ATVD, were analyzed, and the results are summarized in this section.

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<sup>3</sup> <http://www.cpsc.gov/Global/About-CPSC/Budget-and-Performance/FY2014OperatingPlan.pdf>.

## Results

This section summarizes the results of the pilot study of reported, ATV-related fatal incidents where more than one rider was on the ATV at the time of the incident, and the date of death was between January 1, 2005 and December 31, 2007. There are five subsections in this Results section: an overview of reported, fatal incidents with passengers; three subsections detailing the analytical results of the different incident scenarios involving passengers; and a comparison of multi-rider fatal incidents against one-rider fatal incidents. Further description of exactly what is contained in these sections is provided in the overview section.

### Overview: Reported, ATV-Related Fatal Incidents Involving Passengers, 2005-2007

As noted previously, only ATV-related fatalities occurring from 2005 through 2007 were considered for this study. There are 2,454 ATV-related fatalities reported to CPSC staff in these years. There were 536 fatalities involving an ATV with more than one rider. Because 34 incidents involved the death of two people, there are 502 fatal incidents that were related to an ATV carrying more than one rider at the time of the incident.<sup>4</sup>

**Table 1** summarizes the number of riders on the ATV at the time of the fatal incident. Most fatal incidents that involved passengers had only one passenger (total of two riders). Note that where two ATVs were involved, the number of riders on only one ATV is summarized in **Table 1**.

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<sup>4</sup> In ATVD, the number of riders is recorded for only one ATV involved. Thus, there may be other incidents that fit the scope of this study but could not be identified through querying ATVD. An example of a type of incident that cannot be identified would be a fatality that was a solo rider on an ATV, and the incident involved a second ATV with more than one rider. The number of riders would be recorded only for the victim's ATV, which is one. See the Scenario 3 and Methodology sections below for further details about this limitation.

**Table 1: Number of Incidents and Fatalities for the Number of Riders in Reported Multi-Rider, Fatal Incidents, 2005–2007**

<b>Number of Riders</b>	<b>Number of Fatal Incidents</b>	<b>Percent of Total Incidents</b>	<b>Number of Fatalities<sup>5</sup></b>	<b>Percent of Total Fatalities</b>
<i>Two</i>	442	88.0%	474	88.4%
<i>Three</i>	45	9.0%	47	8.8%
<i>Four</i>	8	1.6%	8	1.5%
<i>Five</i>	1	0.2%	1	0.2%
<i>Six</i>	1	0.2%	1	0.2%
<i>Unknown, but more than 1<sup>6</sup></i>	5	1.0%	5	0.9%
<b>Total</b>	<b>502</b>	<b>100%</b>	<b>536</b>	<b>100%</b>

The 502 reported, fatal incidents identified as involving at least one passenger can be classified into one of the scenarios below:

- Scenario 1: one ATV involved with two riders (*i.e.*, a driver and a passenger),
- Scenario 2: one ATV involved with more than two riders (*i.e.*, a driver and two passengers),
- Scenario 3: more than one ATV involved with more than one rider on at least one ATV, and
- Scenario 4: not enough information available for further study.

Of the 502 total incidents analyzed, 419 incidents (83.5%) involving one ATV with two riders represent the most common scenario in the data. Of the 502 incidents identified for this study, there were 53 that involved only one ATV, and the ATV had more than two riders (10.6%). Only 25 incidents (5.0%) were identified in the third scenario, where two or more ATVs were involved in a fatal incident, and at least one ATV had more than one rider. Two of these incidents involved three riders on one ATV, the remaining involved two riders on at least one ATV. One of the 25 incidents involved the deaths of two people. The five incidents where the number of riders could not be determined were not classified into any of these three scenarios.

Incidents in Scenario 1 and Scenario 2 were studied in detail, and the results related to these two scenarios are provided in the next two subsections. Riding characteristics and hazard patterns were compared for Scenario 1 and Scenario 2, both of which are compared against fatal incidents with one ATV and only one rider involved. The results are provided in a following section. Scenario 3 results are also provided, but are not used in any further comparisons, for the reasons described in footnote 6. Scenario 4 is not considered for any further analyses.

<sup>5</sup> There are 34 incidents with more than one fatality. For those incidents where there were two riders on the first ATV, 32 incidents had two fatalities. For incidents where three riders were on the first ATV, there were two incidents, each with two fatalities.

<sup>6</sup> This occurs when the decedent is known to be a passenger, but there are limited details pertaining to the incident. Thus, it is unknown how many total riders were on the ATV. As such, these five incidents are not mentioned or analyzed anywhere else in this study. A similar scenario, in the case where the driver was the decedent and there are limited details about the number of riders, leaving the field unknown, is a limitation of this study. These incidents may have more than one rider, but this cannot be known. Thus, this scenario is not part of this study.

## Scenario 1: Two Riders with One ATV Involved (Most Common Scenario)

Of the 502 incidents analyzed, 419 (83.5%) involved one ATV with two riders, which is the most common riding scenario in ATV-related fatalities involving passengers. This section provides a summary of the rider and incident characteristics for these types of incidents.

**Table 2** tabulates the number of incidents by the location of the passenger for incidents with two riders and only one ATV involved. Although a large proportion of passengers (45.6%) were identified to be on the seat behind the driver, there is also a large proportion of passengers whose location was unknown (29.6%), and a considerable proportion of those known to be on the back of the ATV, but it is unknown if they were on the seat (16.2%). Thus, it cannot be concluded that the majority of passengers were on the seat of the ATV behind the driver. In 21 incidents (5.0%), the passenger was on the seat in front of the driver; in four incidents, the passenger was in a location similar to being in front of the driver, which was on the driver's lap or being held by the driver.

**Table 2: Number of Incidents for the Location of Passenger in Reported ATV-Related Fatal Incidents Involving One ATV with Two Riders, 2005–2007**

<b>Location of Passenger</b>	<b>Number of Incidents</b>	<b>Percent</b>
<i>Unknown</i>	124	29.6%
<i>Behind driver, on the seat<sup>7</sup></i>	191	45.6%
<i>Back of ATV, exact location unknown</i>	68	16.2%
<i>Back of ATV, but not on the seat<sup>8</sup></i>	7	1.7%
<i>In front of the driver, on the seat</i>	21	5.0%
<i>Held by driver/on driver's lap</i>	4	1.0%
<i>Passenger seat</i>	2	0.5%
<i>Standing on ATV<sup>9</sup></i>	2	0.5%
<b>Total</b>	<b>419</b>	<b>100%</b>

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<sup>7</sup> This includes incidents where the police report indicated that the passenger was a motorcycle passenger. The analyst assumed that this indicated that the passenger was on the seat behind the driver. Thus, the numbers associated with the category of passenger's location may be inflated, if the assumption does not hold.

<sup>8</sup> Most passengers who were coded as a passenger on the back of the ATV, but specifically not on the seat, were on the cargo rack or where a cargo rack would be if the ATV was equipped with one. In one case, the passenger was in a car seat strapped to the cargo rack, and in another case, the passenger was noted to be sitting backwards on the back of the ATV.

<sup>9</sup> In one incident, the passenger was standing on the back of the ATV. In the incident, the driver was standing on the right running board controlling the ATV, and the passenger was standing on the left running board holding onto the cargo rack.

**Table 3** tabulates the number of incidents by who died in the incident. Note the driver was the victim in the majority of incidents (52.7%) that involved one ATV with two riders.

**Table 3: Number of Incidents for Who Died in Reported ATV-Related Fatal Incidents Involving One ATV with Two Riders, 2005–2007**

<b>Who Died<sup>10</sup></b>	<b>Number of Incidents</b>	<b>Percent</b>
<i>Driver</i>	221	52.7%
<i>Passenger</i>	167	39.9%
<i>Driver and Passenger</i>	31	7.4%
<b>Total</b>	<b>419</b>	<b>100%</b>

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<sup>10</sup> In 10 incidents, it is unknown exactly who was driving. Coding conventions were implemented in these 10 incidents to deal with the unknown information. See the Methodology section for details on the classification of who died in the incident.

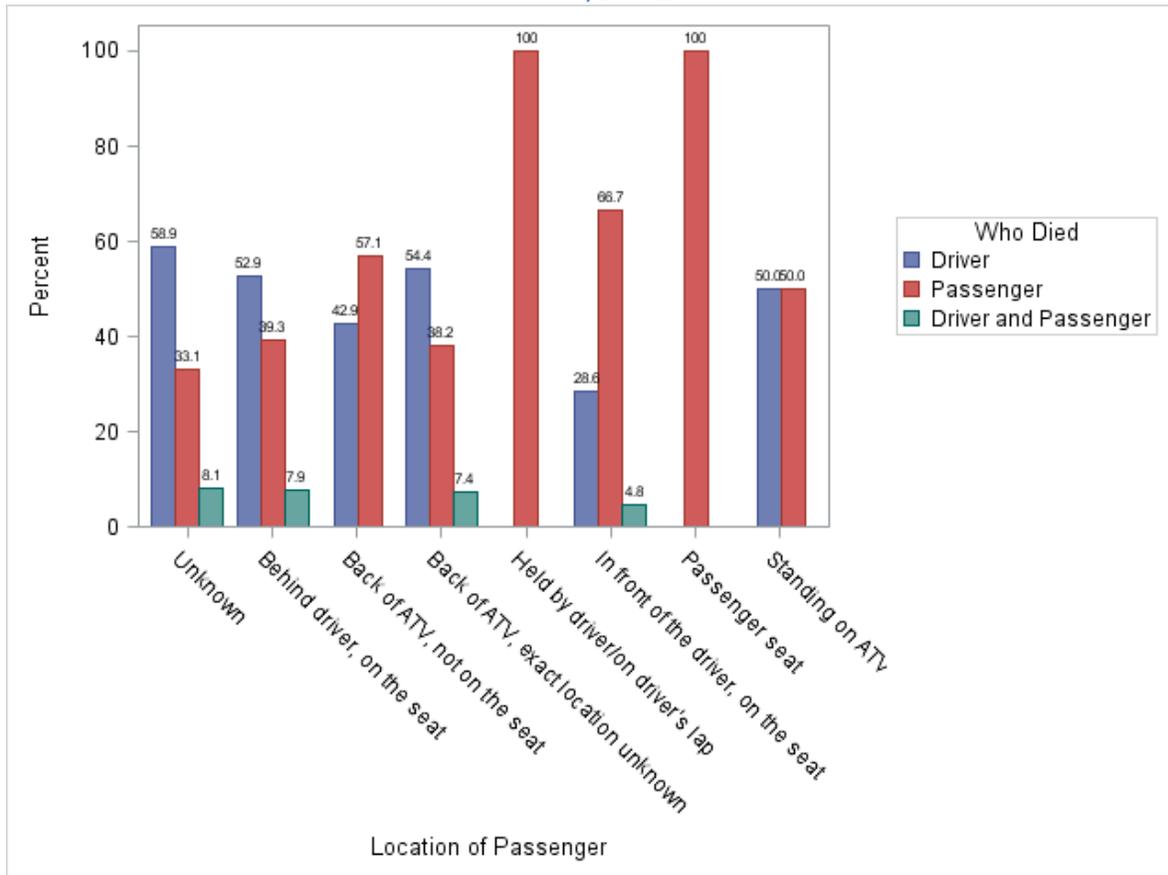
To understand better the relationship between who died and the location of the passenger, **Table 4** provides the cross-tabulation of the number of incidents by these two variables. Note that when the passenger was classified as being on the seat behind the driver, the majority of incidents (52.9%) are associated with the death of the driver only. In the 25 incidents where the passenger was in front of the driver, on the driver’s lap, or held by the driver, the passenger only was killed in 18 incidents (72.0%).

**Table 4: Number of Incidents for the Location of Passenger by Who Died in Reported ATV-Related Fatal Incidents Involving One ATV with Two Riders, 2005–2007**

	Who Died			
	<i>Driver</i>	<i>Passenger</i>	<i>Driver and Passenger</i>	<b>Total</b>
<b>Passenger’s Location</b>				
<i>Unknown</i>	73	41	10	<b>124</b>
<i>Behind driver, on the seat</i>	101	75	15	<b>191</b>
<i>Back of ATV, but not on the seat</i>	3	4	0	<b>7</b>
<i>Back of ATV, exact location unknown</i>	37	26	5	<b>68</b>
<i>Held by driver/on driver's lap</i>	0	4	0	<b>4</b>
<i>In front of the driver, on the seat</i>	6	14	1	<b>21</b>
<i>Passenger seat</i>	0	2	0	<b>2</b>
<i>Standing on ATV</i>	1	1	0	<b>2</b>
<b>Total</b>	<b>221</b>	<b>167</b>	<b>31</b>	<b>419</b>

**Figure 1** represents the information from **Table 4** as the percentage of incidents by who died in the incident for each passenger location. Note that the driver is more likely to be the fatally injured rider, except when the passenger was on the back of the ATV, but not on the seat; when the passenger was in front of the driver, or was on the driver’s lap/being held by the driver.

**Figure 1: Percentage of Who Died by Location of Passenger in Reported ATV-Related Fatal Incidents Involving One ATV with Two Riders, 2005–2007**



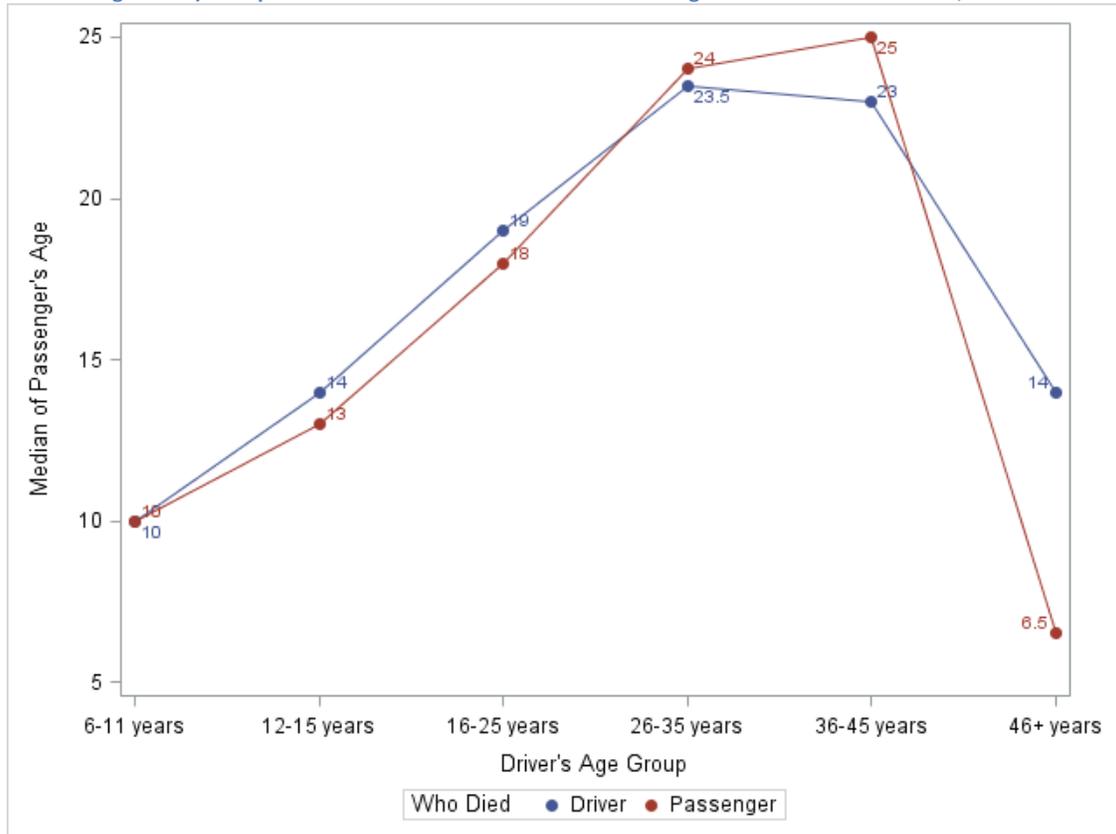
**Table 5** summarizes the number of incidents for the driver’s age group by the passenger’s age group for incidents involving one ATV with two riders. A general pattern can be seen in the relationship between the driver’s age group and the passenger’s age group. For example, note that for the driver’s age group 16–25 years, the passenger’s age group most often (67.4%) was the same age group as the driver, 16–25 years. The same is seen with the driver’s age group of 12–15 years, where the passenger’s age group is most likely the same 12–15 years (54.3%). This is also the case for the driver’s age group 6–11, with 54.2 percent of the incidents involving a passenger in the same age group. In the 26–35 and 36–45 years age groups, the age groupings of the passengers spread out to include the age group younger and the age group older to represent the majority of incidents. In the 46+ years driver’s age group, the plurality of incidents involve a passenger 15 years old or younger.

**Table 5: Number of Incidents for Driver’s Age Group by Passenger’s Age Group in Reported ATV-Related Fatal Incidents Involving One ATV with Two Riders, 2005–2007**

Driver’s Age Group	Passenger’s Age Group								Total
	Unknown	<6 years	6-11 years	12-15 years	16-25 years	26-35 years	36-45 years	46+ years	
Unknown	1	4	3	2	0	6	1	6	<b>23</b>
6-11 years	3	3	13	0	2	0	0	3	<b>24</b>
12-15 years	5	1	12	38	11	1	2	0	<b>70</b>
16-25 years	9	2	6	20	95	5	3	1	<b>141</b>
26-35 years	5	9	7	3	10	18	9	2	<b>63</b>
36-45 years	2	4	8	1	11	5	8	4	<b>43</b>
46+ years	10	11	9	6	6	3	2	8	<b>55</b>
<b>Total</b>	<b>35</b>	<b>34</b>	<b>58</b>	<b>70</b>	<b>135</b>	<b>38</b>	<b>25</b>	<b>24</b>	<b>419</b>

To understand the age relationship of the driver and the passenger better, **Figure 2** graphs the median passenger age for each of the driver's age groups according to who died in the incident. The same relationship as seen in Table 2 between the driver and passenger's ages is seen in this graph. Incidents where both the driver and passenger died are excluded from this graph due to the small number of incidents.

Figure 2: Median Passenger's Age for Driver's Age Group by Who Died (Excluding Incidents where Both the Driver and Passenger Died) in Reported ATV-Related Fatal Incidents Involving One ATV with Two Riders, 2005–2007



**Table 6** tabulates the number of incidents for the passenger’s location by the age group of the passenger. In 50.0 percent of the incidents involving a passenger younger than 6 years old, the passenger was sitting on the seat in front of the driver. However, it should be noted that in 26.5 percent of the incidents with a passenger younger than 6 years old, the exact location of the passenger is unknown. In incidents where the passenger was in the age groups 12–15 years, 16–25 years, and 26–35 years, the majority of the incidents had the passenger on the seat behind the driver (58.6%, 54.8%, and 52.6%).

**Table 6: Number of Incidents for Passenger Location by Passenger Age Group in Reported ATV-Related Fatal Incidents Involving One ATV with Two Riders, 2005–2007**

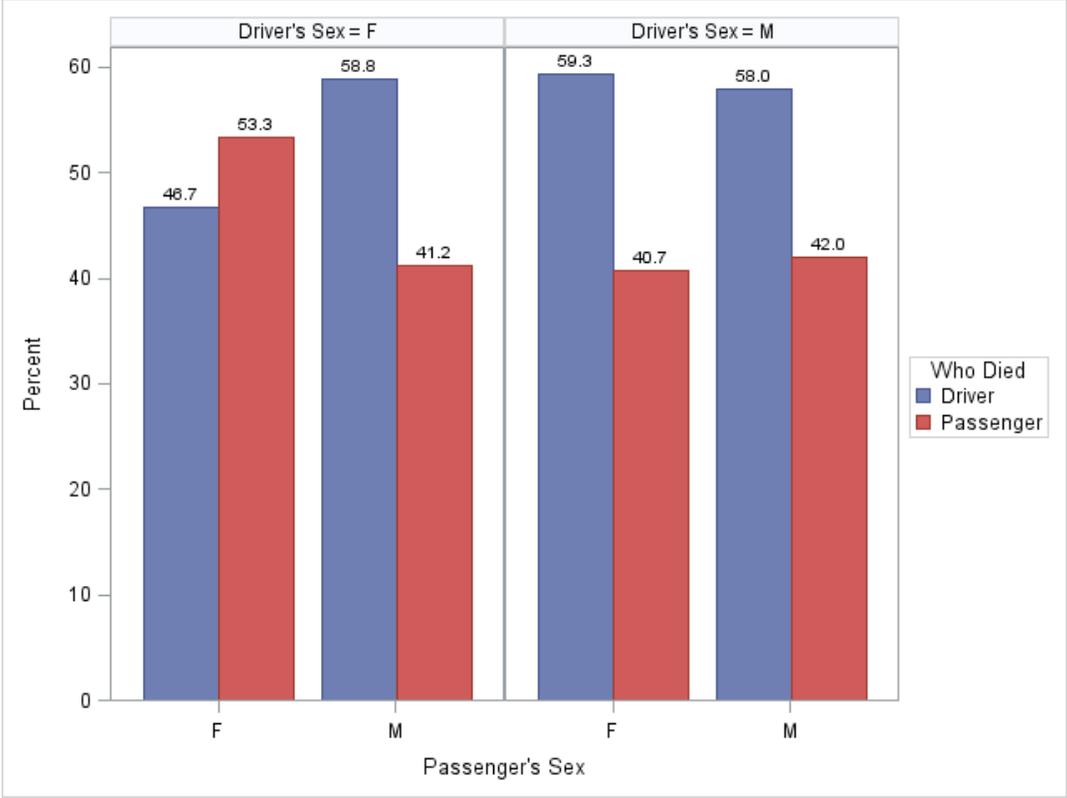
Passenger’s Location	Passenger’s Age Group								Total
	Unknown	<6 years	6-11 years	12-15 years	16-25 years	26-35 years	36-45 years	46+ years	
<i>Unknown</i>	18	9	26	16	32	12	6	5	<b>124</b>
<i>Behind driver, on the seat</i>	8	2	21	41	74	20	13	12	<b>191</b>
<i>Back of ATV, but not on the seat</i>	1	1	1	0	1	0	2	1	<b>7</b>
<i>Back of ATV, exact location unknown</i>	8	2	5	10	28	6	4	5	<b>68</b>
<i>Held by driver/on driver’s lap</i>	0	3	1	0	0	0	0	0	<b>4</b>
<i>In front of the driver, on the seat</i>	0	17	3	0	0	0	0	1	<b>21</b>
<i>Passenger seat</i>	0	0	1	1	0	0	0	0	<b>2</b>
<i>Standing on ATV</i>	0	0	0	2	0	0	0	0	<b>2</b>
<b>Total</b>	<b>36</b>	<b>34</b>	<b>58</b>	<b>70</b>	<b>135</b>	<b>38</b>	<b>25</b>	<b>24</b>	<b>419</b>

**Table 7** provides the cross tabulation of the driver’s sex by the passenger’s sex. The majority of incidents involved a male driver (75.4%). In the incidents with a male driver, the passenger was male 58.5 percent of the time. In 23.4 percent of incidents, the driver was female. In incidents with a female driver, the passenger was also female 63.3 percent of the time. **Figure 3** provides this comparison separated by who died in the incident. It can be seen from this figure that in all male/female riding combinations, the driver is more likely to be the fatally injured victim, with the exception of when two females are riding. When two females were riding, it is slightly more likely that the passenger was the fatally injured victim. Incidents where both the driver and passenger died are excluded from **Figure 3** due to the small number of incidents; also excluded are incidents where information about the driver or passenger’s sex are not available.

**Table 7: Number of Incidents for Driver’s Sex by Passenger’s Sex in Reported ATV-Related Fatal Incidents Involving One ATV with Two Riders, 2005–2007**

Driver’s Sex	Passenger’s Sex			Total
	Female	Male	Unknown	
<i>Female</i>	62	34	2	<b>98</b>
<i>Male</i>	126	185	5	<b>316</b>
<i>Unknown</i>	2	2	1	<b>5</b>
<b>Total</b>	<b>190</b>	<b>221</b>	<b>8</b>	<b>419</b>

Figure 3: Percentage of Incidents for Who Died by Passenger's Sex and Driver's Sex in Reported ATV-Related Fatal Incidents Involving One ATV with Two Riders (Excludes Unknown Sex; Excludes Who Died=Driver and Passenger), 2005–2007



## Scenario 2: More than Two Riders with One ATV Involved

Of the 502 incidents identified for this study, there were 55 that involved an ATV with more than two riders, and 53 of those involved only one ATV. Incidents involving more than one ATV are summarized in a separate subsection below. This section details the 53 incidents (10.6% of all incidents) that involve one ATV with more than two riders.

**Table 8** provides the tabulation of incidents for the number of riders on the ATV by who died in the incident. Note that 43 incidents (81.1%) involved three riders on the ATV: a driver and two passengers. In these 43 incidents, a passenger was most likely to be the one who died in the incident (67.4%). There were two incidents where both the driver and one passenger died. There were no incidents where more than one passenger died. Note that in this section, passengers are identified by the word “passenger” and a number to separate the passengers. There is no particular order assigned to passengers, with the exception of incidents where a passenger died; in this case the passenger who died is listed as Passenger 1. The tables in this section should be interpreted with this in mind.

**Table 8: Number of Incidents for the How Many Riders by Who Died in Reported ATV-Related Fatal Incidents Involving One ATV Was Involved with More than Two Riders, 2005-2007**

Number of Riders	Who Died			Total
	Driver	Passenger 1	Driver and Passenger 1	
<i>Three</i>	12	29	2	<b>43</b>
<i>Four</i>	2	6	0	<b>8</b>
<i>Five</i>	0	1	0	<b>1</b>
<i>Six</i>	0	1	0	<b>1</b>
<b>Total</b>	<b>14</b>	<b>37</b>	<b>2</b>	<b>53</b>

Because most of the incidents involving multiple passengers are incidents where there were three riders on the ATV, these incidents will be analyzed separately from incidents with more than three riders.

**Tables 9-12** summarize the 43 incidents with three riders. **Table 13** summarizes the 10 incidents with more than three riders on the ATV.

**Table 9** provides a summary of where one passenger was located by where the second passenger was located. There are many unknown locations for both passengers in incidents with three riders (37.2%). In seven of the 43 incidents (16.3%), neither passenger was located on the seat of the ATV. In each of these seven incidents, one passenger was on the left rear fender, and the other passenger was on the right rear fender.

In seven of the 43 incidents (16.3%), one passenger was located in front of the driver, on the seat. The other passenger was located in various locations on the ATV in these seven incidents: one was held by the driver or in the driver's lap; five were on the seat behind the driver; and one was in an unknown location on the ATV.

In 11 incidents (25.6%), the driver and two passengers were all on the seat, one directly behind the other.

**Table 9: Number of Incidents for Passenger 1's Location by Passenger 2's Location in Reported ATV-Related Fatal Incidents Involving One ATV with Three Riders, 2005–2007**

<b>Passenger 1's Location</b>	<b>Passenger 2's Location</b>						<b>Total</b>
	<i>Unknown</i>	<i>Behind driver, on the seat</i>	<i>Back of ATV, not on the seat</i>	<i>Back of ATV, exact location unknown</i>	<i>Behind driver and passenger 1, on the seat</i>	<i>In front of the driver, on the seat</i>	
<i>Unknown</i>	16	0	0	0	0	0	<b>16</b>
<i>Behind driver, on the seat</i>	0	0	0	1	9	3	<b>13</b>
<i>Back of ATV, but not on the seat</i>	0	0	7	0	0	0	<b>7</b>
<i>Back of ATV, exact location unknown</i>	0	1	0	0	0	0	<b>1</b>
<i>Behind driver and passenger 2, on the seat</i>	0	2	0	0	0	0	<b>2</b>
<i>Held by driver/on driver's lap</i>	0	0	0	0	0	1	<b>1</b>
<i>In front of the driver, on the seat</i>	1	2	0	0	0	0	<b>3</b>
<b>Total</b>	<b>17</b>	<b>5</b>	<b>7</b>	<b>1</b>	<b>9</b>	<b>4</b>	<b>43</b>

**Table 10** breaks down the tabulation of incidents in **Table 9** by who died in the incident. In most of the cases where the driver was the person who died in the incident, the location of the passengers is unknown. There were 29 incidents where only one of the passengers died. Of these, there is a considerable proportion of incidents where the location is unknown for both passengers (24.1%). Of the 29 incidents where a passenger only died, there were 11 incidents (37.9%) where the passenger who died was sitting on the seat either directly behind the driver or behind the driver and another passenger. The other passenger was on the seat in various locations in relation to the victim who died in these incidents. In four of the 29 incidents where only a passenger died (13.8%), the passenger who died was held by the driver or was on the seat in front of the driver. In two of the 43 incidents summarized here, the driver and one passenger died. The passenger was located directly behind the driver in both of these.

**Table 10: Number of Incidents for Who Died, Passenger 1's Location, and Passenger 2's Location in Reported ATV-Related Fatal Incidents Involving One ATV with Three Riders, 2005–2007**

<b>Who Died</b>	<b>Location of Passenger 1</b>	<b>Location of Passenger 2</b>	<b>Number of Incidents</b>
<i>Driver</i>	<i>Unknown</i>	<i>Unknown</i>	9
	<i>Behind driver, on the seat</i>	<i>Behind driver and passenger 1, on the seat</i>	2
	<i>Back of ATV, but not on the seat</i>	<i>Back of ATV, but not on the seat</i>	1
<i>Passenger 1</i>	<i>Unknown</i>	<i>Unknown</i>	7
	<i>Behind driver, on the seat</i>	<i>Behind driver and passenger 1, on the seat</i>	6
		<i>In front of the driver, on the seat</i>	3
	<i>Back of ATV, but not on the seat</i>	<i>Back of ATV, but not on the seat</i>	6
	<i>Back of ATV, exact location unknown</i>	<i>Behind driver, on the seat</i>	1
	<i>Behind driver and passenger 2, on the seat</i>	<i>Behind driver, on the seat</i>	2
	<i>Held by driver/on driver's lap</i>	<i>In front of the driver, on the seat</i>	1
<i>Driver and Passenger 1</i>	<i>Behind driver, on the seat</i>	<i>Unknown</i>	1
		<i>Behind driver, on the seat</i>	2
<i>Driver and Passenger 1</i>	<i>Behind driver, on the seat</i>	<i>Back of ATV, exact location unknown</i>	1
		<i>Behind driver and passenger 1, on the seat</i>	1
<b>Total</b>			<b>43</b>

**Table 11** breaks down the 43 reported fatal incidents involving three riders by the driver's age group, both of the passengers' age groups, and by who died in the incident. The driver's age groups that are most likely in reported incidents where there is one ATV involved with three riders are the 12–15 years and 16–25 years age groups, at 16 and 12 incidents, respectively. These 28 incidents account for 65.1 percent of reported incidents involving one ATV with three riders, and the passengers in these incidents are most likely to be in age groups at or below the 16–25 years age group.

**Table 11: Number of Incidents for the Driver's Age Group, Passenger 1's Age Group, and Passenger 2's Age Group by Who Died in Reported ATV-Related Fatal Incidents Involving One ATV with Three Riders, 2005–2007**

Driver's Age Group	Passenger 1's Age Group	Passenger 2's Age Group	Who Died			Total	Driver's Age Group Sub-Total
			Driver	Passenger 1	Driver and Passenger 1		
6-11 years	Unknown	<6 years	1	.	.	1	3
	<6 years	<6 years	.	1	.	1	
	6-11 years	6-11 years	1	.	.	1	
12-15 years	<6 years	6-11 years	.	1	.	1	16
		26-35 years	.	1	.	1	
	6-11 years	Unknown	.	1	.	1	
		6-11 years	1	.	.	1	
		12-15 years	.	1	.	1	
	12-15 years	Unknown	.	1	.	1	
		6-11 years	1	2	.	3	
		12-15 years	2	2	.	4	
	16-25 years	16-25 years	.	1	.	1	
16-25 years	12-15 years	.	1	.	1		
36-45 years	16-25 years	.	1	.	1		
16-25 years	Unknown	Unknown	2	.	.	2	12
	<6 years	Unknown	.	1	.	1	
		<6 years	.	1	.	1	
	6-11 years	6-11 years	.	1	.	1	
		12-15 years	.	1	.	1	
		16-25 years	.	1	2	3	
	12-15 years	16-25 years	.	1	.	1	
16-25 years	16-25 years	.	2	.	2		
26-35 years	<6 years	Unknown	.	1	.	1	6
		<6 years	.	1	.	1	
		6-11 years	1	1	.	2	
	6-11 years	<6 years	.	1	.	1	
	26-35 years	26-35 years	.	1	.	1	
36-45 years	26-35 years	16-25 years	.	1	.	1	2
	36-45 years	26-35 years	.	1	.	1	
46+ years	<6 years	<6 years	1	1	.	2	4
		16-25 years	1	.	.	1	
	6-11 years	Unknown	1	.	.	1	
<b>Total</b>			12	29	2	43	43

**Table 12** summarizes the number of three-rider incidents by the driver’s sex, both passengers’ sex, and by who died in the incident. Of the 29 incidents where a passenger only died, 16 fatalities were female (55.2%).

**Table 12: Number of Incidents for the Driver’s Sex, Passenger 1’s Sex, and Passenger 2’s Sex by Who Died in Reported ATV-Related Fatal Incidents Involving One ATV with Three Riders, 2005–2007**

			Who Died			Total	Driver’s Sex Sub-Total
			Driver	Passenger 1	Driver and Passenger 1		
Driver's Sex	Passenger 1's Sex	Passenger 2's Sex					
Female	Female	Female	3	4	2	9	18
		Male	.	3	.	3	
	Male	Female	.	2	.	2	
		Male	1	1	.	2	
	Unknown	Unknown	2	.	.	2	
Male	Female	Female	.	3	.	3	25
		Male	.	5	.	5	
		Unknown	.	1	.	1	
	Male	Female	4	2	.	6	
		Male	.	7	.	7	
		Unknown	.	1	.	1	
	Unknown	Unknown	2	.	.	2	
<b>Total</b>			<b>12</b>	<b>29</b>	<b>2</b>	<b>43</b>	<b>43</b>

There are 10 incidents involving one ATV with more than three riders on the ATV. Of these, eight incidents involved an ATV with four riders, one incident involved five riders, and one case involved six riders on the ATV. Since there are a limited number of incidents involving more than three riders, case descriptions of the incidents, instead of tabulated overall results, are provided in **Table 13**.

Table 13: Case Descriptions of Reported ATV-Related Fatal Incidents Involving One ATV with Four, Five, or Six Riders, 2005–2007

Number of Riders = 4																	
Who Died	Driver		Passenger 1			Passenger 2			Passenger 3								
	Age Group	Sex	Location	Age Group	Sex	Location	Age Group	Sex	Location	Age Group	Sex						
Driver	26-35 years	Female	Back of ATV, exact location unknown	6-11 years	Male	Back of ATV, exact location unknown	<6 years	Male	Back of ATV, exact location unknown	<6 years	Female						
	36-45 years	Male	Behind driver, on the seat	36-45 years	Female	Back of ATV, but not on the seat	36-45 years	Female	Back of ATV, but not on the seat	36-45 years	Male						
Passenger 1	12-15 years	Female	Standing on ATV	6-11 years	Male	Front of ATV, not on seat	12-15 years	Male	Behind driver, on the seat	12-15 years	Male						
	Unknown	Male	Held by driver/on driver's lap	<6 years	Female	Behind driver, on the seat	Unknown	Female	Held by another passenger	Unknown	Female						
	12-15 years	Male	Behind driver, on the seat	6-11 years	Male	In front of the driver, on the seat	<6 years	Male	In front of the driver, on the seat	6-11 years	Female						
	12-15 years	Female	Unknown	12-15 years	Female	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown						
	6-11 years	Male	Behind driver and another passenger, on the seat	12-15 years	Male	Behind driver, on the seat	6-11 years	Male	Back of ATV, but not on the seat	6-11 years	Male						
	36-45 years	Female	Unknown	12-15 years	Female	Unknown	12-15 years	Female	Unknown	16-25 years	Female						
Number of Riders = 5																	
Who Died	Driver		Passenger 1			Passenger 2			Passenger 3			Passenger 4					
	Age Group	Sex	Location	Age Group	Sex	Location	Age Group	Sex	Location	Age Group	Sex	Location	Age Group	Sex			
Passenger 1	12-15 years	Male	Unknown	12-15 years	Male	Unknown	12-15 years	Male	Unknown	6-11 years	Male	Unknown	6-11 years	Male			
Number of Riders = 6																	
Who Died	Driver		Passenger 1			Passenger 2			Passenger 3			Passenger 4			Passenger 5		
	Age Group	Sex	Location	Age Group	Sex	Location	Age Group	Sex	Location	Age Group	Sex	Location	Age Group	Sex	Location	Age Group	Sex
Passenger 1	26-35 years	Male	Front of ATV, not on seat	6-11 years	Female	Front of ATV, not on seat	<6 years	Male	In front of the driver, on the seat	<6 years	Male	Behind driver, on the seat	6-11 years	Male	Back of ATV, not on seat	6-11 years	Female

## Riding and Hazard Pattern Comparisons (One Rider Versus Two Riders Versus More than Two Riders) Where Only One ATV Was Involved

Identification of riding and hazard patterns specific to riding with passengers is of interest to identify areas where hazards may be reduced. ATVD contains variables that identify several different riding and hazard characteristics for each fatal incident in this study, and also the corresponding fatal incidents where there was no passenger on the ATV. There were 1,632 incidents identified in ATVD, where there was only one rider on the ATV and the driver was the fatality (one rider). In this subsection, the characteristics of these fatal incidents are compared to the characteristics of the 419 incidents where the ATV had a driver and a passenger (two riders), and the 53 incidents where the ATV had a driver and two or more passengers (>2 riders). All incidents compared in this section are incidents where only one ATV was involved. The remainder of the fatalities in ATVD did not fit one of the scenarios and were excluded from the analysis completed in this section.

A Chi-square p-value is provided for each comparison, but there are limitations regarding how far conclusions can go about associations. First, this group of incidents is comprised only of fatal incidents, not all incidents. Additionally, this group of incidents is comprised only of incidents reported to the CPSC. Thus, in these comparisons, all remarks are limited to the specific incidents in the comparisons. The remarks cannot be generalized further.

**Tables 14–21** provide the comparisons for different riding and hazard patterns across the three categories of the number of riders (one rider, two riders, and >2 riders). The columns of each table represent the category for how many riders, and the percentages provided are column percentages. Thus, each percentage represents the proportion of incidents for the specific number-of-riders category in a given category of the riding or hazard pattern. The riding and hazard patterns available in ATVD that are compared in **Tables 14-21** are as follows: driver's age group (**Table 14**), driver's sex (**Table 15**), overturning events (**Table 16**), terrain (**Table 17**), road type (**Table 18**), traffic incident (**Table 19**), driver's alcohol use (**Table 20**), and incident hazard pattern (**Table 21**). **Figure 4** shows all these comparisons graphically.

**Table 14** provides the results of the comparison for the distribution of the driver’s age group for each category of the number of riders. Note that the Chi-square p-value excludes the “unknown” and “<6 years” driver’s age group categories, due to small expected values. The Chi-square p-value is less than 0.0001, which indicates there are differences in the driver’s age group distribution of incidents for the number of riders categories. Highlighted in yellow are the two driver’s age groups that hold the largest percentage of incidents for each number of riders categories. Note that for reported one-rider, ATV-related fatalities, the age categories with the largest percentage of fatalities are drivers 16–25 years and drivers 46+ years of age. For incidents where there are 2 or more riders, the two age categories with the largest percentage of fatalities are the 12–15 years and 16–25 years of age, but the proportion of injuries in these two groups is different for the two riders category (with 16.7% and 33.7%, respectively) and >2 riders category (33.7% and 22.6%, respectively). In reported fatalities where only one ATV was involved, younger age groups are more likely when passengers are present on the ATV.

**Table 14: Comparison (Column Percentage) of Driver’s Age Group for One Rider, Two Riders, and More than Two Riders in Reported Fatal Incidents Involving Only One ATV, 2005–2007**

Driver’s Age Group	Number of Riders		
	One rider	Two riders	>2 riders
Unknown	0.0%	5.5%	1.9%
<6 years	0.4%	0.0%	0.0%
6-11 years	4.6%	5.7%	7.6%
12-15 years	7.7%	16.7%	37.7%
16-25 years	24.9%	33.7%	22.6%
26-35 years	16.3%	15.0%	15.1%
36-45 years	15.7%	10.3%	7.6%
46+ years	30.4%	13.1%	7.6%
<b>Total</b>	<b>100.0% (n=1,632)</b>	<b>100.0% (n=419)</b>	<b>100.0% (n=53)</b>
$\chi^2$ p-value < 0.0001 (Excluding Unknowns and <6 years)			

**Table 15** provides the comparison for the distribution of driver’s sex for each category of the number of riders. Note that when the “unknown” category for driver’s sex is excluded, there is a statistically significant p-value in comparing the driver’s sex against the number of riders in an incident involving only one ATV. The proportion of male drivers is largest in one-rider incidents, and the smallest in >2 rider incidents.

**Table 15: Comparison (Column Percentage) of Driver’s Sex for One Rider, Two Riders, and More than Two Riders in Reported Fatal Incidents Involving Only One ATV, 2005–2007**

Driver’s Sex	Number of Riders		
	One rider	Two riders	>2 riders
Female	8.0%	23.4%	41.5%
Male	92.0%	75.4%	58.5%
Unknown	0.0%	1.2%	0.0%
<b>Total</b>	<b>100.0% (n=1,632)</b>	<b>100.0% (n=419)</b>	<b>100.0% (n=53)</b>
$\chi^2$ p-value < 0.0001 (Excluding Unknowns)			

**Table 16** provides the comparison for the distribution of overturning events for each category of the number of riders. Note that there are similar proportions of incidents for overturning events in each number-of-riders category. There is no statistically significant relationship found (p-value=0.10).

**Table 16: Comparison (Column Percentage) of Overturning Events for One Rider, Two Riders, and More than Two Riders in Reported Fatal Incidents Involving Only One ATV, 2005–2007**

<b>Overturn</b>	<b>Number of Riders</b>		
	<i>One rider</i>	<i>Two riders</i>	<i>&gt;2 riders</i>
<i>Unknown</i>	16.7%	15.3%	13.2%
<i>Yes</i>	62.8%	59.4%	54.7%
<i>No</i>	20.6%	25.3%	32.1%
<b>Total</b>	<b>100.0% (n=1,632)</b>	<b>100.0% (n=419)</b>	<b>100.0% (n=53)</b>
$\chi^2$ p-value = 0.10			

**Table 17** provides the comparison for the distribution of the type of terrain of the incident, by each category of the number of riders. Note that for each of the number-of-riders categories, there are similar proportions of incidents for each terrain type; the largest categories are highlighted in the table. There is no statistically significant relationship found (p-value=0.055).

**Table 17: Comparison (Column Percentage) of Terrain for One Rider, Two Riders, and More than Two Riders in Reported Fatal Incidents Involving Only One ATV, 2005–2007**

<b>Terrain</b>	<b>Number of Riders</b>		
	<i>One rider</i>	<i>Two riders</i>	<i>&gt;2 riders</i>
<i>Unknown</i>	6.1%	5.3%	7.6%
<i>Forest, Woods</i>	8.9%	10.0%	9.4%
<i>Desert, sand dunes, beach</i>	4.4%	1.9%	3.8%
<i>Field, pasture, farmland, ranch land</i>	13.8%	9.1%	15.1%
<i>Paved surface<sup>11</sup></i>	33.3%	37.7%	30.2%
<i>Non-paved road</i>	21.0%	23.6%	26.4%
<i>Lawn, yard</i>	1.8%	3.3%	3.8%
<i>Other</i>	10.8%	9.1%	3.8%
<b>Total</b>	<b>100.0% (n=1,632)</b>	<b>100.0% (n=419)</b>	<b>100.0% (n=53)</b>
$\chi^2$ p-value = 0.055			

<sup>11</sup> Paved surface includes paved road as well as other paved surfaces, such as parking lots.

**Table 18** provides the comparison for the distribution of the type of road for each category of the number of riders. Note the similarities in the distributions of road type for each category of the number of riders. Incidents on a public road and not on a road are the majority road types in each category for the number of riders, all with similar proportions (highlighted in the table). There is no statistically significant relationship found (p-value=0.22).

**Table 18: Comparison (Column Percentage) of Road Type for One Rider, Two Riders, and More than Two Riders in Reported Fatal Incidents Involving Only One ATV, 2005–2007**

Road Type <sup>12</sup>	Number of Riders		
	One rider	Two riders	>2 riders
Unknown	3.4%	3.6%	3.8%
Public road	46.0%	53.7%	43.4%
Private road	7.6%	6.9%	11.3%
Road, not specified	6.6%	5.3%	9.4%
NA (not a road)	36.5%	30.6%	32.1%
<b>Total</b>	<b>100.0% (n=1,632)</b>	<b>100.0% (n=419)</b>	<b>100.0% (n=53)</b>
$\chi^2$ p-value = 0.22			

**Table 19** provides the comparison for the distribution of traffic incidents for each category of the number of riders. Note the similarities in the distributions. Incidents that are not considered traffic incidents represent the largest proportion of incidents in each of the number-of-riders categories (highlighted in the table); thus, incidents that do not involve on-road vehicles, such as cars and trucks, are the majority type of incident in each number of riders category. There is no statistically significant relationship found (p-value=0.72).

**Table 19: Comparison (Column Percentage) of Traffic Incident for One Rider, Two Riders, and More than Two Riders in Reported Fatal Incidents Involving Only One ATV, 2005–2007**

Traffic Incident	Number of Riders		
	One rider	Two riders	>2 riders
Unknown if traffic incident	1.5%	1.7%	1.9%
Traffic incident	13.9%	15.8%	9.4%
Not a traffic incident	84.6%	82.6%	88.7%
<b>Total</b>	<b>100.0% (n=1,632)</b>	<b>100.0% (n=419)</b>	<b>100.0% (n=53)</b>
$\chi^2$ p-value = 0.72			

<sup>12</sup> These percentages will not match the terrains related to roads in Table 17. The terrain variable codes the most relevant terrain characteristics (as determined by the professional judgment of the analyst).

**Table 20** provides the comparison for the distribution of the driver’s alcohol use for each category of the number of riders. As the number of riders increase, the proportion of incidents *not* involving the use of alcohol by the driver increases, and the proportion decreases for incidents that do involve the driver’s use of alcohol. The differences are statistically significant (p-value=0.0201). Making any conclusions on this data should be caveated. Note that the pattern seen could be a mere artifact of “known” data. The proportions of “unknown” driver’s alcohol use are large; if these “unknowns” became “knowns,” the distributions of driver’s alcohol use could change substantially, which could affect any results seen here. Additionally, when there are more than two riders, the driver’s age group is more likely younger than that of the other groups (see **Table 14**). Thus, the results of driver’s alcohol use could be confounded with driver’s age.

**Table 20: Comparison (Column Percentage) of Driver’s Alcohol for One Rider, Two Riders, and More than Two Riders in Reported Fatal Incidents Involving Only One ATV, 2005–2007**

Driver’s Alcohol Use	Number of Riders		
	<i>One rider</i>	<i>Two riders</i>	<i>&gt;2 riders</i>
<i>Unknown</i>	30.9%	32.5%	34.0%
<i>Yes</i>	29.8%	25.5%	11.3%
<i>No</i>	39.3%	42.0%	54.7%
<b>Total</b>	<b>100.0% (n=1,632)</b>	<b>100.0% (n=419)</b>	<b>100.0% (n=53)</b>
$\chi^2$ p-value = 0.0201			

**Table 21** provides the comparison for the distribution of the hazard pattern for each category of the number of riders. This hazard pattern is identified in ATVD’s hazard pattern and is chosen based on an analyst’s professional judgment for what they determine to be the event in the sequence of events for an incident. It does not necessarily represent the first event in the sequence. As such, caution should be used in interpreting any results associated with hazard pattern. Note that the proportion of incidents for the hazard pattern of collision is smaller in the >2 rider category than in the two-rider category. In addition, note that when there are more than two riders, the proportion of incidents with the victim being thrown, falling, or jumping from the ATV is larger than in the other hazard pattern categories for the number of riders. There is a statistically significant association found between hazard pattern and number of riders (p-value < 0.0001).

**Table 21: Comparison (Column Percentage) of Hazard Pattern for One Rider, Two Riders, and More than Two Riders in Reported Fatal Incidents Involving Only One ATV, 2005–2007**

Hazard Pattern <sup>13</sup>	Number of Riders		
	One rider	Two riders	>2 riders
<i>Unknown</i>	7.5%	3.6%	1.9%
<i>Extreme terrain change</i>	18.0%	16.2%	18.9%
<i>Collision</i>	41.4%	52.3%	30.2%
<i>Victim thrown, fell, or jumped off ATV</i>	8.5%	10.3%	22.6%
<i>Other</i>	24.5%	17.7%	26.4%
<b>Total</b>	<b>100.0% (n=1,632)</b>	<b>100.0% (n=419)</b>	<b>100.0% (n=53)</b>
$\chi^2$ p-value < 0.0001			

**Figure 4** shows all comparisons graphically.

<sup>13</sup> The “Other” hazard pattern category has overturning events included within it, which accounts for most of the incidents in this hazard pattern category. This was done due to the ambiguity of the category, which occurs because this is not a sequence-of-events classification, but instead, a significant-event classification. For example, if the rider swerved in the road which lead to an overturning event, there is no hazard pattern category for the swerve, and the overturning event is the most significant even that can be coded.

Figure 4: Percentage of Incidents for Riding and Hazard Patterns for One Rider, Two Riders, and More than Two Riders, Involving Only One ATV, 2005–2007

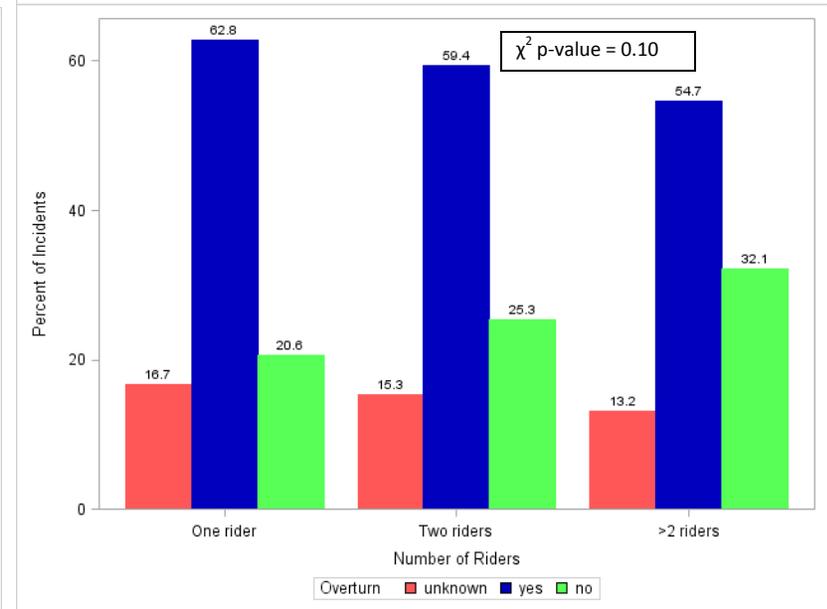
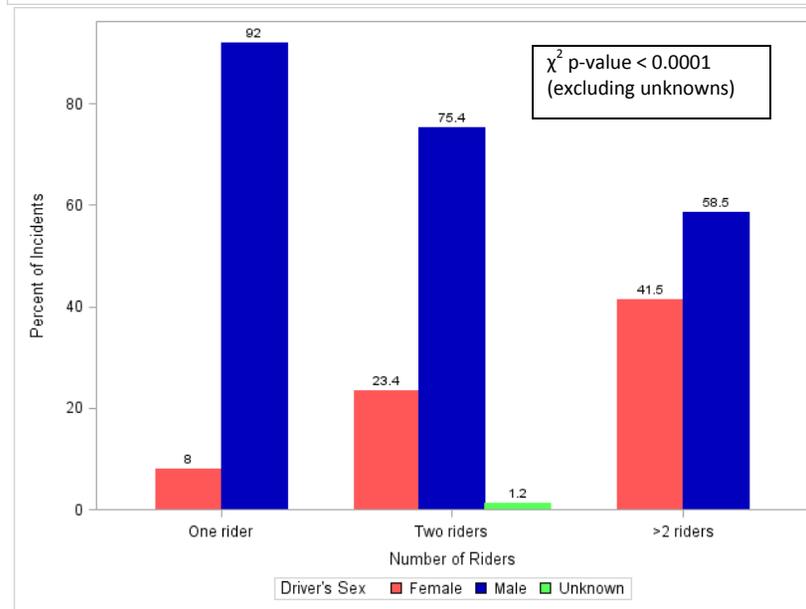
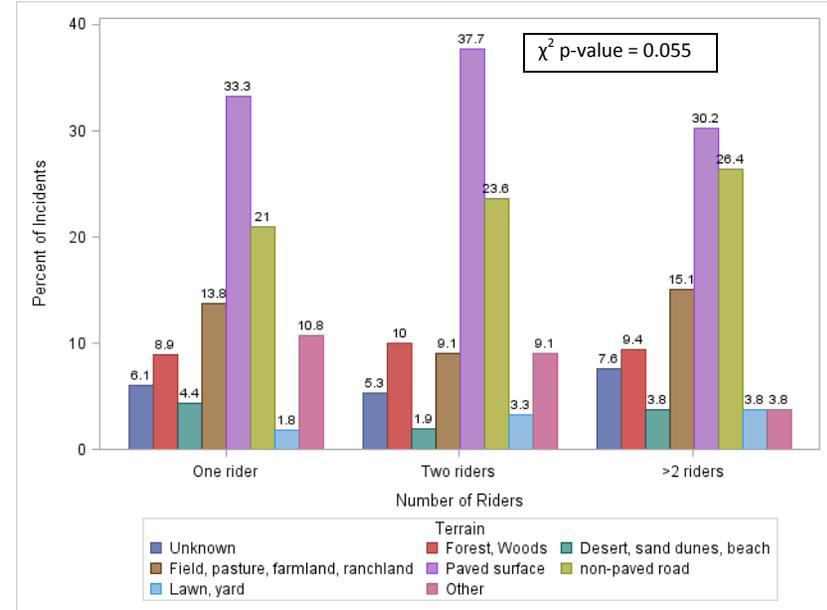
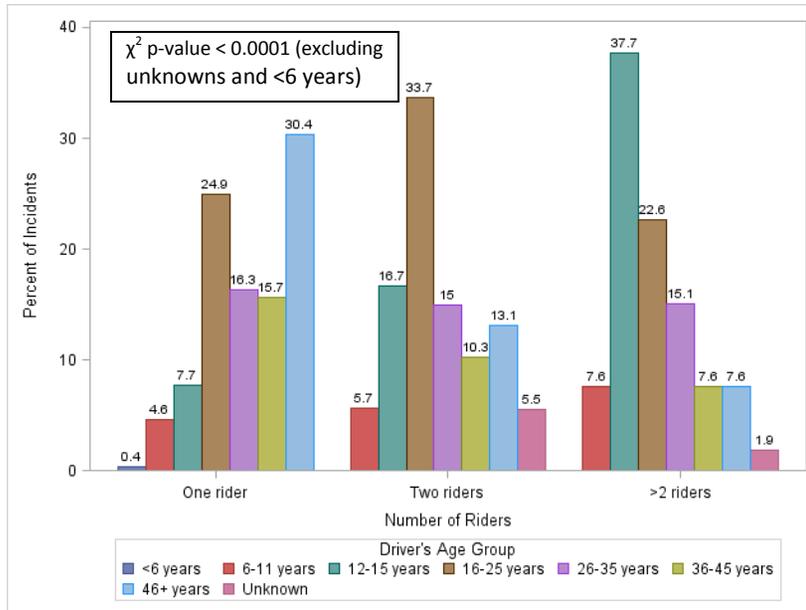
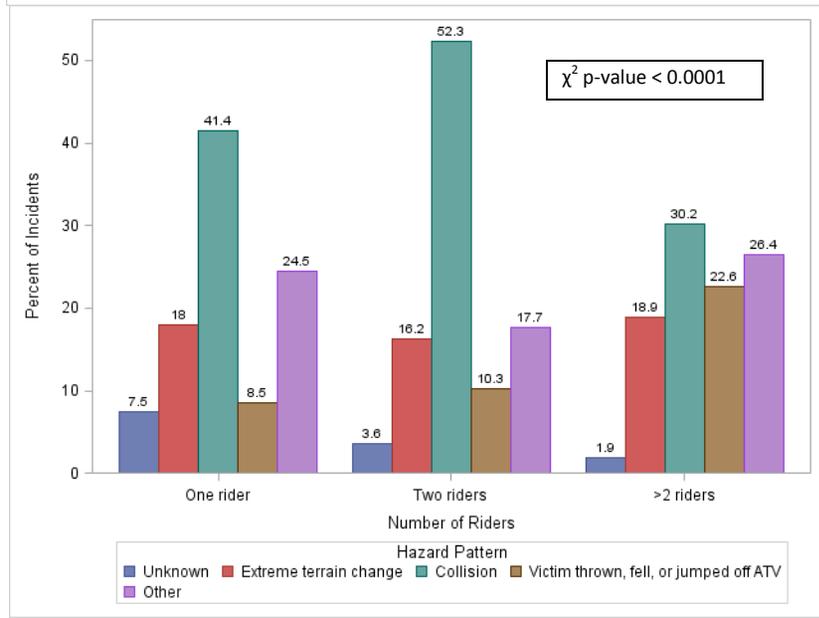
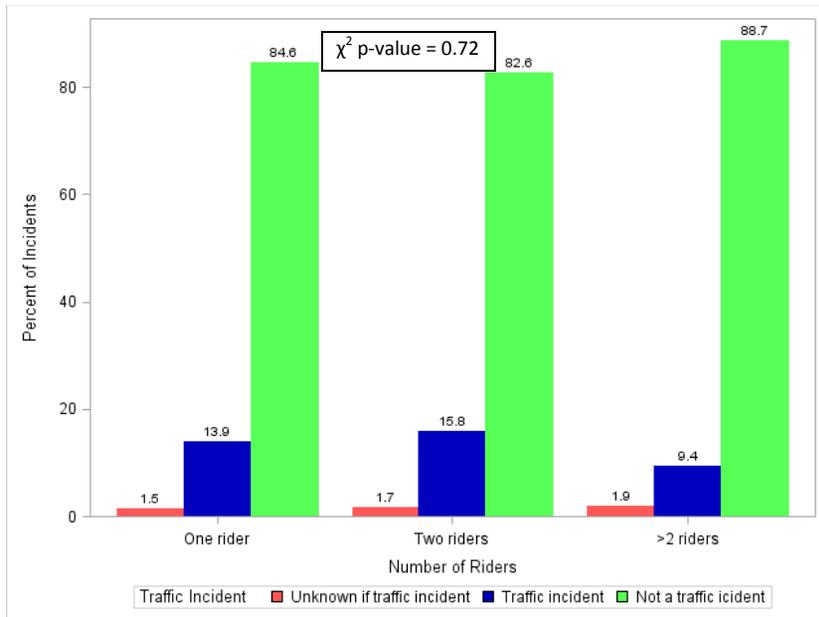
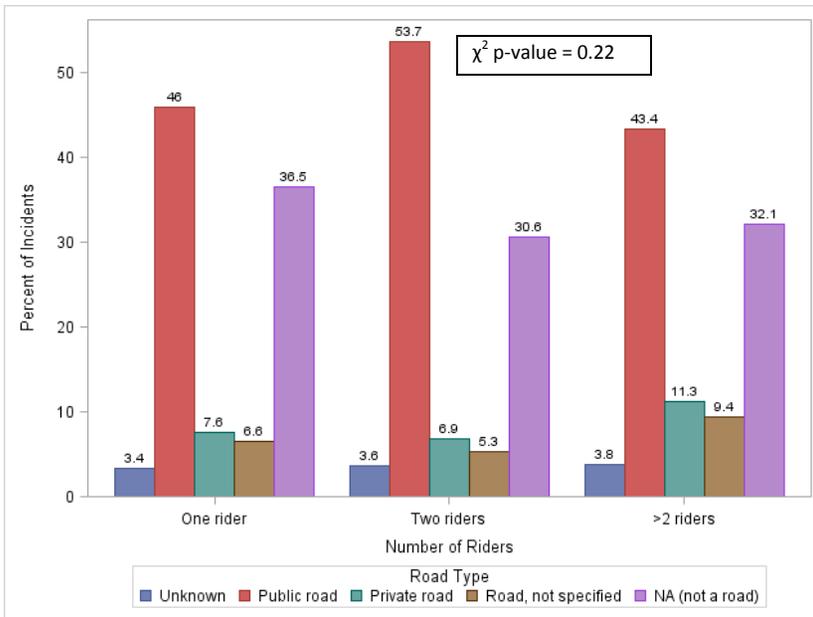


Figure 4 (Continued)



### Scenario 3: Two ATVs Involved and at Least One ATV Had More than One Rider (Least Common Scenario)

Only 25 of the 502 incidents were identified in ATVD where two or more ATVs were involved in a fatal incident, and at least one ATV had more than one rider. However, ATVD has a limitation in identifying this type of incident, because it records information about the number of riders on only one ATV. Thus, there may be other incidents that fit the scope of this section but could not be identified through querying ATVD. An example of a type of incident that cannot be identified is a fatality that was a solo rider on an ATV, and the incident involved a second ATV with more than one rider. The number of riders would be recorded only for the victim's ATV, which is one; the number of riders on the second ATV would not be recorded. Because of this limitation, for the identified incidents only the locations of the passengers are provided for who died, which can be identified in three scenarios for passengers involved. No further analysis is provided.

In the identified incidents involving two ATVs, where at least one ATV had two or more riders, there are three scenarios for passengers involved:

- (1) There were two ATVs involved in the incident; one ATV had two riders, and the second had only one rider. There were 13 incidents that fit this scenario.
- (2) There were two ATVs involved in the incident, and both ATVs had two riders. There were 10 incidents that fit this scenario.
- (3) There were two ATVs involved in the incident; one ATV had three riders, and the second ATV had one rider. There were two incidents that fit this scenario.

#### Scenario 3.1: Two ATVs (first ATV has two riders, second ATV has one rider)

**Table 22** summarizes incidents by who died in the incident and the location of the passenger, where the incident was identified as involving two ATVs, and one ATV had one passenger, while the second ATV had only a driver.

**Table 22: Number of Incidents for Who Died and the Passenger's Location for ATV 1 in Reported, ATV-Related Fatal Incidents Involving Two ATVs with ATV 1 Having Two Riders and ATV 2 Having One Rider, 2005-2007**

<b>Who Died</b>	<b>ATV 1: Passenger Location</b>	<b>Number of Incidents</b>
<i>Passenger 1: ATV 1</i>	<i>Back of ATV, exact location unknown</i>	1
	<i>Unknown</i>	3
	<i>Behind driver, on the seat</i>	2
<i>Driver: ATV 1</i>	<i>Behind driver, on the seat</i>	4
	<i>Unknown</i>	2
<i>Driver: ATV 1 and Driver: ATV 2</i>	<i>Behind driver, on the seat</i>	1
<b>Total</b>		<b>13</b>

Scenario 3.2: Two ATVs (first ATV has two riders, second ATV has two riders)

**Table 23** summarizes incidents by who died in the incident and the location of the passengers, where the incident was identified as involving two ATVs, and both ATVs had one passenger.

**Table 23: Number of Incidents for Who Died and the Passenger’s Location for ATV 1 and ATV 2 in Reported, ATV-Related Fatal Incidents Involving Two ATVs with ATV 1 Having Two Riders and ATV 2 Having Two Riders, 2005-2007**

<b>Who Died</b>	<b>ATV 1: Passenger Location</b>	<b>ATV 2: Passenger Location</b>	<b>Number of Incidents</b>
<i>ATV 1: Passenger</i>	<i>Behind driver, on the seat</i>	<i>Behind driver, on the seat</i>	4
	<i>Back of ATV, exact location unknown</i>	<i>Unknown</i>	1
<i>ATV 1: Driver</i>	<i>Behind driver, on the seat</i>	<i>Behind driver, on the seat</i>	4
	<i>Behind driver, on the seat</i>	<i>Unknown</i>	1
<b>Total</b>			<b>10</b>

Scenario 3.3: Two ATVs (first ATV has three riders, second ATV has one rider)

**Table 24** summarizes incidents by who died in the incident and the location of the passengers, where the incident was identified as involving two ATVs, with one ATV having two passengers and the second ATV having only a driver.

**Table 24: Number of Incidents for Who Died, Passenger 1’s Location, and the Passenger 2’s Location for ATV 1 in Reported, ATV-Related Fatal Incidents Involving Two ATVs with ATV 1 Having Three Riders and ATV 2 Having One Rider, 2005-2007**

<b>Who Died</b>	<b>ATV 1: Passenger 1 Location</b>	<b>ATV 1: Passenger 2 Location</b>	<b>Number of Incidents</b>
<i>ATV 1: Driver</i>	<i>Behind driver, on the seat</i>	<i>In front of the driver, on the seat</i>	1
	<i>Behind driver, on the seat</i>	<i>Back of ATV, exact location unknown</i>	1
<b>Total</b>			<b>2</b>

## Passengers in Emergency Department-Treated, ATV-Related Injuries

The data are limited about passengers in incidents resulting in injuries (no fatalities). However, to provide what is known currently about passengers in ATV-related incidents, this section summarizes results related to passengers from the 2010 National Electronic Surveillance System (NEISS) off-road vehicle special study.

In 2010, CPSC staff conducted a special study of emergency department-treated, ATV-related injuries through the NEISS. Through follow-up surveys about ATV-related injuries reported through the NEISS, additional information regarding the victim and incident characteristics was collected and analyzed. This study also analyzed the available data for ATV-related fatalities recorded in ATVD 2011. This study and the results are summarized in [1]. Part of the data collected and analyzed included some characteristics of passengers involved in the incidents. This section summarizes the available information on passengers in ATV-related injuries.

Because there are small sample sizes associated with more than one passenger and with the passenger being the injured party, there are few comparisons that can be made in studying injuries associated with passengers on ATVs. No further statistical analyses of injuries associated with passengers on ATVs is provided in this report.

**Tables 25–28** are excerpts from the full tables because these are the results pertained to passengers in the report on the NEISS special study. The full report is available for full review as [2].

In **Table 25**, an excerpt from Table 1 and 2 in [2], it can be noted that the majority of emergency department-treated injuries are to the driver of the ATV (76.5%), and most injuries are associated with only one rider on the ATV (68.5%). These results are similar to what is seen in the reported fatal ATV-related incidents.

**Table 25: Excerpt from Tables 1 and 2 in [2] for Passenger-Related Injury Statistics**

Characteristic	n	Estimate	Coefficient of Variation (CV) <sup>14</sup>	Percent of Total
<b>Total</b>	<b>523</b>	<b>71,800</b>	<b>0.12</b>	<b>100%</b>
Victim Location				
<i>Driver</i>	409	54,900	0.12	76.5
<i>Passenger</i>	114	16,900	0.18	23.5
Number of Passengers				
<i>1+ passengers</i>	157	22,600	0.19	31.5
<i>No passenger</i>	366	49,100	0.12	68.5

<sup>14</sup> The coefficient of variation (CV) is an expression of the standard deviation in relation to the estimate itself.

In **Table 26**, an excerpt from Table 7 in [2], an association was detected between the location of the victim and whether the ATV hit/landed on the victim. When the victim was the driver, a larger proportion of injuries are associated with the ATV hitting or landing on the driver than when the victim was the passenger.

**Table 26: Excerpt from Table 7 in [2] for Passenger-Related Injury Statistics and the “ATV hit/land on victim” Variable**

Characteristic	ATV hit/land on victim						Rao-Scott $\chi^2$ p-value (adjusted $\chi^2$ p-value)
	Yes			No			
	n	Estimate (CV)	Row %	n	Estimate (CV)	Row %	
<b>Total</b>	<b>181</b>	<b>26,500 (0.16)</b>	<b>36.9</b>	<b>342</b>	<b>45,300 (0.11)</b>	<b>63.1</b>	
Location of Victim							
<i>Driver</i>	154	21,800 (0.15)	39.7	255	33,100 (0.12)	60.3	0.0089
<i>Passenger</i>	27	4,700 (0.27)	27.8	87	12,200 (0.18)	72.2	(0.0355)

In **Table 27**, an excerpt from Table 6 in [2], the number of passengers and the victim’s location were found to be associated with helmet use. The proportion of estimated injuries associated with helmet use is larger when no passenger was present and when there was a passenger.

**Table 27: Excerpt from Table 6 in [2] for Passenger-Related Injury Statistics and the “Helmet Use” Variable**

Characteristic	Helmet Use						Rao-Scott $\chi^2$ p-value (adjusted $\chi^2$ p-value)
	Yes			No			
	n	Estimate (CV)	Row %	n	Estimate (CV)	Row %	
<b>Total</b>	<b>253</b>	<b>30,900 (0.14)</b>	<b>43.1</b>	<b>270</b>	<b>40,800 (0.15)</b>	<b>56.9</b>	
Number of Passengers							
<i>1+ passenger</i>	47	6,400 (0.21)	28.3	110	16,200 (0.23)	71.7	0.0001
<i>No passenger</i>	206	24,500 (0.15)	49.9	160	24,600 (0.14)	50.1	(0.0010)
Victim Location							
<i>Driver</i>	218	25,800 (0.15)	47.1	191	29,100 (0.14)	52.9	0.0021
<i>Passenger</i>	35	5,100 (0.22)	30.4	79	11,700 (0.22)	69.6	(0.0166)

In **Table 28**, an excerpt from Table 9 in [2], there was no association detected between the number of riders and whether the ATV overturned. This is the same result seen in reported, fatal ATV-related incidents.

**Table 28: Excerpt from Table 9 in [2] for Passenger-Related Injury Statistics and the “Overturn” Variable**

Characteristic	Overturn						Rao-Scott $\chi^2$ p-value (adjusted $\chi^2$ p-value)
	Yes			No			
	n	Estimate (CV)	Row %	n	Estimate (CV)	Row %	
<b>Total</b>	<b>309</b>	<b>43,300 (0.13)</b>	<b>60.3</b>	<b>214</b>	<b>28,500 (0.13)</b>	<b>39.7</b>	
Number of Passengers							
<i>1+ passenger</i>	86	13,700 (0.22)	60.3	71	9,000 (0.22)	39.7	0.9962
<i>No passenger</i>	223	29,600 (0.14)	60.3	143	19,500 (0.13)	39.7	(1.00)

## Conclusion

As a result of this study, new information about passengers in reported fatal, ATV-related incidents is known, and can be summarized as follows:

- Of the 2,454 reported ATV-related fatalities from 2005 through 2007, 536 (21.8 percent) involved an ATV with more than one rider.
- Of the 502 reported incidents where there was more than one rider on an ATV, most (83.5%) involved two riders and only one ATV.
  - A majority of passengers *may* be behind the driver on the seat, but this cannot be concluded absolutely from the data.
    - In 45.6 percent of incidents, the passenger was reported to be on the seat behind the driver.
    - In 29.6 percent of incidents, the location of the passenger was not reported.
    - In 68 incidents (16.2%), the passenger was behind the driver, but it is unknown whether the passenger was on the seat with the driver.
    - In 36 incidents (8.6%), the passenger on the back of the ATV but not on the seat, was in front of the driver, was held by the driver/on the driver's lap, in a passenger seat, or standing on the ATV.
  - The driver is most likely to be the fatally injured party in these incidents (52.7% of incidents). The driver and passenger both died in 7.4 percent of incidents.
  - There is a statistical association between the age of the driver and passenger, as well as the sex of the driver and passenger.
- In the small proportion of incidents with more than two riders (n=53):
  - Most were incidents involving three riders on an ATV (n=43).
    - A passenger is most likely to be the fatality injured rider, unlike the two-rider scenario.
    - The driver's age group is younger than seen in the two-rider scenario.
    - Three riders on the seat (multiple configurations) and unknown locations are most common in the incident scenarios.
      - In 16 incidents, the location for both passengers is unknown.
      - In 16 incidents, the passengers were on the seat with the driver (11 incidents had both passengers behind the driver, and five incidents had one passenger in front of the driver and one behind the driver).
      - In seven incidents, neither passenger was on the seat.
      - In one incident, one passenger was on the seat in front of the driver, and one passenger was held by driver or in the driver's lap.
      - One incident had a passenger in front of the driver, but it is unknown where the second passenger was located.
  - When the number of riders was four, five, or six, there were several different riding configurations, with passengers on and off of the seat, and several passengers with an unknown riding location.
- Overall, in fatal incidents:
  - The driver's age group is associated with carrying a passenger in reported fatal incidents.
  - The driver's sex is associated with carrying a passenger in reported fatal incidents.

- Although overturning remains the most significant hazard pattern in all ATV-related fatalities, overturning events are not more or less prevalent in multi-rider scenarios.
- The type of terrain and type of road in fatality incidents do not change when multiple riders are on the ATV.
- The proportion of traffic-related incidents does not change in multi-rider scenarios.

Although this study identified the relationship of age and sex in reported fatal incidents with multiple riders, it cannot be concluded from this analysis that a passenger not being present would prevent a fatality from occurring. The driver was most likely to be the fatally injured rider in this data set. It is possible, although it cannot be concluded from the data available, that the driver would have died instead of the passenger if the passenger had not been present, in incidents that resulted in a passenger's death. And because there was not enough evidence to show that hazard patterns changed across incidents with multiple riders, it is unknown what affect a passenger's absence would have on fatal, ATV-related incidents.

Further study of the incidents would be required to conclude that there would not still be a hazard if a passenger were removed from the situation. Data required to complete a full-scale study includes, but is not limited to:

- mechanism of driver and passenger injuries;
- disposition of all riders (injury severity);
- interactions between driver and passenger(s);
- weight of all riders;
- helmet use of all riders; and
- the sequence of events of the incident.

Note that if the additional data are collected, there may or may not be enough information to understand how a passenger's absence would affect fatal, ATV-related incidents. Currently, there is no evidence that the driver would not have died anyway, if no passenger was present in incidents where the driver died. There is no evidence that the driver of the ATV would not have been fatally injured had the passenger not been present, in incidents where the passenger was the fatality. The collection of this additional data is required to understand whether a passenger's absence could prevent a fatality. However, there is the distinct possibility, even if the additional data are collected, that little-to-no evidence will exist to show that the absence of a passenger would reduce the chance of a fatality.

The rate at which passengers are injured or killed is also unknown. That is, CPSC staff does not have current data demonstrating how often passengers ride on ATVs. This data can only be obtained through an exposure study. Knowledge of the rate of deaths and injuries for passengers enables staff to gauge the risk associated with riding as a passenger.

## Methodology

The variable that identifies the number of riders on the ATV (riders) in ATVD, which is CPSC's database containing all reported, ATV-related fatalities, was used to identify fatalities associated with more than one rider on the ATV [2]. An updated version of ATVD is released each year, containing all reported ATV-related fatalities received by CPSC staff through the end of the previous calendar year. At the time of this study, the most recent version of ATVD was ATVD 2011, which contains all reported, ATV-related fatalities received by CPSC staff through December 31, 2011. For the most recent years (2008–2011), reporting is considered to be ongoing, and CPSC staff will receive additional reports for deaths that occurred in these years, which will be added to ATVD and available in future releases of the database. Due to the ongoing reporting, analyzing records from the years of ongoing reporting is not analytically sound. To complete sound analyses, years where reporting is considered complete must be used. For this study, the years 2005–2007 were chosen because they are the three most recent years where reporting is considered complete. A three-year timeframe was chosen to ensure an accurate picture of reported ATV-related fatalities. A comparison of records was made for six years with completed reporting. Each of these six years, and the two groups of 3 years, were considered, and all comparisons indicated that the three years 2005, 2006, and 2007 were representative of all recent reported, ATV-related fatalities.

There are limitations to what this study can be said to represent, due to how and what data are collected. The records in ATVD are *reported* ATV-related fatalities, not all ATV-related fatalities, nor a statistical sample that can represent all ATV-related fatalities. However, reported fatalities are a large proportion of the estimated number of fatalities.<sup>15</sup> Based on professional judgment and experience, CPSC staff has some level of confidence that what is represented here covers a large proportion of all ATV-related fatalities, but this cannot be determined statistically. This is true of any analysis completed from ATVD.

Specific to this study, there is a limitation in which records can be identified as in scope through the data recorded in the ATVD. The data for this study were pulled from ATVD based on values coded in ATVD for the number of riders on the ATV at the time of the incident. If there were multiple ATVs involved, the driver on one ATV, being the fatality and that driver was alone on that ATV, and there were multiple riders on a second ATV (none of which were killed), this would not be a fatality that could be identified in a data pull looking at multiple-rider incidents. These types of records are not common, and no substantial results or conclusions are expected to change if this additional data were identifiable.

To complete this study, data that are not available in ATVD were of interest. To obtain the needed data for this study, fatalities occurring from 2005 through 2007, were pulled from ATVD, if the "rider's" variable indicated that there was at least one passenger on the ATV at the time of the incident. Note that each record in ATVD is a fatality, not an incident. Thus, there can be multiple records associated with a single incident, if more than one person died in the incident. For this study, the number of incidents was of interest, not the number of fatalities; so duplicate records of a single incident were removed. Additional variables were coded by the analyst for each record: driver's age (for each driver associated with the incident), driver's sex (for each driver), whether the driver died, passenger's age (for every passenger on the ATV(s)), passenger's sex (for every passenger), passenger's location on the ATV (for every passenger), the number of riders for each ATV involved, the number of ATVs involved, and any

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<sup>15</sup> <http://www.cpsc.gov/en/Media/Documents/Research--Statistics/Injury-Statistics/Sports/ATV/2012-Annual-Report-of-ATV-Related-Deaths-and-Injuries/>

notes the analyst recorded. Some of the data are also recorded in ATVD, which was used to quality check the data recorded for this study. Some coding conventions were necessary:

- The passenger location recorded as “Behind driver” and “Behind driver and passenger” indicates the person was on the seat in the specified location.
- If the description of the passenger’s location is “rear” or “back” of ATV—“back of ATV, exact location unknown” was coded, unless other descriptors are available, such as “holding driver’s waist.”
- Incidents with the passenger described as a “motorcycle passenger” were coded as “behind driver,” which assumes that the passenger was on the seat behind the driver.
- If a passenger is described as riding double with driver, then “Behind driver” was coded. Thus, it was assumed the passenger was immediately behind the driver on the seat.
- There were 10 incidents where it is unknown exactly who was driving. Whenever possible, the coding followed how state police coded the driver/passenger (n=3). When police coding was unavailable, the younger victim was coded as the passenger (n=5). In one incident, no police report was available, but a description of who was driving was available in a news article, coding followed the news article’s description. In one incident, it is unknown who died (driver or passenger), and the ages of the riders are unknown, the driver was coded as the fatality in this incident.
- Incidents where the passenger was in a passenger seat, whether on a tandem ATV or an after-market passenger seat, were coded as “passenger seat.” It was often not possible to determine what type of seat (tandem ATV seat or after-market passenger seat).

The variables recorded for this study specifically were combined with the data about the incident available in ATVD. Also identified in ATVD were incidents involving one ATV with one rider, where that rider was the fatality. All of this data were combined to create the full dataset for the analysis results provided in this report. A variable indicating the number of riders (one rider, two riders, >2 riders) was created to categorize each incidents. Riding and hazard patterns were compared across each of the three categories for the number of riders. A chi-square test was used to test for differences across the number of riders groups for each riding and hazard pattern analyzed. The p-values for the test are provided in the report. The level of significance was set at 0.05. No p-values were corrected for multiple comparisons; however, if the p-values were adjusted for multiple comparisons, no conclusions would change. If necessary, categories with little or no observations were removed from the chi-square test, for the needed number of expected values to be greater than five to obtain a valid chi-square test. Anytime this was necessary, it is noted with the results of the chi-square test.

## Works Cited

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