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National Estimates of Victim, Driver, and Incident Characteristics for ATV-Related, Emergency Department-Treated Injuries in the United States from January 2010–August 2010 with an Analysis of Victim, Driver and Incident Characteristics for ATV-Related Fatalities from 2005 through 2007

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Executive Summary

CPSC staff implemented a NEISS special study in 2010, to collect data on all-terrain vehicle (ATV) and utility vehicle (UTV) emergency department-treated injuries. CPSC staff developed a telephone-based survey to follow up on injuries associated with ATVs and UTVs, gaining additional information on the type of vehicle involved, victim and driver characteristics, and the incident scenarios. CPSC staff attempted to follow up on all injuries recorded in the NEISS database involving an ATV or UTV that occurred between January 1, 2010 and August 31, 2010. Of these, ATV-related injuries where the victim was the driver or a passenger of an operational ATV were considered in scope for this report.

The CPSC's All-Terrain Vehicle Deaths database (ATVD) contains all ATV-related fatalities reported to CPSC staff since the early 1980s. The version used for this study is ATVD 2011, which contains all deaths reported to CPSC staff through December 31, 2011. The 3 years chosen for this study were 2005−2007. Victims that were drivers or passengers of operational ATVs were considered in scope for this analysis.

The following highlights the results of the injury and fatality analyses that are detailed fully in this report.

ATV-Related, Emergency Department-Treated Injuries (January 2010−August 2010)

The total estimated number of non-occupational, operational ATV-related, emergency department-treated injuries to drivers or passengers of ATVs between January 1, 2010 and August 31, 2010 is 71,800. Extrapolated annually, the estimated number of non-occupational, operational ATV-related, emergency department-treated injuries to drivers or passengers of ATVs for 2010 is 101,000.

Total Estimated Injuries 71,800		
Selected Characteristic	% of Estimated Injuries	Location of Full Analysis
≤35 years of age	76.7%	Table 1 (extracted from age group analysis)
Males	69.4%	Table 1 (extracted from sex analysis)
Extremities Injuries	38.7%	Table 1 (extracted from body part injured analysis)
Torso Injuries	34.1%	
Head Injuries	27.2%	
Contusion/Abrasion	27.5%	Table 1 (extracted from diagnosis analysis)
Fracture	23.2%	
Driver was the victim	76.5%	Table 1 (extracted from victim location analysis)
No helmet	56.9%	Table 1 (extracted from helmet use analysis)
One rider (no passenger)	68.5%	Table 2 (extracted from number of passengers analysis)
Dry terrain	80.8%	Table 2 (extracted from terrain condition analysis)
Dirt	39.3%	Table 2 (extracted from terrain analysis)
Grass	25.5%	
Pavement	11.6%	
ATV Overturned	60.3%	Table 2 (extracted from overturning event analysis)
Driver ≤35 years of age	74.6%	Table 3 (extracted from driver age group analysis)
Driver <16 years of age	20.9%	
5+ years of driving experience	49.6%	Table 3 (extracted from driver experience analysis)
4 wheels	97.1%	Table 4 (extracted from number of wheels analysis)
Recreational Use	88.9%	Table 4 (extracted from use analysis)
Aftermarket modification	7.4%	Table 4 (extracted from ATV modifications analysis)

- Helmet Use and Associated Injuries (Tables 5)
    - There is a statistically significant relationship between helmet use and the most severely injured body part (p-value=0.0004), indicating that head injuries were more likely for injured riders not wearing a helmet.
        - When the head is the body part associated with the injury, the proportion of injured riders without a helmet is much higher than injured riders wearing a helmet (72.9% and 27.1%, respectively). This is different from the helmet use for riders with injuries to the extremities and the torso, which have fairly even distributions for helmet use or not. Of the estimated 30,900 injuries for those wearing a helmet, the most severely injured parts of the body were the extremities (49.0%).

- Variables Associated with Helmet Use (Table 6)
    - The only two characteristics found to have a statistically significant association with helmet use in injuries were the number of passengers on the ATV and the location of the victim on the ATV (p-value=0.0010 and 0.0166, respectively).
        - When there was at least one passenger (in addition to the driver), 71.7 percent of the injuries were to those without helmets versus 50.1 percent when only the driver was present on the ATV. For passengers injured, 69.6 percent were without helmets, while 52.9 percent of driver victims were not wearing helmets.
        - This indicates that having multiple people on the ATV reduced the likelihood of helmet use when an injury is involved, and an injured passenger was less likely to be wearing a helmet.

- Characterization of Overturn Events for Injuries (Tables 8-9)
    - A statistically significant association was found between the body part injured and overturning events (p-value=0.0076).
        - For overturning events, the most often injured body part is the torso (41.7%), while the extremities were the most commonly injured body part in non-overturning incidents (45.1%). For injuries to the torso, 73.8 percent were associated with an overturning event, while 52.9 percent of head injuries were associated with overturning events.
    - For driver and incident characteristics reported by overturning events, only slope and driver's weight show a statistically significant relationship between estimated injuries for overturning events (p-value < 0.0001 and 0.0235, respectively). Speed, number of passengers, terrain, terrain condition, driver's age group, and driver's experience did not exhibit a correlation with overturning events.
        - For the estimated overturning events, 43.4 percent of estimated injuries occurred on flat terrain; 52.9 percent on a slope, either gentle or steep. Slope does play a part in overturning events because it is more likely that an overturning event will occur as slope increases. However, slope does not explain fully overturning events because 50.5 percent of injuries on flat terrain involved an overturning event.
        - As the driver's weight increases, so does the proportion of overturning events. For the weight category <100 pounds (lbs.), 36.8 percent of the estimated injuries were related to an overturning event; for the 150−199 lbs. and 200-lb.+ categories, 66.1 percent and 65.5 percent, respectively, of the estimated injuries were related to overturning events.

Comparison of ATV-Related Injuries to All Consumer Product-Related Injuries

There are an estimated 9,814,600 consumer product-related, emergency department-treated injuries that are not in the scope of this study and that were treated between January 1, 2010 and August 31, 2010. A comparison of all consumer product-related injuries to ATV-related injuries was performed across several characteristics, including age group, sex, body part injured, diagnosis, and disposition.

- The distribution of age, sex, body part, and diagnosis were statistically significantly different for ATV-related injuries than for all other consumer product-related injuries (all p-values<0.0001).
    - The majority of injuries from the ATV study were sustained by victims younger than age 35; while for all consumer products, the majority of injuries were to those younger than 16 and ≥46 years old.
    - In this study, most injuries were associated with males (69.4%), while 53.9 percent of all consumer product-related injuries were associated overall with males.
    - This study shows there were similar proportions (34.1% for the torso, 38.5 for the extremities, and 27.4% for the head) of injuries to each of the body part categories for ATV-related injuries, while all consumer product-related injury estimates show the largest proportions of injuries were to the extremities (50.7%), followed by the head (29.5%), and then the torso (19.8%). This shows that torso injuries present a larger hazard with ATV-related injuries than consumer products in general.
    - A majority of injuries (50.7%) in this study were diagnosed as contusions/abrasions, or fractures, while for all consumer product-related injuries there is a fairly even distribution across all diagnoses, with the exception of internal injuries.

ATV-Related Fatalities (2005−2007)

A total of 2,321 reported ATV-related fatalities from 2005 through 2007, where the victim was a driver or passenger of an operational ATV, were analyzed in this study. The reported fatalities do not represent a statistical sample. Thus, results and conclusions drawn from the analysis of ATV-related fatalities should only be considered for those reported, and by definition, cannot be generalized to all ATV-related fatalities.

2005−2007 Reported Fatalities 2,321		
Selected Characteristic	% of Reported Fatalities	Location of Full Analysis
16−25 years of age	26.8%	Table 13 (extracted from victim age group analysis)
≥46 years of age	25.6%	
Male	85.8%	Table 13 (extracted from victim sex analysis)
Driver was the victim	89.3%	Table 13 (extracted from victim location analysis)
No helmet	66.0%	Table 13 (extracted from helmet analysis)
Head	41.3%	Table 13 (extracted from Body part/mechanism with cause of death analysis)
ATV overturned	60.6%	Table 14 (extracted from overturn analysis)
One rider (no passenger)	72.8%	Table 14 (extracted from number of riders analysis)
Paved road	34.4%	Table 14 (extracted from terrain analysis)
Non-paved road	20.6%	
Field	12.3%	
4 wheels	89.6%	Table 15 (extracted from number of wheels analysis)
Unknown number of wheels	7.2%	

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Section I: Introduction

The U.S. Consumer Product Safety Commission (CPSC, Commission) reports annually the estimated number of all-terrain vehicle (ATV)-related, emergency department-treated injuries in the United States. Considering recent data, the estimated number of U.S. emergency department-treated injuries increased from 2001 through 2007, then declined through 2011, when there were an estimated 107,500 injuries, of which an estimated 29,000 injuries were to children younger than 16 years old [1]. However, because these estimates are derived from the National Electronic Injury Surveillance System (NEISS), there is limited information about the specific scenarios surrounding the injuries.[1] This study aimed to "fill in the blanks" about victim and incident characteristics for the national estimates of ATV-related emergency department-treated injuries in the United States.

Furthermore, because victim and incident characteristics associated with ATV-related, emergency department-treated injuries may differ from the characteristics of ATV-related deaths, a parallel analysis was performed to identify the characteristics of reported ATV-related fatalities. Using the CPSC's 2011 All-Terrain Vehicle Deaths (ATVD 2011) database,[2] fatalities from 2005 through 2007 were analyzed to determine victim, driver, and incident characteristics.

The national ATV-related, emergency department-treated injury estimates and comparisons associated with victim, incident, and driver characteristics are described in detail in Section III. Results of this analysis are provided in Section IV. A discussion of the comparison of the results between the injury study and the fatality study is provided in Section V.

Section II: Background

II.A: Injuries

NEISS is a national stratified probability sample of hospitals in the United States and its territories. NEISS has five strata: children's hospitals, small hospitals, medium hospitals, large hospitals, and very large hospitals. For each hospital within each stratum, information about every emergency department visit that is associated with a consumer product is captured in a record in the NEISS sample. To help calculate injury estimates associated with a product or product group, each record has a product code that identifies the type of product involved. For example, ATVs are identified by three codes: 3285 (3-wheel ATV), 3286 (4-wheel ATV), 3287 (ATV, unknown number of wheels), and 5044 (utility vehicle).

A NEISS special study was implemented in 2010, to collect data on ATV and utility vehicle (UTV) emergency department-treated injuries. CPSC staff developed a telephone-based survey to follow up on injuries associated with ATVs and UTVs to gain additional information on the type of vehicle involved related to each recorded injury, demographic, and other characteristics of the victim and driver involved

[1] For information regarding the data available in the NEISS, see [10].
[2] ATVD 2011 consists of ATV-related fatalities reported to CPSC staff from January 1, 1982 through December 31, 2011. The years 2008–2011 are considered years where reporting is ongoing; that is, CPSC staff expects to receive additional reports for these years, which will be part of future releases of the database. The years 2005 through 2007 were selected for this study because they are the most recent years when reporting is considered complete.

(note: the driver and the victim were often the same individual), and the incident scenarios. CPSC staff initiated a follow-up survey on all injuries recorded in the NEISS database involving an ATV or UTV that occurred between January 1, 2010 and August 31, 2010.

The total number of completed surveys is 668. However, the total number of completed surveys considered in scope for this study is 523,[3] resulting in an estimated 71,800 ATV-related, emergency department-treated injuries treated nationwide from January 1, 2010, to August 31, 2010, where the injured party was a driver of or a passenger on an ATV in operation at the time of the incident (*i.e.,* an operational ATV). Another 145 completed surveys were considered not-in-scope for this study for various reasons, such as no ATV involvement, the victim was a bystander, or the ATV was not being operated at the time of the incident.

II.B: Fatalities

The CPSC's All-Terrain Vehicle Deaths database (ATVD) contains all ATV-related fatalities reported to CPSC staff since the early 1980s. Nearly all ATV-related fatal incidents are investigated by CPSC field staff, where field staff attempts to collect additional reports and information about each fatality. Additional reports collected include police reports, medical examiner reports, and/or medical records. Each year the ATVD is updated with an additional year of data collected by CPSC staff. The version used for this study is ATVD 2011, which contains all deaths reported to CPSC staff from January 1, 1982 through December 31, 2011. Notably, the years 2008 through 2011 are considered years where reporting is ongoing, and CPSC staff expects to receive more reports of fatalities for those years. As a result, these 4 years were not included in the special study.

Because using all fatality data from the 1980s forward may not provide a picture of the hazard patterns occurring now, *i.e.*, because hazard patterns may not have stayed the same from the 1980s to the present, only recent years were chosen for this analysis. Because the years of ongoing reporting also may not provide a full picture of the hazard patterns, due to geographic areas or other demographics not being reported yet, the 3 years chosen for this study were 2005−2007. These are the three most recent years where reporting is considered complete. CPSC staff notes that the hazard patterns, victim characteristics, and driver characteristics appear to be similar in each of the 3 years; thus, CPSC staff believes that these 3 years are representative of the characteristics of recent ATV-related fatalities reported to CPSC staff. Only fatalities where the victim was a driver or passenger of an operational ATV were considered in scope for this analysis. Excluded fatalities were those that did not fit the scope of this study for various reasons, such as the victim was a bystander.

Section III: NEISS Special Study Results for ATV-Related Injuries

III.A: Introduction

This section summarizes the results of the analysis of the follow-up surveys for ATV-related injuries reported through the NEISS. The surveys were weighted based on the NEISS and adjusted based on the structure of the NEISS and the response to this study.[4] All estimates provided in this section are the

[3] See the Methodology section for response rates.
[4] For further details on analysis methodology, see the Methodology section.

estimated number of U.S. emergency department-treated injuries associated with a non-occupational, operational ATVs occurring between January 1, 2010 and August 31, 2010.

The total estimated ATV-related, emergency department-treated injuries for all of 2010 is 115,000. [1] The partial year estimate for the study period (January 1, 2010 through August 31, 2010) is 81,800 (71.1% of the total estimated injuries in 2010; 81,800/115,000). Of the 81,800 total estimated injuries for the study's time period, an estimated 71,800 injuries are considered in scope for this study. To gauge what proportion of injuries are considered in-scope for the full year of 2010 is to extrapolate the full year estimate for 2010 by dividing by 0.711. This gives a rounded estimated of 101,000 estimated injuries (115,000/0.711) considered in scope in this study for all of 2010. This factor can be applied to any partial year estimate provided in this report.

III.B: Results

III.B.1 Victim Demographics, Injury Disposition and Injury Diagnosis (Table 1)

Table 1 summarizes the victim characteristics, including characteristics that are recorded in the NEISS, such as age group and sex; the table also provides characteristics from the study that are specific to ATVs, such as helmet use and location of the victim on the ATV. There were five age groups defined for this study: Younger than 16, 16–25, 26–35, 36–45, and older than 46. Whenever possible, all the defined age groups are used. However, some comparisons provided later in this report required collapsing these age groups into two categories: younger than 16 and 16 or older. Other measurement categories were collapsed, based on the ability of the staff to generate reliable estimates from data.

The younger age groups constituted a majority (76.7%) of the estimated injuries (<16: 18,500; 16–25: 19,200; 26–35: 17,400). Males accounted for the largest proportion of the estimated injuries with 49,800 of the total 71,800 estimated injuries (69.4%). The majority of victims were non-Hispanic (63,500; 88.5%). For the race designations, "white" accounted for the largest injury estimate at 64,200 (89.5%). Most injuries were to the driver of the ATV (54,900; 76.5%), and 36.9 percent of injuries (26,500) involved the ATV hitting or landing on the victim. The majority of injuries were associated with the victim being treated and released from the emergency room (62,800; 87.5%). The most frequently-occurring diagnoses were contusions/abrasions and fractures (27.5% and 23.2%, respectively).

The variable called "body part" was developed from the body part recorded in NEISS, which captures the most severely injured body part. For this study, the NEISS body-part variable was collapsed into three categories: torso (anything between the neck and the legs, excluding extremities); extremities (shoulder, arms, hands, fingers, legs, feet, and toes); and head (head, face, and neck). The extremities were the most often injured body part (27,800; 38.7%). However, head and torso injuries showed similar results (19,500; 27.2% and 24,400; 34.1%, respectively).

The majority of injuries were associated with victims who were not wearing a helmet (40,800; 56.9%).

Table 1: ATV-Related Estimated Emergency Department-Treated Injuries by Victim Characteristics, January 2010–August 2010

Victim Characteristic	n	Estimate[5]	Coefficient of Variation (CV)[6]	Percent of Total
Total	**523**	**71,800**	**0.12**	**100%**
Victim Age Group*				
<16	169	18,500	0.16	25.8
16-25	122	19,200	0.17	26.7
26-35	109	17,400	0.17	24.2
36-45	57	8,700	0.20	12.1
≥46	66	8,000	0.18	11.2
Victim Sex*				
Female	143	22,000	0.15	30.6
Male	380	49,800	0.12	69.4
Victim Ethnicity				
Hispanic/Latino	60	8,300	0.22	11.5
Not Hispanic/Latino	463	63,500	0.12	88.5
Victim Race				
White	468	64,200	0.13	89.5
Other/Unknown	55	7,600	0.22	10.5
Victim Location				
Driver	409	54,900	0.12	76.5
Passenger	114	16,900	0.18	23.5
Victim Helmet Use				
Yes	253	30,900	0.14	43.1
No	270	40,800	0.15	56.9
ATV hit/land on victim				
Yes	181	26,500	0.16	36.9
No	342	45,300	0.11	63.1
Disposition*				
Treated and Released	446	62,800	0.12	87.5
Other	77	8,900	0.21	12.5
Diagnosis*				
Contusions/Abrasions	131	19,800	0.16	27.5
Fracture	131	16,600	0.13	23.2
Laceration	55	7,600	0.18	10.6
Internal Injury	74	9,100	0.17	12.7
Strain/Sprain	75	10,700	0.15	14.9
Other	57	7,900	0.19	11.0
Body Part*				
Torso	169	24,400	0.15	34.1
Extremities	210	27,800	0.14	38.7
Head	144	19,500	0.15	27.2

*Indicates data recorded in NEISS, not provided by the respondents of the survey.

[5] Extrapolation of any estimate in this report to the full year of 2010 can be completed by dividing by 0.711. See Section III.A for details.

[6] The coefficient of variation (CV) is an expression of the standard deviation in relation to the estimate itself.

III.B.2 Incident Characteristics: Initiating Event, Location, Speed, Terrain, and Passengers (Table 2)

Table 2 breaks down injury estimates for the study time period by the characteristics of the incident leading to the emergency department-treated injury. The special study survey asked about the initiating event in the respondents' opinion. Twenty-eight percent (20,100) of the estimated injuries were associated with an initiating event of collision.[7] The remaining initiating events included making a turn, failing to turn, overturning, striking a hole or bump, slope, and other. The majority of the estimated injuries were associated with only one rider; that is, in 68.5% of injuries (49,100), only a driver was on the ATV, no passengers. The condition of the terrain was dry for a majority of injuries (58,000; 80.8%).

When considering the reported speed of the ATV at the time of the incident, more estimated injuries fell into the category of less than 10 miles per hour (26,200; 36.5%), than the 10–19 mph category (14,400; 20.1%) or the ≥20 mph category (18,500; 25.8%). Note that 17.7 percent of injuries were associated with an unknown speed. This analysis does not consider any possible over/underestimation of speed by the respondents. The results provided in this study are estimates based on the responses obtained and should be interpreted as such.

The majority of estimated injuries were related to two types of terrain: dirt and grass (28,200; 39.3% and 18,300; 25.5%, respectively). The remaining estimated injuries fell into the terrain types of pavement, gravel, sand, other, and unknown. Only 11.6 percent of estimated injuries were related to the ATV being ridden on pavement. Additionally, note that in later analyses, the "Sand," "Other," and "Unknown" categories of the terrain variable were collapsed to facilitate comparisons between other variables and terrain. The majority of the estimated injuries occurred in a field, woods, or yard (14,500, 20.1%; 14,400, 20.0%; and 11,500, 16.1%, respectively). A little more than half of the estimated injuries occurred on flat terrain (37,200; 51.9%).

Terrain and incident location are related variables detailing where the incident occurred. Terrain considers the type of surface where the incident took place, while incident location considers the general locale of the incident. Both variables include a response involving pavement, and the results are not a perfect match. This is due to the differences in the nature of the questions. If the terrain indicates pavement as the surface type, the location of the incident could be in a park, leading to a response "off-highway vehicle park" for the incident location. In the incident location, "paved surface" is a category made up of two responses from the survey: "Paved road" and "Paved surface that is not a road, like a driveway or a parking lot." The majority of these two categories fell into the "Paved road" category (71.9% of these two categories fell into the "Paved road" category). These categories were collapsed to facilitate meaningful estimates and comparisons for incident location.

A majority of injuries were associated with an overturning event of the ATV (43,300; 60.3%).

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[7] Estimates for the "initial event" of incidents are determined based on what respondents in the survey opined was the initiating event of the incident that lead to the injury, *i.e.*, the results provided in this study are estimates based on the responses obtained in the survey and should be interpreted as such.

Table 2: ATV-Related Estimated Emergency Department-Treated Injuries Associated with Incident Characteristics, January 2010–August 2010

Incident Characteristic	n	Estimate	CV of Estimate	Percent of Total
Total	**523**	**71,800**	**0.12**	**100%**
Initial Event				
Collision	162	20,100	0.14	28.0
Making a turn	80	11,600	0.16	16.2
Failed to turn	17	2,700	0.28	3.8
Overturn	82	10,900	0.19	15.2
Hole/Bump	36	5,000	0.23	7.0
Slope	36	5,000	0.24	6.9
Other	110	16,400	0.16	22.9
Number of Passengers				
1+ passengers	157	22,600	0.19	31.5
No passenger	366	49,100	0.12	68.5
Terrain				
Pavement†	64	8,300	0.20	11.6
Gravel	47	5,700	0.23	7.9
Dirt	196	28,200	0.16	39.3
Sand	21	3,600	0.28	5.0
Grass	134	18,300	0.15	25.5
Other	36	4,500	0.22	6.2
Unknown	25	3,200	0.32	4.5
Incident Location				
*Paved Surface**	57	7,500	0.19	10.4
Non-paved Road	66	9,900	0.22	13.8
Field	103	14,500	0.14	20.1
Yard	91	11,500	0.13	16.1
Woods	108	14,400	0.20	20.0
Off-highway Vehicle Park	40	5,200	0.20	7.3
Other	58	8,800	0.17	12.2
Reported Speed				
<10 mph	185	26,200	0.16	36.5
10-19 mph	112	14,400	0.16	20.1
≥20 mph	139	18,500	0.15	25.8
Unknown	87	12,700	0.17	17.7
Terrain Condition				
Dry	419	58,000	0.12	80.8
Wet	64	8,400	0.18	11.6
Other	24	3,400	0.29	4.7
Unknown	16	2,100	0.34	2.9
Slope				
Flat	284	37,200	0.11	51.9
Gentle	135	18,900	0.17	26.4
Steep	78	11,700	0.18	16.4
Unknown	26	3,900	0.25	5.4
Overturning Event				
Yes	309	43,300	0.13	60.3
No	214	28,500	0.13	39.7

*Most of the paved surface estimate is related to paved roads (72.6%). The remaining portion (27.4%) of the paved surface category is non-road paved surfaces, *e.g.*, driveways.

† See page 11 for additional details on the difference in "pavement" in the terrain variable, and "paved surface" in the incident location variable.

III.B.3 Driver Demographics and Characteristics (Table 3)

Table 3 summarizes the estimated injuries associated with different characteristics of the drivers involved in the incidents, regardless of who was injured. Similar to the distribution of victim's age group, the driver's age group distribution shows that a majority of the estimated injuries were to younger age groups (74.6% were 35 years old or younger), where 20.9 percent of all estimated injuries were with a driver younger than 16 years old (15,000). This distribution being similar to the victim age distribution is not surprising, given that 76.5 percent of estimated injuries were to the driver of the ATV (see **Table 1**). Similarly, the majority of injuries were associated with male drivers (55,400; 77.2%).

The driver owned the ATV involved in an estimated 33,300 injuries (46.5%). Of the remaining estimated injuries in which the ATV was not owned by the driver, the ATV was borrowed for an estimated 18,600 injuries (26.0%) and parent-owned for an estimated 12,100 injuries (17.0%). The remaining estimated injuries fell into the category of "the driver did not own the ATV." However, part of this estimate could have fallen into the "borrowed" or "parent-owned" categories, but further details were unavailable to make this determination.

Experience of the driver was asked in two separate survey questions. The first question asked about the number of years of experience on any type of off-road vehicles, and the second question regarding experience probed specifically about ATVs. Focusing on the years of experience specific to ATVs, the largest proportion of injuries is associated with a driver with more than 5 years of experience (35,600 injuries; 49.6 %). This does not account for the number of drivers in the population who have that amount of experience. Any conclusions based on this information would be more applicable if exposure was known. Of the total estimated 71,800 injuries, only 2.5 percent of drivers (1,800 injuries) reportedly learned to drive an ATV by taking a training course. In comparison, a 2001 national study on ATV use reported that 7 percent of all ATV drivers received training from an organized program, salesperson, or dealer [2]. In a similar 1997 study, this was estimated at 23 percent (11% from a training course, 12% from a dealer or sales person). The 1997 exposure study reported "about 4% of drivers involved in injury incidents reported formal ATV training or training by a dealer or sales person." [3] The majority of the injuries in the 2010 study were related to a driver who learned from a friend or relative how to drive the ATV (41,700; 58.1%).

Table 3: ATV-Related Estimated Emergency Department-Treated Injuries Associated with Driver Characteristics January 2010–August 2010

Driver Characteristic	n	Estimate	CV of Estimate	Percent of Total
Total	**523**	**71,800**	**0.12**	**100%**
Driver Age Group				
Less than 16	143	15,000	0.14	20.9
16-25	128	20,200	0.17	28.2
26-35	116	18,300	0.17	25.5
36-45	62	9,000	0.19	12.5
≥46	74	9,200	0.18	12.9
Driver Sex				
Male	416	55,400	0.10	77.2
Female	107	16,400	0.14	22.8
Driver Training				
Course	14	1,800	0.33	2.5
Friend/Relative	313	41,700	0.13	58.1
Self-taught	162	24,100	0.16	33.5
Other/Unknown	34	4,200	0.24	5.8
Driver Weight Category				
Unknown	31	4,700	0.25	6.5
<100 lbs.	48	4,700	0.19	6.5
100-149 lbs.	136	18,500	0.14	25.7
150-199 lbs.	183	25,600	0.15	35.6
200+ lbs.	125	18,400	0.15	25.6
Driver ATV Experience				
Less than 1 year	111	14,000	0.16	19.6
Between 1 and 5 years	142	18,500	0.15	25.8
More than 5 years	246	35,600	0.13	49.6
Unknown	24	3,600	0.28	5.0
Driver's Alcohol Use				
Yes	22	3,600	0.31	5.1
No	501	68,100	0.12	94.9
ATV Owned By Driver				
Yes	233	33,300	0.14	46.5
No, borrowed	136	18,600	0.14	26.0
No, parent owned	101	12,100	0.16	17.0
No	52	7,500	0.21	10.5

III.B.4: ATV Characteristics (Table 4)

Table 4 provides the estimated injuries associated with different ATV characteristics. Most of the estimated injuries were attributed to ATVs with four wheels (69,700; 97.1%). Of those 4-wheel ATV-related injuries, 39,800 injuries (57.1%) were estimated not to be 4-wheel drive-equipped vehicles (This result is not displayed in a table). The estimated number of injuries associated with automatic transmissions (32,400; 45.1%) was similar to the number of injuries associated with a manual transmission (31,400; 43.7%); although 8,000 (11.2%) were estimated to have an unknown type of transmission. Only a small portion of the ATVs involved were reported to have aftermarket modifications (5,300; 7.4%). The majority of the estimated injuries occurred while the ATV was being used recreationally (63,800; 88.9%). The remainder fell into other categories, such as chores and transportation use.

Of the estimated 71,800 emergency department treated injuries associated with a driver or passenger of an operational ATV, 37,100 (51.7%) occurred on adult ATVs, while an estimated 32,500 (45.2%) occurred with an unknown classified ATV. For the estimated 18,500 injuries to children under the age of 16, an estimated 1,900 (10.0%) occurred on youth ATVs; 4,900 (26.7%) on adult ATVs; and 11,700 (63.3%) on ATVs with an unknown classification (This result is not displayed in a table). Thus, little can be concluded about injuries associated with youth ATVs and the youngest age group.

Table 4: ATV-Related Estimated Emergency Department-Treated Injuries Associated with ATV Characteristics January 2010–August 2010

ATV Characteristic	n	Estimate	CV of Estimate	Percent of Total
Total	**523**	**71,800**	**0.12**	**100%**
Model Year				
Before 1991	25	3,600	0.23	5.0
1991-2000	54	8,400	0.20	11.7
2001+	187	24,900	0.15	34.7
Unknown	257	34,900	0.14	48.6
Transmission				
Automatic	249	32,400	0.14	45.1
Manual	219	31,400	0.13	43.7
Unknown	55	8,000	0.19	11.2
3 v 4 wheels				
3 wheels	16	2,100	0.32	2.9
4 wheels	507	69,700	0.12	97.1
Aftermarket Modifications				
Yes	31	5,300	0.26	7.4
No	430	57,700	0.12	80.4
Unknown	62	8,800	0.20	12.3
Youth v Adult ATV				
Youth	21	2,200	0.27	3.1
Adult	263	37,100	0.13	51.7
Unknown	239	32,500	0.14	45.2
Use				
Recreational	478	63,800	0.12	88.9
Other	45	8,000	0.20	11.1

III.B.5: Helmet Use (Table 5 and Table 6)

Table 5 investigates the relationship of helmet use and the injury received, while **Table 6** considers possible influences of helmet use based on injuries related to victim, driver, and incident characteristics.

The estimated number of injuries where a helmet was in use is 30,900 (43.1%). **Tables 5** provides further breakdowns of helmet use with what body part was reported to have received the most severe injury, the disposition of the victim from the emergency department, and the diagnosis received. When the head is the body part associated with the injury, the proportion of head injuries in those with a helmet is much lower than those without (27.1% and 72.9%, respectively). By contrast, the proportions of injuries of the extremities and the torso were fairly similar in victims with a helmet, compared with those with no helmet. Of the estimated 30,900 injuries associated with wearing a helmet, the most severely injured parts of the body were most frequently the extremities (15,200; 49.2%). Without a helmet in use, the distribution of most severely injured body part across head, torso, and extremities is fairly even. There is a statistically significant relationship found between helmet use and the most severely injured body part (p-value=0.0004). This shows helmet use as a factor in the diagnosis of head injuries.

Each diagnosis has a similar proportion of injuries for victims using helmets and those who do not. No statistical relationship was detected between helmet use and diagnosis (p-value=0.4724).[8] Similarly, disposition of the victim and helmet use, or non-use, are independent (p-value=0.4724).

Table 5: ATV-Related Estimated Emergency Department-Treated Injuries Associated for Victim Injury Characteristics by Helmet Use, January 2010-August 2010

	Helmet Use						Rao-Scott χ^2 p-value (adjusted χ^2 p-value)
	Yes			*No*			
	n	Estimate (CV)	Row %	n	Estimate (CV)	Row %	
Total	**253**	**30,900 (0.14)**	**43.1**	**270**	**40,800 (0.15)**	**56.9**	
Body Part*							
Torso	86	10,500 (0.18)	42.9	83	14,000 (0.18)	57.1	<0.0001 (0.0004)
Extremities	120	15,200 (0.17)	54.7	90	12,600 (0.18)	45.3	
Head	47	5,300 (0.20)	27.1	97	14,300 (0.18)	72.9	
Disposition*							
Treated and Released	223	27,900 (0.14)	44.4	223	34,900 (0.14)	55.6	0.2362 (0.4724)
Other	30	3,000 (0.32)	33.9	47	5,900 (0.26)	66.1	
Diagnosis*							
Contusions/Abrasions	67	9,400 (0.18)	47.6	64	10,400 (0.20)	52.4	0.2409 (0.4724)
Fracture	68	7,100 (0.19)	42.4	63	9,600 (0.19)	57.6	
Laceration	16	2,000 (0.29)	26.7	39	5,600 (0.22)	73.3	
Internal Injury	30	3,400 (0.22)	37.3	44	5,700 (0.25)	62.7	
Strain/Sprain	41	5,200 (0.21)	48.9	34	5,500 (0.23)	51.1	
Other	31	3,800 (0.26)	48.4	26	4,100 (0.22)	51.6	

*Indicates data recorded in NEISS, not provided by the respondents of the survey.

[8] All p-values reported in the text of the report are adjusted p-values that reflect the correction for multiple comparisons. See Methodology section for details.

Because there is a relationship between helmet use and the body part injured, specifically the head, an analysis was performed to identify possible factors associated with helmet use. Comparisons include victim, driver, and incident characteristics. The results are provided in **Table 6**.

After correcting for multiple comparisons, the only two characteristics associated statistically with helmet use were the number of passengers on the ATV and the location of the victim on the ATV (p-value=0.0010 and 0.0166, respectively). When there was at least one passenger (in addition to the driver), 71.7 percent of the injuries were to those without helmets, versus 50.1 percent when only the driver was present on the ATV. Considering victim location, 69.6 percent of passengers injured were without helmets, while 52.9 percent of driver victims were not wearing helmets.

Considering the victim age group breakdown of helmet use, the proportion of injuries is fairly even comparing those under 16 years old wearing/not wearing helmets. The proportion of injuries where a helmet was worn appears to decrease as age increases. However, the relationship between these variables is not statistically significant (p-value=0.3993). A similar relationship is seen with the driver's age group distribution and helmet use; this relationship is not statistically significant (p-value=0.3993).

Table 6: ATV-Related Emergency Department-Treated Injuries Influences of Helmet Use
January 2010–August 2010

	Helmet Use						Rao-Scott χ^2 p-value (adjusted χ^2 p-value)
	Yes			*No*			
	n	**Estimate (CV)**	**Row %**	**n**	**Estimate (CV)**	**Row %**	
Total	**253**	**30,900 (0.14)**	**43.1**	**270**	**40,800 (0.15)**	**56.9**	
Victim's Age Group*							
<16	94	9,200 (0.16)	49.7	75	9,300 (0.24)	50.3	0.0799 (0.3993)
16-25	65	9,400 (0.19)	48.8	57	9,800 (0.22)	51.2	
26-35	45	6,900 (0.23)	39.9	64	10,400 (0.18)	60.1	
36-45	27	3,300 (0.26)	38.2	30	5,400 (0.25)	61.8	
≥46	22	2,200 (0.26)	26.8	44	5,900 (0.21)	73.2	
Victim's Sex*							
Male	191	22,500 (0.14)	45.1	189	27,300 (0.15)	54.9	0.2857 (0.5008)
Female	62	8,500 (0.20)	38.6	81	13,500 (0.19)	61.4	
Driver's Age Group							
<16	84	7,800 (0.17)	52.0	59	7,200 (0.24)	48.0	0.1102 (0.3993)
16-25	69	9,900 (0.19)	48.9	59	10,300 (0.24)	51.1	
26-35	47	7,100 (0.23)	38.7	69	11,200 (0.21)	61.3	
36-45	29	3,600 (0.26)	39.8	33	5,400 (0.25)	60.2	
≥46	24	2,600 (0.26)	28.3	50	6,600 (0.21)	71.7	
Driver's Sex							
Male	206	24,900 (0.13)	44.9	210	30,500 (0.13)	55.1	0.2504 (0.5008)
Female	47	6,100 (0.21)	37.1	60	10,300 (0.19)	62.9	
Number of Passengers							
1+ passenger	47	6,400 (0.21)	28.3	110	16,200 (0.23)	71.7	0.0001 (0.0010)
No passenger	206	24,500 (0.15)	49.9	160	24,600 (0.14)	50.1	
Victim Location							
Driver	218	25,800 (0.15)	47.1	191	29,100 (0.14)	52.9	0.0021 (0.0166)
Passenger	35	5,100 (0.22)	30.4	79	11,700 (0.22)	69.6	
Reported Speed							
<10 mph	76	8,900 (0.19)	33.8	109	17,300 (0.17)	66.2	0.0885 (0.3993)
10-19 mph	59	7,000 (0.22)	49.0	53	7,300 (0.24)	51.0	
≥20 mph	75	9,600 (0.18)	51.7	64	8,900 (0.21)	48.3	
Unknown	43	5,500 (0.22)	43.3	44	7,200 (0.23)	56.7	
Transmission							
Automatic	110	11,600 (0.20)	35.7	139	20,800 (0.17)	64.3	0.0091 (0.0637)
Manual	122	16,400 (0.15)	52.3	97	15,000 (0.15)	47.7	
Unknown	21	3,000 (0.27)	37.3	34	5,000 (0.25)	62.7	
Incident Location							
Paved Surface	23	2,400 (0.30)	32.6	34	5,000 (0.24)	67.4	0.0304 (0.1822)
Non-paved Road	23	2,800 (0.29)	27.9	43	7,100 (0.24)	72.1	
Field	59	7,100 (0.18)	49.0	44	7,400 (0.24)	51.0	
Yard	41	4,700 (0.17)	40.4	50	6,900 (0.19)	59.6	
Woods	49	6,600 (0.23)	46.1	59	7,700 (0.23)	53.9	
Off-highway Vehicle Park	32	3,500 (0.23)	67.0	8	*	*	
Other	26	3,900 (0.24)	44.0	32	4,900 (0.23)	56.0	

*Indicates data recorded in NEISS, not provided by the respondents of the survey.
**Indicates estimates that do not meet minimum reporting requirements.

III.B.6: ATV Hitting or Landing on the Victim (Table 7)

Table 7 provides the estimated injuries associated with events where the ATV hit or landed on the victim by victim's age group, body part injured, and location of the victim on the ATV. For victim's age group, the 26−35 and the 36−45 age groups have the largest proportions of injuries where the ATV hits or landed on the victim versus not. There is an association between victim age group and whether the ATV hit the victim for emergency department-treated injuries (p-value=0.0185). There is an association detected between the location of the victim and whether the ATV hit the victim (p-value=0.0355), where the driver location has a higher proportion of the ATV hitting or landing on the victim than does the passenger.

Table 7: ATV-Related Estimated Emergency Department-Treated Injuries by Victim Characteristics and Whether the ATV Hit or Landed on the Victim, January 2010–August 2010

	ATV hit/land on victim						Rao-Scott χ^2 p-value (adjusted χ^2 p-value)
	Yes			*No*			
	n	Estimate (CV)	Row %	n	Estimate (CV)	Row %	
Total	**181**	**26,500 (0.16)**	**36.9**	**342**	**45,300 (0.11)**	**63.1**	
Victim Age Group*							
<16	41	4,500 (0.23)	24.5	128	14,000 (0.16)	75.5	0.0037 (0.0185)
16-25	40	6,400 (0.22)	33.2	82	12,800 (0.17)	66.8	
26-35	49	8,400 (0.21)	48.4	60	8,900 (0.20)	51.6	
36-45	22	3,800 (0.27)	44.4	35	4,800 (0.23)	55.6	
≥46	29	3,300 (0.23)	41.2	37	4,700 (0.22)	58.8	
Body Part*							
Torso	69	9,900 (0.19)	40.6	100	14,500 (0.15)	59.4	0.5186 (0.5186)
Extremities	66	9,400 (0.19)	33.7	144	18,400 (0.16)	66.3	
Head	46	7,200 (0.23)	36.9	98	12,300 (0.15)	63.1	
Diagnosis*							
Contusions/Abrasions	55	9,300 (0.19)	46.9	76	10,500 (0.18)	53.1	0.0189 (0.0568)
Fracture	46	6,500 (0.20)	38.9	85	10,200 (0.15)	61.1	
Laceration	19	2,800 (0.25)	36.4	36	4,900 (0.22)	63.6	
Internal Injury	26	3,500 (0.27)	38.4	48	5,600 (0.19)	61.6	
Strain/Sprain	21	2,600 (0.29)	24.7	54	8,000 (0.15)	75.3	
Other	14	1,800 (0.30)	23.1	43	6,100 (0.19)	76.9	
Disposition*							
Treated and Released	150	22,200 (0.15)	35.3	296	40,600 (0.12)	64.7	0.0442 (0.0885)
Other	31	4,300 (0.29)	48.1	46	4,600 (0.21)	51.9	
Location of Victim							
Driver	154	21,800 (0.15)	39.7	255	33,100 (0.12)	60.3	0.0089 (0.0355)
Passenger	27	4,700 (0.27)	27.8	87	12,200 (0.18)	72.2	

*Indicates data recorded in NEISS, not provided by the respondents of the survey.

III.B.7: Overturning Events (Table 8 and Table 9)

Of the 71,800 estimated injuries in this study, a majority were estimated to have included the ATV overturning during the incident (43,300; 60.3%). **Table 8** breaks down the resulting injuries by overturning events, while **Table 9** considers the characteristics of the driver and incident in relationship to overturning events.

Table 8 gives information on the breakdown of overturning events by age group, the ATV hitting/landing on the victim, and the body part injured. Of the estimated 43,300 overturning-related injuries, an estimated 22,800 (52.8%) of the victims were hit by the ATV or the ATV landed on them (ATV hit/land on). In comparison, of the 28,500 injuries not related to an overturning, the victim was hit by the ATV or the ATV landed on the victim in 12.8 percent (3,600) of injuries. For overturning events, the most often injured body part is the torso (41.7%), while the extremities were the most commonly injured body part for non-overturning incidents (45.1%). For injuries to the torso, 73.8 percent were associated with an overturning event, while head injuries had 52.9 percent associated with overturning events. An association was found between the body part injured and overturning events (p-value=0.0076).

Table 8: ATV-Related Estimated Emergency Department-Treated Injuries Associated for Victim Injury Characteristics by Overturning Events, January 2010–August 2010

	Overturn							Rao-Scott χ^2 p-value (adjusted χ^2 p-value)
	Yes				*No*			
	n	Estimate (CV)	Row %		n	Estimate (CV)	Row %	
Total	**309**	**43,300 (013)**	**60.3**		**214**	**28,500 (0.13)**	**39.7**	
Age Group*								
<16	79	8,600 (0.18)	46.2		90	10,000 (0.20)	53.8	0.0021 (0.0076)
16-25	72	11,600 (0.20)	60.4		50	7,600 (0.18)	39.6	
26-35	67	11,000 (0.20)	63.4		42	6,400 (0.22)	36.6	
36-45	43	6,400 (0.22)	74.2		14	2,200 (0.29)	25.8	
≥46	48	5,700 (0.20)	71.3		18	2,300 (0.25)	28.7	
ATV hit/land on victim								
Yes	157	22,800 (0.16)	86.3		24	3,600 (0.30)	13.7	<0.0001 (<0.0001)
No	152	20,500 (0.14)	45.2		190	24,800 (0.13)	54.8	
Body Part*								
Torso	127	18,000 (0.17)	73.8		42	6,400 (0.21)	26.2	0.0019 (0.0076)
Extremities	106	14,900 (0.17)	53.7		104	12,800 (0.16)	46.3	
Head	76	10,300 (0.19)	52.9		68	9,200 (0.18)	47.1	
Disposition*								
Treated and Released	257	36,900 (0.13)	58.8		189	25,900 (0.13)	41.2	0.0983 (0.1965)
Other	52	6,400 (0.24)	71.4		25	2,600 (0.29)	28.6	
Diagnosis*								
Contusions/Abrasions	77	11,900 (0.19)	60.4		54	7,800 (0.21)	39.6	0.2090 (0.2090)
Fracture	88	11,400 (0.16)	68.6		43	5,200 (0.19)	31.4	
Laceration	22	3,400 (0.33)	45.1		33	4,200 (0.22)	54.9	
Internal Injury	49	6,200 (0.22)	68.0		25	2,900 (0.25)	32.0	
Strain/Sprain	44	6,200 (0.18)	57.7		31	4,500 (0.21)	42.3	
Other	29	4,100 (0.23)	52.4		28	3,800 (0.24)	47.6	

*Indicates data recorded in NEISS, not provided by the respondents of the survey.

In **Table 9,** for driver and incident characteristics reported by overturning events, note that the only two characteristics showing a statistically significant relationship between estimated injuries for overturning events are slope and driver's weight. Speed, number of passengers, terrain, terrain condition, driver's age group, and driver's experience did not exhibit any correlation with overturning events. For the estimated overturning events, 18,800 (43.4%) occurred on flat terrain; 22,900 (52.9%) on a slope, either gentle or steep. There is a statistically significant correlation between slope and an overturning event for estimated injuries (p-value < 0.0001). Note that the majority of injuries occurred on flat terrain (37,200; 51.9%), and about half of that estimate indicates an overturning event was involved. Thus, slope does play a part in overturning events, as it is more likely that an overturning event will occur as slope increases, where injuries were involved. However, slope does not fully explain overturning events, as 50.5 percent of injuries on flat terrain involved an overturning event.

The more the driver weighs, the greater the proportion of overturning events. For the weight category <100 pounds (lbs.), only 36.8 percent of the estimated injuries were related to an overturning event; while the 150-199 lbs. and 200+ categories, 66.1 percent and 65.5 percent, respectively, of the estimated injuries were related to overturning events.

Table 9: ATV-Related Estimated Emergency Department-Treated Injuries Associated by Incident Characteristics and Overturning Events, January 2010–August 2010

	Overturn						Rao-Scott χ^2 p-value (adjusted χ^2 p-value)
	Yes			*No*			
	N	Estimate (CV)	Row %	n	Estimate (CV)	Row %	
Total	**309**	**43,300 (0.13)**	**60.3**	**214**	**28,500 (0.13)**	**39.7**	
Speed							
<10 mph	103	15,200 (0.19)	58.2	82	10,900 (0.18)	41.8	0.1396 (1.00)
10-19 mph	70	9,400 (0.17)	65.3	42	5,000 (0.21)	34.7	
≥20 mph	94	12,300 (0.16)	66.8	45	6,100 (0.23)	33.2	
Unknown	42	6,300 (0.20)	49.7	45	6,400 (0.21)	50.3	
Number of Passengers							
1+ passenger	86	13,700 (0.22)	60.3	71	9,000 (0.22)	39.7	0.9962 (1.00)
No passenger	223	29,600 (0.14)	60.3	143	19,500 (0.13)	39.7	
Terrain							
Pavement	43	5,500 (0.24)	66.5	21	2,800 (0.29)	33.5	0.2461 (1.00)
Gravel	27	*	*	20	3,100 (0.27)	54.8	
Dirt	121	18,500 (0.18)	65.4	75	9,800 (0.18)	34.6	
Grass	69	10,000 (0.18)	54.8	65	8,300 (0.20)	45.2	
Other/Unknown	49	6,700 (0.22)	59.7	33	4,500 (0.23)	40.3	
Terrain Condition							
Dry	242	34,700 (0.14)	59.8	177	23,300 (0.14)	40.2	0.2873 (1.00)
Wet	43	5,800 (0.21)	69.7	21	2,500 (0.29)	30.3	
Other/Unknown	24	2,800 (0.30)	51.3	16	2,600 (0.30)	48.7	
Slope							
Flat	144	18,800 (0.13)	50.5	140	18,400 (0.15)	49.5	<0.0001 (<0.0001)
Gentle	87	12,600 (0.19)	66.5	48	6,300 (0.19)	33.5	
Steep	67	10,300 (0.20)	87.9	11	*	*	
Unknown	11	*	*	15	2,300 (0.32)	58.9	
Driver's Age Group							
<16	68	6,900 (0.20)	45.7	75	8,100 (0.18)	54.3	0.0284 (0.2837)
16-25	77	12,600 (0.20)	62.5	51	7,600 (0.19)	37.5	
26-35	70	11,400 (0.20)	62.4	46	6,900 (0.21)	37.6	
36-45	42	6,000 (0.23)	66.3	20	3,000 (0.25)	33.7	
≥46	52	6,400 (0.21)	69.6	22	2,800 (0.24)	30.4	
Driver's Experience							
Less than 1 year	59	7,900 (0.21)	56.5	52	6,100 (0.22)	43.5	0.6652 (1.00)
Between 1 and 5 years	76	10,400 (0.19)	56.1	66	8,100 (0.20)	43.9	
More than 5 years	157	22,600 (0.13)	63.5	89	13,000 (0.17)	36.5	
Unknown	17	2,400 (0.32)	65.6	7	*	*	

	Overturning Event							Rao-Scott χ^2 p-value (adjusted χ^2 p-value)
	Yes				*No*			
	n	Estimate (CV)	Row %		n	Estimate (CV)	Row %	
Driver Training								
Training Course	9	*	*		5	*	*	0.8273 (1.00)
Friend/Relative	174	24,600 (0.15)	59.0		139	17,100 (0.15)	41.0	
Self-taught	100	14,700 (0.18)	61.1		62	9,400 (0.19)	38.9	
Other/Unknown	26	2,900 (0.27)	69.1		8	*	*	
Driver's Sex								
Male	247	33,700 (0.12)	60.8		169	21,700 (0.10)	39.2	0.7729 (1.00)
Female	62	9,600 (0.18)	58.8		45	6,700 (0.23)	41.2	
Transmission								
Automatic	157	21,400 (0.15)	66.1		92	11,000 (0.17)	33.9	0.0331 (0.2975)
Manual	127	18,400 (0.15)	58.5		92	13,000 (0.17)	41.5	
Unknown	25	3,500 (0.26)	44.1		30	4,500 (0.25)	55.9	
Driver's Weight								
Unknown	11	*	*		20	3,200 (0.29)	68.1	0.0021 (0.0235)
<100 lbs.	21	1,700 (0.29)	36.8		27	2,900 (0.26)	63.2	
100-149 lbs.	79	11,200 (0.17)	60.4		57	7,300 (0.18)	39.6	
150-199 lbs.	117	16,900 (0.17)	66.1		66	8,700 (0.18)	33.9	
200+ lbs.	81	12,000 (0.17)	65.5		44	6,400 (0.22)	34.5	
Incident Location								
Paved Surface	38	5,200 (0.24)	69.1		19	2,300 (0.26)	30.9	0.1867 (1.00)
Non-paved Road	40	6,100 (0.26)	61.9		26	3,800 (0.26)	38.1	
Field	53	7,800 (0.19)	53.7		50	6,700 (0.18)	46.3	
Yard	41	5,400 (0.19)	46.5		50	6,200 (0.18)	53.5	
Woods	66	9,300 (0.25)	64.4		42	5,100 (0.23)	35.6	
Off-highway Vehicle Park	31	3,500 (0.23)	67.5		9	*	*	
Other	40	6,100 (0.20)	69.2		18	*	*	

*Indicates an estimate that is not considered reportable.

III.B.8: ATV Transmission (Table 10)

Table 10 provides emergency department-treated injuries from January 1, 2010 to August 31, 2010, by transmission type of the ATV involved for the victim's age group, driver's age group, and driver's experience. Victim age group was defined into two groups: <16 and ≥16, instead of the five categories used previously. Using the five age groups, estimates were often deemed unreliable due to high CVs. The driver's age group is defined in the same groups as victim's age group in this comparison: <16 and ≥16.

Using the adjusted p-values, the associations between victim's age group and transmission, as well as driver's experience and transmission, were statistically significant (adjusted p-values = 0.0042 and 0.0003, respectively). In other words, the distribution of proportions of estimated injuries associated with each transmission type were different across victim age groups, as well as across driver's experience. However, when a sensitivity analysis was performed by omitting the "Unknown" transmission type estimates, the tests for association were not statistically significant for either victim's age group or driver's experience. Because there is strong evidence that the statistically significant p-values were caused by the "Unknown" transmission type, the results in this section should be treated as no association could be evidenced for transmission type for victim age group, driver age group, or driver experience. This does not mean that there were insignificant proportions of injuries occurring with any type of transmission for different ages or driver's experience; rather, this demonstrates that there is not enough evidence to show that the transmission type is related to the victim's age groups and driver's experience.

For automatic transmissions, the proportion of estimated emergency department-treated injuries for those in the <16 victim age group is similar to that of the ≥16 victim age group (42.9% and 45.9%, respectively). To illustrate the relationship between the age group percentages for manual transmissions, the 95 percent confidence intervals of these percentages will be considered. In the <16 victim age group, 37.7 percent of the estimated injuries were associated with a manual transmission, where the 95 percent confidence interval is 28.7 percent to 46.8 percent. In the ≥16 victim age group, 45.8 percent were associated with manual transmissions, where the 95 percent confidence interval is 38.5 percent to 53.2 percent. Note that the two confidence intervals have a large overlap, indicating that there is not sufficient evidence to conclude that the two percentages were different. This supports the statement that no association between victim age group and transmission type was detected, and the "Unknown" category is the driving force behind the significant p-value. When the "Unknown" category was removed during sensitivity testing, the resulting p-value was not significant. Again, this does not mean that the proportions and number of injuries were insignificant for any victim's age group by transmission type; rather, it simply means that no differences in the proportion of injuries for each group could be found.

The pattern is slightly different for driver's experience. For the automatic transmission category, the proportion of estimated injuries is similar for experience for the categories "Less than 1 year" and "Between 1 and 5 years" (48.9% and 51.6%, respectively); however, a smaller proportion of injuries in the automatic transmission group were seen for drivers with more than 5 years of experience. For the manual transmission category, the proportion of estimated injuries, again, is similar for the less than 1 year of experience and between 1 and 5 years of experience (37.2% and 39.7%, respectively); however, the proportion of estimated injuries is higher for those with more than 5 years of experience. However, as noted above, when the "Unknown" transmission category is removed from the analysis, the p-values indicate that no statistically significant association exists between transmission type and driver's ATV experience.

Table 10: ATV-Related Emergency Department-Treated Injuries Associated with Victim and Driver Characteristics by Transmission Type January 2010–August 2010

	Transmission									Rao-Scott χ^2 p-value (adjusted χ^2 p-value)
	Automatic			*Manual*			*Unknown*			
	n	Estimate (CV)	Row %	n	Estimate (CV)	Row %	n	Estimate (CV)	Row %	
Total	**249**	**32,400 (0.14)**	**45.1**	**219**	**31,400 (0.13)**	**43.7**	**55**	**8,000 (0.19)**	**11.2**	
Victim Age Group										
<16	89	7,900 (0.17)	42.9	52	7,000 (0.21)	37.7	28	3,600 (0.25)	19.4	0.0021 (0.0042)†
≥16	160	24,400 (0.17)	45.9	167	24,400 (0.14)	45.8	27	4,400 (0.24)	8.3	
Driver Age Group										
<16	81	7,400 (0.17)	49.2	43	5,400 (0.19)	36.0	19	2,200 (0.30)	14.8	0.2285 (0.2285)
≥16	168	25,000 (0.16)	44.1	176	26,000 (0.14)	45.7	36	5,800 (0.22)	10.2	
Driver Experience with ATVs										
Less than 1 year	59	6,900 (0.21)	48.9	37	5,200 (0.20)	37.2	15	*	*	<0.0001 (0.0003)†
Between 1 and 5 years	75	9,600 (0.18)	51.6	56	7,300 (0.18)	39.7	11	*	*	
More than 5 years	108	14,900 (0.16)	41.9	120	18,000 (0.15)	50.5	18	2,700 (0.30)	7.6	
Unknown	7	*	*	6	*	*	11	*	*	

*Indicates an estimate that is not deemed reportable.

†When the "Unknown" transmission estimates were omitted, the p-value was *not* statistically significant. This analysis was performed as a sensitivity analysis; refer to the *Transmission* section of this memorandum for further details on interpreting the results provided in this table.

III.B.9: Reported Speed (Table 11)

Table 11 provides emergency department-treated injury estimate comparisons for the reported speed of the ATV at the time of the incident for victim and driver characteristics.

Considering the relationship between reported speed and the victim's age group, a statistically significant association is detected (adjusted p-value = 0.0145). Note that as the reported speed increases, the proportion of injuries decreases for the <16 age group; while the ≥16 age group has 33.6 percent of injuries in the "<10 mph" category and 30.6 percent in the "≥20 mph" category. The "Unknown" speed category constitutes 21.8 percent of the <16 age group and 16.3 percent of the ≥16 age group. Caution should be used in examining the reported speed with the large proportions in the "Unknown" category.

However, when considering speed and the driver's age group, no statistically significant association is detected (adjusted p-value = 0.0728). For the different speed categories, the proportion of estimated injuries in the <16 and ≥16 age groups were not evidenced to be different.

The only other comparison that shows a statistically significant relationship is reported speed with driver's experience (p-value<0.0001). For the categories for less than 5 years of experience, the largest proportions of estimated injuries were in the <10 mph reported speed category. While for the more than 5 years of experience category, the proportions for the <10 mph and ≥20 mph were similar (33.0% and 32.6%, respectively).

Note that the driver's age group, sex, and training were not evidenced to have a statistically significant relationship. The same holds for the victim's sex. This does not mean that apparent differences in the number of injuries are trivial; rather, the distribution of reported speeds is not evidenced to be different for each of the victim and driver characteristics. That is, we cannot rule out that the observed differences were not merely a product of chance.

Table 11: ATV-Related Emergency Department-Treated Injuries Associated with Victim Age Group and Driver Age Group by Reported Speed
January 2010–August 2010

	Reported Speed												Rao-Scott χ^2 p-value (adjusted χ^2 p-value)
	<10 mph			*10-19 mph*			*≥20 mph*			*Unknown*			
	n	Estimate (CV)	Row %	n	Estimate (CV)	Row %	n	Estimate (CV)	Row %	n	Estimate (CV)	Row %	
Total	**185**	**26,200 (0.16)**	**36.5**	**112**	**14,400 (0.16)**	**20.1**	**139**	**18,500 (0.15)**	**25.8**	**87**	**12,700 (0.17)**	**17.7**	
Victim Age Group													
<16	73	8,300 (0.22)	44.8	39	4,000 (0.24)	21.6	22	2,200 (0.29)	11.7	35	4,000 (0.25)	21.8	0.0029 (0.0145)
≥16	112	17,900 (0.18)	33.6	73	10,400 (0.17)	19.5	117	16,300 (0.15)	30.6	52	8,700 (0.22)	16.3	
Driver Age Group													
<16	61	6,800 (0.19)	45.0	32	3,300 (0.25)	22.2	21	2,000 (0.31)	13.2	29	2,900 (0.27)	19.6	0.0364 (0.0728)
≥16	124	19,400 (0.18)	34.2	80	11,100 (0.17)	19.5	118	16,500 (0.15)	29.1	58	9,800 (0.21)	17.2	
Victim Sex													
Male	118	15,700 (0.15)	31.5	87	10,700 (0.18)	21.4	112	14,600 (0.16)	29.2	63	8,900 (0.18)	17.8	0.0231 (0.0709)
Female	67	10,500 (0.22)	47.7	25	3,700 (0.20)	17.0	27	3,900 (0.30)	17.8	24	3,800 (0.26)	17.4	
Driver Sex													
Male	134	18,500 (0.13)	33.3	95	11,800 (0.15)	21.3	115	15,300 (0.13)	27.6	72	9,800 (0.18)	17.8	0.1245 (0.1245)
Female	51	7,700 (0.22)	47.1	17	2,600 (0.26)	15.7	24	3,200 (0.28)	19.7	15	2,900 (0.29)	17.5	
Driver Training													
Training Course	9	*	*	1	*	*	3	*	*	1	*	*	0.0177 (0.0709)
Friend/Relative	113	16,300 (0.19)	39.2	68	8,400 (0.17)	20.0	77	9,700 (0.18)	23.2	55	7,300 (0.20)	17.6	
Self-taught	52	7,000 (0.20)	29.1	37	5,300 (0.22)	22.2	50	7,700 (0.23)	31.8	23	4,100 (0.29)	16.9	
Other/Unknown	11	*	*	6	*	*	9	*	*	8	*	*	
Driver Experience													
Less than 1 year	45	5,800 (0.22)	41.5	21	*	*	25	2,900 (0.25)	20.7	20	2,800 (0.29)	19.7	<0.0001 (<0.0001)
Between 1 and 5 years	60	8,400 (0.19)	45.5	35	4,200 (0.21)	22.6	24	3,400 (0.28)	18.2	23	*	*	
More than 5 years	76	11,700 (0.19)	33.0	53	7,000 (0.19)	19.5	84	11,600 (0.16)	32.6	33	5,300 (0.21)	14.8	
Unknown	4	*	*	3	*	*	6	*	*	11	*	*	

III.B.10: Collisions (Table 12)

Table 12 provides the estimates for collision- versus non-collision-initiating events by each of the types of lights equipped on the ATV (headlights, taillights, brake lights, and no lights) and by an indicator variable for any lights in use at the time of the incident. For this part of the analysis, the responses for the initiating event were collapsed into two categories"; collision constituted one group, and all other events were collapsed into one category labeled: "not a collision." There were no associations that were statistically significant in these comparisons (all adjusted p-values = 1.00).

For collision events, similar proportions of estimated injuries were generated for ATVs equipped with headlights (27.0%, 36.0%, and 28.9% for ATVs equipped with headlights, not equipped with headlights, and unknown if equipped with headlights, respectively). Similar results were seen for collisions and ATVs with and without taillights (26.3%, 33.8%, and 28.9% for ATVs equipped with taillights, not equipped with taillights, and unknown if equipped with taillights, respectively). This also holds with collisions for ATVs equipped versus not equipped with brake lights (27.7%, 29.8%, and 26.7% for ATVs equipped with brake lights, not equipped with brake lights, and unknown if equipped with brake lights, respectively).

When considering collision events and whether lights were in use at the time of the incident, no statistically significant association was detected (adjusted p-value = 1.00). Results are provided in **Table 12**. For collision events, the proportion of estimated injuries where no lights were in use is similar for those reporting at least one type of light in use, and the "Unknown" category (26.0%, 27.4%, and 37.6%, respectively).

Although equipped lights or lights in use were not evidenced to be related to collisions, collisions have the largest proportion of estimated injuries for the initiating events of all the reported events (see **Table 2**); thus, identifying collisions as a substantial hazard pattern.

Table 12: ATV-Related Emergency Department-Treated Injuries Associated with ATV Lights by Reported Initial Event January 2010–August 2010

	Initial Event						Rao-Scott χ^2 p-value (adjusted χ^2 p-value)
	Collision			*Not a Collision*			
	n	Estimate (CV)	Row %	N	Estimate (CV)	Row %	
Total	**162**	**20,100 (0.14)**	**28.0**	**361**	**51,700 (0.13)**	**72.0**	
Headlights equipped							
Yes	127	15,700 (0.15)	27.0	293	42,500 (0.14)	73.0	0.4485 (1.00)
No	16	2,300 (0.28)	36.0	29	4,100 (0.20)	64.0	
Unknown	19	2,000 (0.31)	28.9	39	5,000 (0.21)	71.1	
Taillights equipped							
Yes	108	13,400 (0.16)	26.3	261	37,500 (0.14)	73.7	0.3859 (1.00)
No	35	4,600 (0.20)	33.8	61	9,100 (0.16)	66.2	
Unknown	19	2,000 (0.31)	28.9	39	5,000 (0.21)	71.1	
Brake lights equipped							
Yes	114	14,800 (0.15)	27.7	268	38,500 (0.14)	72.3	0.9080 (1.00)
No	30	3,500 (0.21)	29.8	54	8,200 (0.18)	70.2	
Unknown	18	1,800 (0.29)	26.7	39	5,000 (0.21)	73.3	
No lights equipped							
No lights†	12	*	*	22	3,200 (0.24)	68.2	0.8766 (1.00)
*At least one light type in use^*	131	16,500 (0.14)	27.5	300	43,400 (0.14)	72.5	
Unknown	19	2,000 (0.31)	28.9	39	5,000 (0.21)	71.1	
Lights in Use							
Yes	21	2,300 (0.30)	26.0	50	6,600 (0.23)	74.0	0.4577 (1.00)
No	126	15,800 (0.15)	27.4	289	41,800 (0.14)	72.6	
Unknown	15	2,000 (0.30)	37.6	22	3,300 (0.25)	62.4	

*Respondents were able to select multiple lights available on the ATV. To understand the data more clearly, each light type should be considered separately.

† One respondent indicated that the lights were removed for racing. This case is included in the "No lights" group.

^The light types include headlights, taillights, and brake lights.

Section IV: Results of ATV-Related Fatalities (2005–2007)

IV.A: Introduction

The CPSC's 2011 All-Terrain Vehicle Deaths (ATVD 2011) database consists of all ATV-related fatalities reported to CPSC staff from January 1, 1982 through December 31, 2011. Characteristics of the victim, driver, and incident are captured for each fatality recorded in the ATVD. Note that the reported fatalities do not represent a statistical sample. Thus, results and conclusions drawn from the analysis of ATV-related fatalities should only be considered applicable for those reported fatalities; by definition, they cannot be generalized to all ATV-related fatalities. However, due to the large number of reported fatalities, CPSC staff expects that the characteristics of victims and incidents from the non-reported fatalities would not substantially change the hazards and characteristics identified from the analysis of reported fatalities. Because the years 2008 through 2011 are years where reporting is considered ongoing (see [1] for further details), this report uses records where the year of death is 2005 through 2007, the three most recent years where reporting is considered complete. While this 3-year span was considered to capture all the victim, driver, and incident characteristics for reported ATV-related deaths, each year had similar results.

An ATV-related fatality was considered in scope for this analysis if the fatality was the driver or passenger of an operational ATV, *i.e.*, an ATV that was in operation at the time of the incident. Fatalities to bystanders and drivers of other vehicles that were not ATVs were excluded. Fatalities that involved a nonoperational ATV were excluded. Thus, totals for the years 2005 through 2007, may not match totals reported for these years in the CPSC's ATV annual reports. The total number of reported fatalities considered in scope for this report is 2,321.

IV.B: Results

The numbers provided throughout this section are the number of reported fatalities. For all incident and driver characteristics displayed, this is the number of reported fatalities, not incidents. Thus, where there were two fatalities involved in the same incident, the numbers reflect both, even though the driver and incident characteristics are the same for both victims. This occurs for only a small proportion of the total number of fatalities. There were 33 reported incidents from 2005 through 2007 that involved two fatalities each, where both victims were considered in scope in this analysis.

The number of fatalities associated with different victim, incident, ATV, and driver characteristics are provided in the following subsections. Also provided are cross-tabulations for the number of fatalities associated with helmet use and overturning events by a variety of characteristics.

IV.B.1: Victim Characteristics (Table 13)

Table 13 provides the number of reported fatalities associated with victim characteristics of the reported ATV-related fatalities from 2005 through 2007, along with the percent each characteristic represented in the total number of reported fatalities. Note that a majority of the reported fatalities were victims in the 16 through 25 year old and ≥46 age group (52.4% of reported fatalities). Most victims were male (85.8%), and most were the driver of the ATV (89.3%). A majority of victims were not wearing a helmet at the time of the incident (66.0%). The most commonly reported body

part/mechanism[9] associated with the cause of death was the head alone, *i.e.*, only the head was mentioned in the cause of death, not the head plus some other body part (41.3%).

Table 13: Victim Characteristics of Reported ATV-Related Fatalities, 2005–2007

	Number of Reported Fatalities 2005-2007	Percent of Total
Total	**2,321**	**100%**
Victim Age Group		
<16	412	17.8%
16-25	623	26.8%
26-35	363	15.6%
36-45	330	14.2%
≥46	593	25.6%
Victim Sex		
Male	1,992	85.8%
Female	329	14.2%
Victim Location		
Driver	2,072	89.3%
Passenger	243	10.5%
*Driver or Passenger**	6	0.3%
Helmet		
Yes	321	13.8%
No	1,532	66.0%
Unknown	468	20.2%
Body Part/Mechanism Associated with Cause of Death		
Unknown	284	12.2%
Head	959	41.3%
Torso	240	10.3%
Head and Torso	154	6.6%
Asphyxia	140	6.0%
Multiple	309	13.3%
Other	235	10.1%

Source: U.S. Consumer Product Safety Commission: Directorate for Epidemiology/Division of Hazard Analysis.
*Exact location on ATV is unknown.

[9] See Methodology section for an explanation of the body part/mechanism variables and how it compares to the body part variables used in the injury study.

IV.B.2: Incident Characteristics (Table 14)

Table 14 breaks down the reported fatalities by the characteristics of the associated incident. The hazard pattern is determined by the CPSC analyst, based on official reports of the incident. Note that all hazard patterns could also have an overturning event. For example, if the ATV jumped off a 30-foot sand dune, and the victim and ATV landed at the bottom, then the ATV overturned, the hazard pattern will most likely be identified by "Extreme Terrain Change." All overturning events were captured in the overturn variable, and the hazard pattern for overturn is used when no other hazard pattern fits the scenario prior to the overturning event. The largest proportion of fatalities is related to the collision hazard pattern (45.1%), and most fatalities fell into one of three categories: collision, extreme terrain change (such as jumping a sand dune or going over a cliff), and overturned (81.8%). A majority of fatalities were associated with the ATV overturning (60.6%). Most reported fatalities were related to ATVs with only a driver, no passengers (72.8%).

A majority of the reported fatalities (67.3%) were related to the ATV being driven on one of three terrain types: paved road, non-paved road, or field/pasture/farmland. A large proportion of fatalities occurred on public roads, that is, road maintained by a public entity, such as a city, county, or state (47.4%). Note that fatalities identified as involving an ATV being driven on the road may not exactly match in number of fatalities identified in the "road" variables. This is the case due to CPSC staff choosing the terrain that might have had the most impact on the incident. For example, consider an incident might have occurred on a paved, public road that was icy at the time of the incident. Thus, the "road" variable would indicate a "public road" for the fatality, while the "terrain" variable would identify "snow/ice" instead of "paved road."

It should also be noted that only one "terrain" category is assigned for each fatality. Thus, some information is lost for any incident that could fall into more than one terrain category. For example, this could occur if the ATV was being ridden in a desert in an off-highway vehicle park. Either choice could be used in the "terrain" variable. It should be noted that the desert terrain incidents often occur in off-highway vehicle parks.

Table 14: Incident Characteristics of Reported ATV-Related Fatalities, 2005–2007

	Number of Reported Fatalities 2005–2007	Percent of Total
Total	**2,321**	**100%**
Hazard Pattern		
Unknown	183	7.9%
*Overturned**	466	20.1%
Extreme Terrain Change	385	16.6%
Collision	1,046	45.1%
Thrown, fell or jumped	200	8.6%
Contact with ATV	4	0.2%
Contact with Surroundings	18	0.8%
Other Operation	19	0.8%
Overturn		
Unknown	414	17.8%
Yes	1,407	60.6%
No	500	21.5%
Number of Riders		
Unknown	98	4.2%
No Passengers (Driver Only)	1,689	72.8%
1+ Passengers	534	23.0%
Terrain		
Unknown	188	8.1%
Forest, Woods	204	8.8%
Desert	51	2.2%
Vehicle Park, Track	30	1.3%
Dunes, Beach (Shallow Water)	39	1.7%
Field, Pasture, Farmland	286	12.3%
Paved Road	798	34.4%
Non-paved Road	477	20.6%
Snow, Ice	36	1.6%
Lawn, Yard	48	2.1%
Other	164	7.1%
Road		
Unknown	114	4.9%
Public Road	1,100	47.4%
Private Road	172	7.4%
Road, Unknown Class	155	6.7%
NA (Not a Road)	780	33.6%

Source: U.S. Consumer Product Safety Commission: Directorate for Epidemiology/Division of Hazard Analysis.

*Overturning event may occur in any other category as well; all overturning events are given by the overturn variable.

IV.B.3: ATV Characteristics (Table 15)

Table 15 breaks down the reported fatalities by the characteristics of the ATV. Most fatalities were related to a late model ATV (77.7%). Not surprisingly, 4-wheel ATVs were associated with most of the reported fatalities (89.6%); note that 7.2 percent of reported fatalities were related to ATVs with an unknown number of wheels. For the majority of fatalities, the size of ATV is unknown, and most of the remaining fatalities were associated with adult-size ATVs (Unknown: 51.1%, Adult: 48.2%, and Youth: 0.7%). With this large of a proportion of unknown size ATVs, it is difficult to form any conclusions about adult and youth ATVs. However, if the unknown size classification follows the same distribution as the ATVs of known size, then most fatalities would be associated with an adult-sized ATV.

Table 15: ATV Characteristics of Reported ATV-Related Fatalities, 2005–2007

	Number of Reported Fatalities 2005–2007	Percent of Total
Total	**2,321**	**100%**
Model Year		
Unknown	153	6.6%
<1991	116	5.0%
1991-2000	248	10.7%
2001+	1,804	77.7%
Number of Wheels		
3 wheels	73	3.2%
4 wheels	2,080	89.6%
Unknown Number of Wheels	168	7.2%
Youth vs. Adult ATV[10]		
Youth	17	0.7%
Adult	1,118	48.2%
Unknown	1,186	51.1%

Source: U.S. Consumer Product Safety Commission: Directorate for Epidemiology/Division of Hazard Analysis.

[10] See Methodology section for details on the classifications of youth and adult ATVs.

IV.B.4: Driver Characteristics (Table 16)

Table 16 summarizes the reported fatalities by the characteristics of the driver involved. The driver is not always the victim; however, they often were (Drivers represent 89.3% of reported fatalities. See section IV.B.1). The driver's age group distribution is similar to the victim age distribution (See section IV.B.1), which is expected since the majority of victims were the driver of the ATV. The driver age groups of 16 through 25-year-old and ≥46-year-old age groups have the majority of reported fatalities (52.8%). These two age groups represent 52.4 percent of the victim's age groups (see **Table 13**). Similarly, the sex of the driver and sex of victim match closely, with the proportion of reported fatalities being male drivers (87.6 percent). The training of the driver is unknown for most of the reported fatalities (94.7%); thus, no conclusions can be made regarding training.

The driver of the ATV consumed at least one alcoholic beverage before driving the ATV for 27.4 percent of the reported fatalities; note that the driver's alcohol use is unknown in 33.7 percent of the reported fatalities.

Table 16: Driver Characteristics of Reported ATV-Related Fatalities, 2005–2007

	Number of Reported Fatalities 2005–2007	Percent of Total
Total	**2,321**	**100%**
Driver Age Group		
Unknown	36	1.6%
<16	367	15.8%
16-25	629	27.1%
26-35	366	15.8%
36-45	327	14.1%
≥46	596	25.7%
Driver Sex		
Unknown	22	1.0%
Male	2,032	87.6%
Female	267	11.5%
Driver Weight		
Unknown	1,228	52.9%
<100 lbs.	51	2.2%
100-149 lbs.	198	8.5%
150-199 lbs.	439	18.9%
200+ lbs.	405	17.4%
Driver Alcohol Use		
Unknown	781	33.7%
Yes	635	27.4%
No	905	39.0%
Driver Training		
Organized Program	3	0.1%
Dealer	3	0.1%
Friend/Relative	22	1.0%
Self-taught	53	2.3%
Other	43	1.9%
Unknown	2,197	94.7%

Source: U.S. Consumer Product Safety Commission: Directorate for Epidemiology/Division of Hazard Analysis.

IV.B.5: Helmet Use (Table 17)

Table 17 cross tabulates the incident, driver, and victim characteristics by helmet use for reported fatalities.

Each of the victim's age groups shows a similar distribution for "wearing helmets," "not wearing helmets," and "unknown helmet use." Proportions of victims not wearing a helmet were between 60 and 70 percent for each age group. Although the <16 age group shows 23.3 percent of victims wearing a helmet, and 7.3 percent for the ≥46 age group, it cannot be said that there is difference in these two groups because unknown helmet use is 12.6 percent and 30.0 percent for each group, respectively. For the victim's sex, females were less likely to be reported wearing a helmet than males (9.1% and 14.6%, respectively); however, note that unknown helmet use is at 18.2 percent and 20.5 percent for each group, making conclusions about sex and helmet use difficult.

The results for the "body part/mechanism associated with the cause of death" variable show that reported head injuries represent smaller proportions of reported fatalities for victims wearing helmets (10.4% for head, and 14.9% for head and torso) than for victims not wearing helmets. Note that unknown helmet use is still high in these two categories (15.8% and 14.9%, respectively), which makes it difficult to make conclusions. However, if the "unknowns" follow the same pattern as the "knowns," then head injuries associated with the cause of death in those who were not wearing helmets represent larger proportions of victims than other body part/mechanism categories associated with the cause of death.

The reported fatalities for driver's age group and sex have helmet use distributions that were similar to the distributions for the victim's age group and sex. This is expected due to the large proportion of reported fatalities involving the driver of the ATV (89.3%, see **Table 13**). When the driver of the ATV had consumed at least one alcoholic beverage before driving the ATV, helmet use was less likely among reported fatalities; again, there were still significant proportions with unknown helmet use in each category. There was a large proportion of reported fatalities where alcohol use is unknown (33.7%, see **Table 16**).

The results for the "victim location" variable show a higher proportion of deaths reported in those without helmets when the victim is the passenger (75.7% of passengers without helmet, 64.9% of drivers without helmets). Again, the large proportion of unknown helmet use makes it difficult to determine if victims as passengers were actually wearing helmets less often than victims as drivers. Similarly, when there is more than one rider on the ATV, the proportion of fatality injured victims not wearing helmets is 78.1 percent, while 65.1 percent of fatalities were associated with an ATV with only a driver who was not wearing a helmet.

The three terrain types that stand out with higher proportions of helmet usage were the "desert," "vehicle park/track," and "dunes/beach," with 52.9, 53.3, and 56.4 percent, respectively, of reported fatalities in each group that were wearing a helmet. This may be due to many of these fatalities occurring in a recreational park, where helmet use is more likely to be mandatory. See the description of terrain on page 31.

Table 17: Victim and Incident Characteristics by Helmet Use for Reported ATV-Related Fatalities, 2005–2007

	Helmet Use						
	Yes		No		Unknown		
	n	Row %	n	Row %	n	Row %	Total
Total	**321**	**13.8%**	**1,532**	**66.0%**	**468**	**20.2%**	**2,321**
Body Part/Mechanism Associated with Cause of Death							
Unknown	39	13.7%	174	61.3%	71	25.0%	284
Head	100	10.4%	708	73.8%	151	15.8%	959
Torso	52	21.7%	129	53.8%	59	24.6%	240
Head and Torso	23	14.9%	108	70.1%	23	14.9%	154
Asphyxia	24	17.1%	76	54.3%	40	28.6%	140
Multiple	53	17.2%	197	63.8%	59	19.1%	309
Other	30	12.8%	140	59.6%	65	27.7%	235
Victim Age Group							
<16	96	23.3%	264	64.1%	52	12.6%	412
16-25	94	15.1%	429	68.9%	100	16.1%	623
26-35	53	14.6%	249	68.6%	61	16.8%	363
36-45	35	10.6%	218	66.1%	77	23.3%	330
≥46	43	7.3%	372	62.7%	178	30.05%	593
Victim Sex							
Male	291	14.6%	1,293	64.9%	408	20.5%	1,992
Female	30	9.1%	239	72.6%	60	18.2%	329
Driver Age Group							
Unknown	4	11.1%	17	47.2%	15	41.7%	36
<16	90	24.5%	238	64.9%	39	10.6%	367
16-25	92	14.6%	434	69.0%	103	16.4%	629
26-35	53	14.5%	252	68.9%	61	16.7%	366
36-45	39	11.9%	214	65.4%	74	22.6%	327
≥46	43	7.2%	377	63.3%	176	29.5%	596
Driver Sex							
Unknown	4	18.2%	9	40.9%	9	40.9%	22
Male	289	14.2%	1,332	65.6%	411	20.2%	2,032
Female	28	10.5%	191	71.5%	48	18.0%	267
Driver Alcohol Use							
Unknown	80	10.2%	451	57.8%	250	32.0%	781
Yes	62	9.8%	472	74.3%	101	15.9%	635
No	179	19.8%	609	67.3%	117	12.9%	905
Victim Location							
Driver	298	14.4%	1,344	64.9%	430	20.8%	2,072
Passenger	23	9.5%	184	75.7%	36	14.8%	243
*Driver or Passenger**	0	0%	4	66.7%	2	33.3%	6
Number of Riders							
Unknown	3	3.1%	16	16.3%	79	80.6%	98
No Passengers (Driver Only)	273	16.2%	1,099	65.1%	317	18.8%	1,689
1+ Passengers	45	8.4%	417	78.1%	72	13.5%	534
Terrain							
Unknown	10	5.3%	72	38.3%	106	56.4%	188
Forest, Woods	25	12.3%	141	69.1%	38	18.6%	204
Desert	27	52.9%	18	35.3%	6	11.8%	51
Vehicle Park, Track	16	53.3%	13	43.3%	1	3.3%	30
Dunes, Beach (Shallow Water)	22	56.4%	11	28.2%	6	15.4%	39
Field, Pasture, Farmland	29	10.1%	179	62.6%	78	27.3%	286
Paved Road	81	10.2%	603	75.6%	114	14.3%	798
Non-paved Road	72	15.1%	345	72.3%	60	12.6%	477
Snow, Ice	10	27.8%	12	33.3%	14	38.9%	36
Lawn, Yard	5	10.4%	35	72.9%	8	16.7%	48
Other	24	14.6%	103	62.8%	37	22.6%	164

Source: U.S. Consumer Product Safety Commission: Directorate for Epidemiology/Division of Hazard Analysis.

*Exact location on the ATV unknown.

IV.B.6: Overturning Events (Table 18)

Table 18 breaks down reported fatalities for victim, incident, and driver characteristics according to whether the ATV overturned. Each body part/mechanism associated with the cause of death had similar proportions for overturning events versus not, with the exception of asphyxia. Asphyxia occurred most often with an ATV overturning (92.1% of asphyxia cause of death). This would be due to the ATV landing on the victim and inhibiting the victim's breathing.

The 16 through 25-year-old victim age group has the lowest proportion of overturning events (50.7%), as compared to the other age groups. The largest proportion of overturning events occurred in the ≥46 victim's age group. However, the unknown overturning events in each age group make any conclusions difficult. Male and female victims had similar proportions of overturning events (60.1% and 63.8%, respectively). The driver's age group and sex have similar results.

The number of riders show similar proportions of overturning events for one rider only and for passengers present (62.5% and 58.8%, respectively). The largest proportions of overturning events occurred on terrains classified as "forest/woods" and "field/pasture/farmland" (77.5% and 75.2%, respectively).

Overturning events occurred in similar proportions in each driver's weight category and according to whether the driver had at least one alcoholic beverage before driving the ATV. Note the large proportion of unknown alcohol usage.

Table 18: Victim and Incident Characteristics by Overturning Events for Reported ATV-Related Fatalities, 2005–2007

	Overturn						
	Yes		No		Unknown		
	n	Row %	n	Row %	n	Row %	Total
Total	**1,407**	**60.6%**	**500**	**21.5%**	**414**	**17.8%**	**2,321**
Body Part/Mechanism Associated with Cause of Death							
Unknown	147	51.8%	51	18.0%	86	30.3%	284
Head	586	61.1%	219	22.8%	154	16.1%	959
Torso	149	62.1%	47	19.6%	44	18.3%	240
Head and Torso	88	57.1%	42	27.3%	24	15.6%	154
Asphyxia	129	92.1%	6	4.3%	5	3.6%	140
Multiple	165	53.4%	86	27.8%	58	18.8%	309
Other	143	60.9%	49	20.9%	43	18.3%	235
Victim Age Group							
<16	266	64.6%	87	21.1%	59	14.3%	412
16-25	316	50.7%	186	29.9%	121	19.4%	623
26-35	224	61.7%	81	22.3%	58	16.0%	363
36-45	189	57.3%	67	20.3%	74	22.4%	330
≥46	412	69.5%	79	13.3%	102	17.2%	593
Victim Sex							
Male	1,197	60.1%	434	21.8%	361	18.1%	1,992
Female	210	63.8%	66	20.1%	53	16.1%	329
Number of Riders							
Unknown	37	37.8%	2	2.0%	59	60.2%	98
No Passengers (Driver Only)	1,056	62.5%	352	20.8%	281	16.6%	1,689
1+ Passengers	314	58.8%	146	27.3%	74	13.9%	534
Terrain							
Unknown	69	36.7%	12	6.4%	107	56.9%	188
Forest, Woods	158	77.5%	21	10.3%	25	12.3%	204
Desert	28	54.9%	3	5.9%	20	39.2%	51
Vehicle Park, Track	21	70.0%	5	16.7%	4	13.3%	30
Dunes, Beach (Shallow Water)	20	51.3%	11	28.2%	8	20.5%	39
Field, Pasture, Farmland	215	75.2%	37	12.9%	34	11.9%	286
Paved Road	420	52.6%	250	31.3%	128	16.0%	798
Non-paved Road	313	65.6%	113	23.7%	51	10.7%	477
Snow, Ice	19	52.8%	6	16.7%	11	30.6%	36
Lawn, Yard	32	66.7%	13	27.1%	3	6.3%	48
Other	112	68.3%	29	17.7%	23	14.0%	164
Driver Age Group							
Unknown	17	47.2%	2	5.6%	17	47.2%	36
<16	233	63.5%	83	22.6%	51	13.9%	367
16-25	322	51.2%	185	29.4%	122	19.4%	629
26-35	227	62.0%	85	23.2%	54	14.8%	366
36-45	194	59.3%	63	19.3%	70	21.4%	327
≥46	414	69.5%	82	13.8%	100	16.8%	596
Driver Sex							
Unknown	7	31.8%	3	13.6%	12	54.6%	22
Male	1,234	60.7%	444	21.9%	354	17.4%	2,032
Female	166	62.2%	53	19.9%	48	18.0%	267
Driver Weight							
Unknown	712	58.0%	269	21.9%	247	20.1%	1,228
<100 lbs.	36	70.6%	9	17.7%	6	11.8%	51
100-149 lbs.	118	59.6%	45	22.7%	35	17.7%	198
150-199 lbs.	286	65.2%	99	22.6%	54	12.3%	439
200+ lbs.	255	63.0%	78	19.3%	72	17.8%	405
Alcohol							
Unknown	420	53.8%	136	17.4%	225	28.8%	781
Yes	413	65.0%	143	22.5%	79	12.4%	635
No	574	63.4%	221	24.4%	110	12.2%	905

Source: U.S. Consumer Product Safety Commission: Directorate for Epidemiology/Division of Hazard Analysis.

Section V: Discussion

V.A: ATV-Related Injuries Versus Consumer Product-Related Injuries

Table 19 compares ATV-related emergency department-treated injuries from this study to all other consumer product-related, emergency department-treated injuries from January 2010 through August 2010. Note that all comparisons show that there are differences in the distribution of each variable for the study versus all other consumer product-related injuries. The majority of injuries from the study occurred to victims younger than 35 years of age, while all other consumer products saw the majority of injuries to those younger than 16 and ≥46 years old. In this study, most injuries were associated with males (69.4%), while consumer product-related injuries were associated overall with 53.9 percent males. Thus, ATV-related injuries affect a different age population and affect a specific sex than do consumer products in general.

After collapsing the categories for body part in the remainder of NEISS to match the body parts that were used in the study, the study results have a similar proportion of injuries to each of the three categories, while the results for all consumer product-related injuries show that the largest proportion of injuries were to the extremities (50.7%), followed by the head (29.5%), and then the torso (19.8%). This shows that torso injuries represent a larger hazard in ATV-related injury victims than in consumer product-related injuries in general.

A majority of injuries (50.7%) in the study were diagnosed as contusions/abrasions or fractures, while results for all consumer product injuries show a fairly even distribution across all diagnoses, with the exception of internal injuries. The study results show a smaller proportion of victims being treated and released for ATV-related injuries than results for all consumer product-related injuries (87.5% versus 92.6%). The “Other” dispositions includes treated and admitted, treated and transferred, held for observation, left without being seen, and fatality.

Note that the sample size of all consumer products injuries recorded in the NEISS for this time frame is very large. Thus, differences can be detected statistically when there are only small differences. It is up to the analyst to determine whether these differences constitute a practical difference. In the case of the results in **Table 19**, the differences in age group, sex, body part, and diagnosis identify a hazard patterns that are specific to ATVs versus all other consumer products. The differences in disposition were smaller and may not have practical implications.

Table 19: Comparison of Victim Characteristics for ATV-Related Injuries from this Study Versus All Other Consumer Product-Related Injuries, January 2010–August 2010

	Domain							Rao-Scott χ^2 p-value (adjusted χ^2 p-value)
	ATV Study (in-scope only)				*All Consumer Product Related Injuries (includes out-of-scope observations from study)*			
	n	Estimate*	Column %		n	Estimate*	Column %	
Total	**523**	**71,800**	**100%**		**271,472**	**9,814,600**	**100%**	
Age Group								
<16	169	18,500	25.8		112,489	3,253,800	33.2	<0.0001 (<0.0001)
16-25	122	19,200	26.7		41,410	1,586,200	16.2	
26-35	109	17,400	24.2		27,920	1,148,400	11.7	
36-45	57	8,700	12.1		22,998	970,500	9.9	
≥46	66	8,000	11.2		66,655	2,855,600	29.1	
Sex								
Male	380	49,800	69.4		149,622	5,292,400	53.9	<0.0001 (<0.0001)
Female	143	22,000	30.6		121,856	4,522,200	46.1	
Body Part								
*Torso***	168	24,300	34.1		47,148	1,877,700	19.8	<0.0001 (<0.0001)
Extremities	209	27,500	38.5		129,050	4,803,200	50.7	
Head	142	19,500	27.4		84,859	2,796,200	29.5	
Diagnosis								
Contusions/Abrasions	131	19,800	27.5		45,347	1,723,800	17.6	<0.0001 (<0.0001)
Fracture	131	16,600	23.2		39,773	1,404,900	14.3	
Laceration	55	7,600	10.6		54,653	1,954,400	19.9	
Internal Injury	74	9,100	12.7		28,921	896,600	9.1	
Strain/Sprain	75	10,700	14.9		46,230	1,781,900	18.2	
Other	57	7,900	11.0		56,560	2,053,300	20.9	
Disposition								
Treated and Released	446	62,800	87.5		249,788	9,086,600	92.6	0.0004 (0.0004)
Other	77	8,900	12.5		21,696	728,200	7.4	

*CVs for the study are reported in Section III. CV's for estimates of all consumer products range from 0.06 to 0.10.

**Note that for the NEISS body part designations as "all parts of the body (more than 50% of body) were placed in the torso category for this analysis. This constitutes a very small portion of cases, and changes to this would not change to the overall results.

V.B: ATV-Related Injuries Versus ATV-Related Deaths

Section III of this report analyzed the results of the NEISS special study for ATV-related, emergency department-treated injuries; and Section IV analyzed reported fatalities occurring from 2005 through 2007. In Section III, hazard patterns and victim characteristics associated with injuries were not necessarily the same as those for fatalities. The remainder of this section considers the similarities and differences found in the hazard patterns and victim characteristics between fatalities and injuries.

The comparisons between injuries and fatalities include variables related to victim characteristics, driver characteristics, and incident characteristics. Comparisons were completed by considering the proportions of injuries or fatalities across different variables and displayed in this section via bar graphs (**Figure 1**). Note that while injuries constitute a statistical sample and the resulting estimates represent all U.S. ATV-related, emergency department-treated injuries that were in scope for this study, fatalities do not represent a statistical sample, and the results should only be interpreted as fatalities that have been reported to CPSC staff. Thus, caution should be used when making any comparisons. The goal here is to understand hazard patterns that were similar across injuries and fatalities or to identify hazard patterns that might be unique to injuries or fatalities. The goal of this section is not to create statistically valid analyses. The comparisons can be difficult, due to the different nature of the data collected for deaths as compared to injuries.

As noted in previous sections, victim and driver age group and sex distributions were similar for injuries, and similar for fatalities. When comparing injuries and fatalities, the victim's age group and sex will be discussed but not the driver's. However, both victim and driver comparisons are displayed in the following graphs. Victim's age group distribution for injuries has similar proportions for age groups of 35 years or less, while fatalities have the largest proportions in the 16 through 25-year-old age group and the ≥46 age group. Victim's sex distributions were similar for injuries and deaths, although the males have a slightly larger proportion for deaths as compared to injuries.

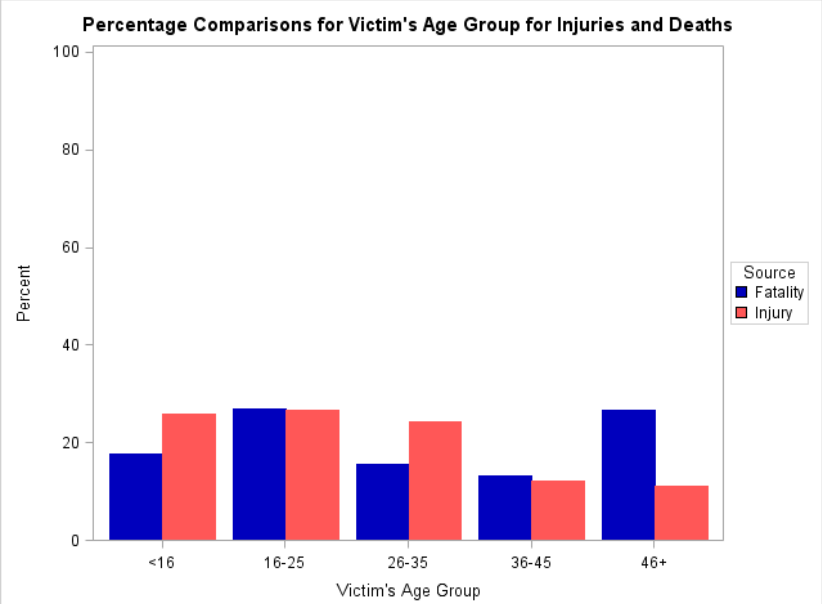
At first glance, the proportion of injuries related to helmet use seems higher than for fatalities related to helmet use. However, there is a fairly large proportion of unknown helmet use for fatalities, making comparisons of helmet use between deaths and injuries difficult. The injured body parts (or mechanism for fatalities) follow different patterns for injuries than fatalities. For injuries, the largest proportion of injuries consists of injuries to the extremities, while head injuries represent, by far, the largest proportion for fatalities. The distributions of victim's location on the ATV were similar for injuries and fatalities. The driver was the victim most often for both injuries and fatalities.

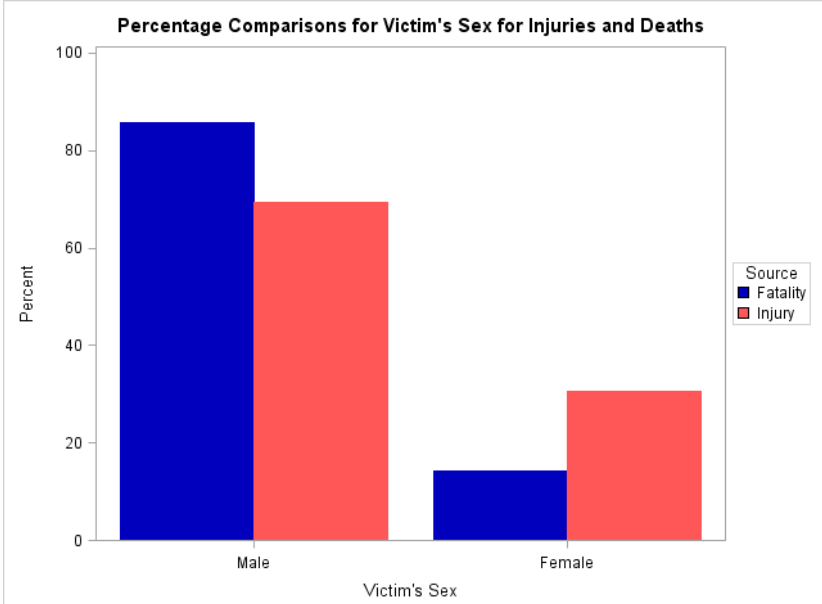
The distributions for driver's characteristics among deaths and injuries show similarities and some differences. The driver's weight distribution follows a similar pattern for injuries and fatalities; however, the driver's weight is unknown for a large proportion of fatalities, making comparisons difficult. The driver was reported to have had at least one alcoholic beverage much more often for reported fatalities than for injuries. There are a large proportion of unknowns for fatalities; however, no matter how they would be distributed if known, the proportion of deaths related to the driver's alcohol use is larger than the proportion of estimated injuries based on reported alcohol use. For comparisons of the driver's age group and sex, see the description of victim's age group and sex.

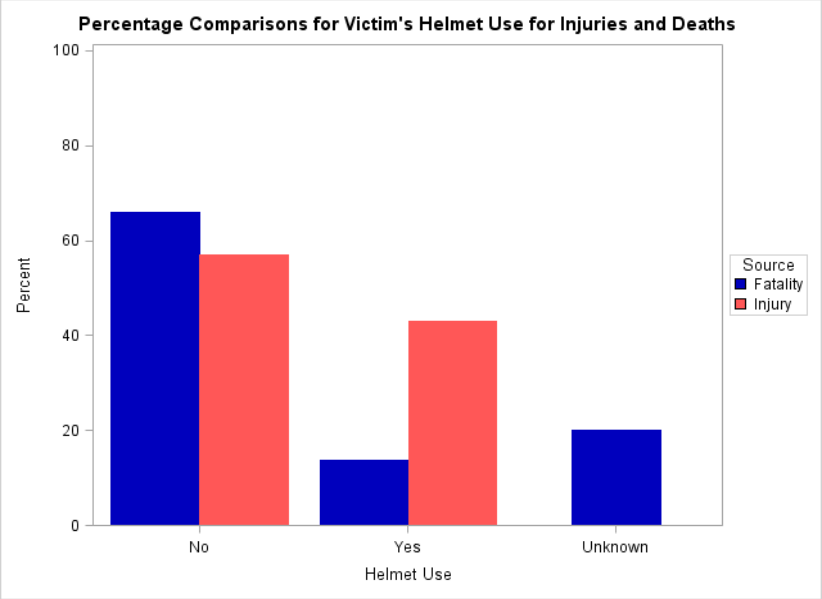
The proportions of injuries and deaths are similar for riding with passengers and also for overturning events. Around 60 percent of both deaths and injuries were associated with an overturning event. Differences were noticed in the location for injuries versus deaths and in the hazard pattern. The

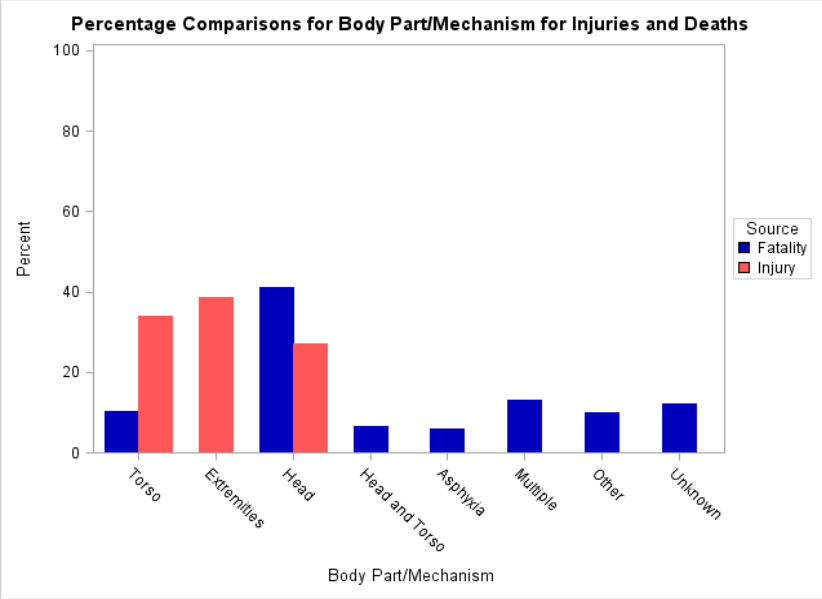
location of the incident shows that paved surfaces were related to a much larger proportion of deaths than injuries.

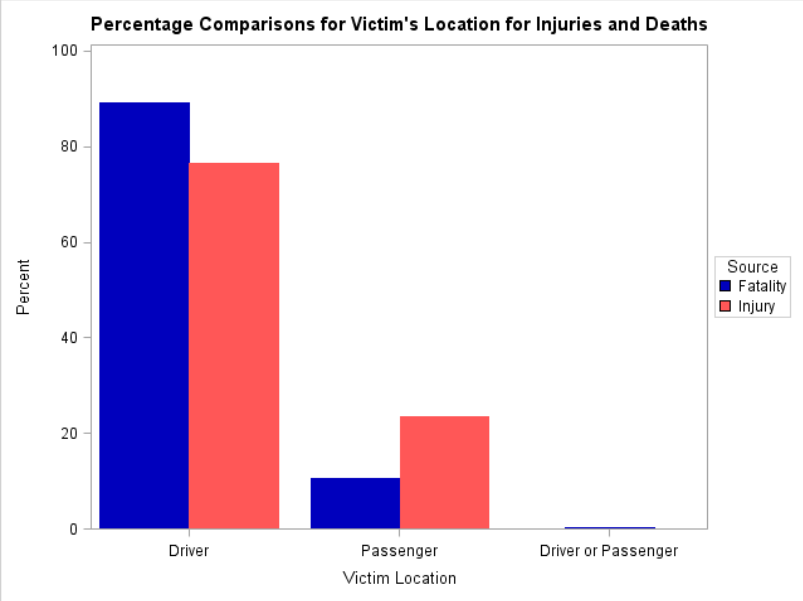
Figure 1: Comparisons of Proportions for Victim, Driver, and Incident Characteristics of ATV-Related Fatalities Versus Injuries

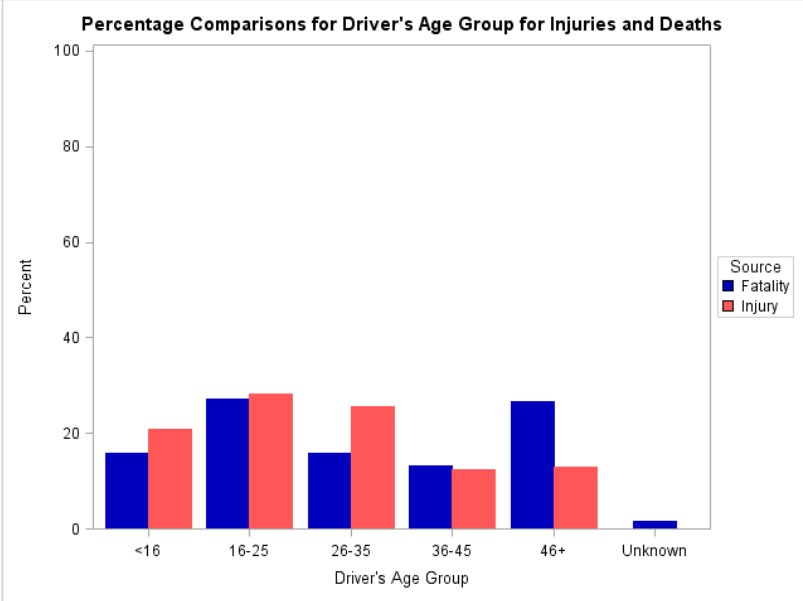


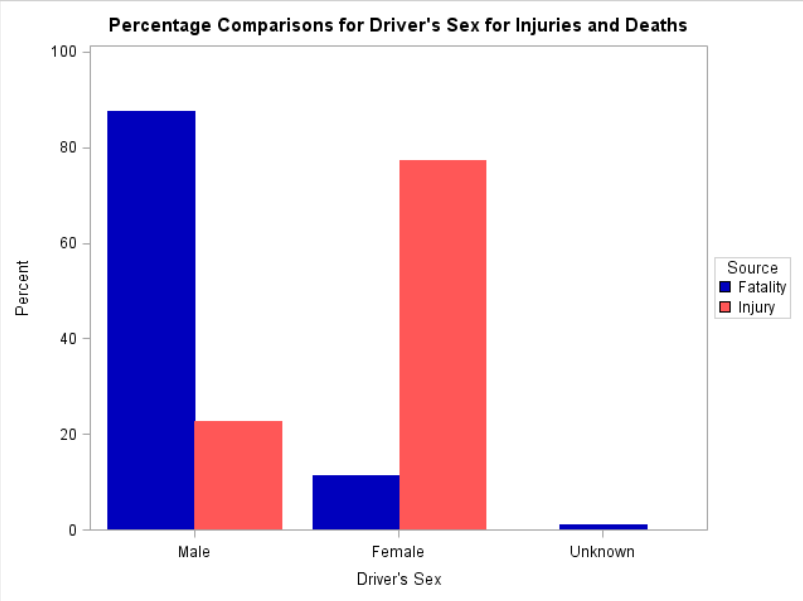


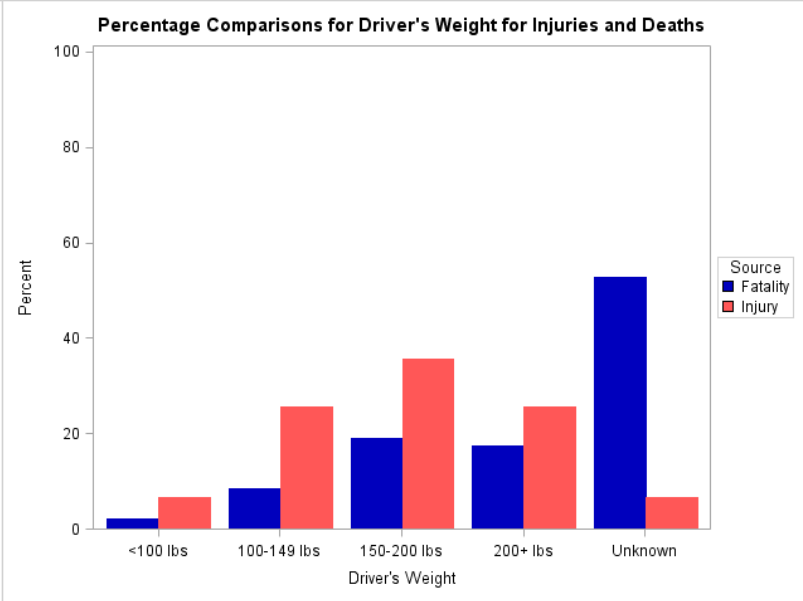


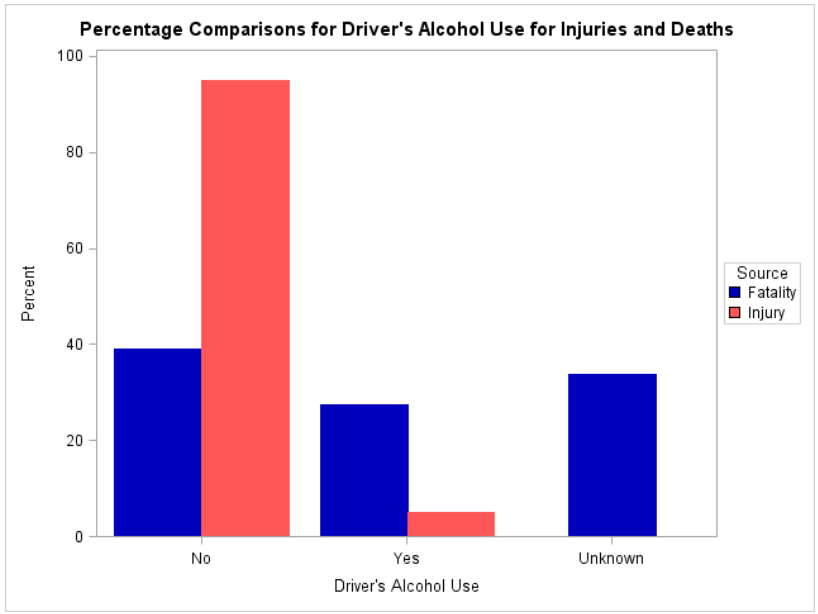


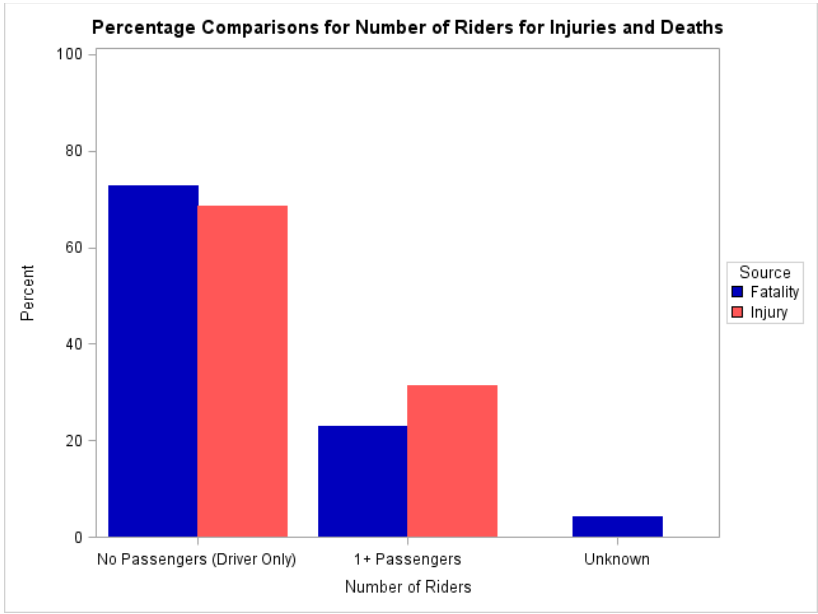

Percentage Comparisons for Victim's Location for Injuries and Deaths
Percent
100
80
60
40
20
0
Driver
Passenger
Driver or Passenger
Victim Location
Source
Fatality
Injury

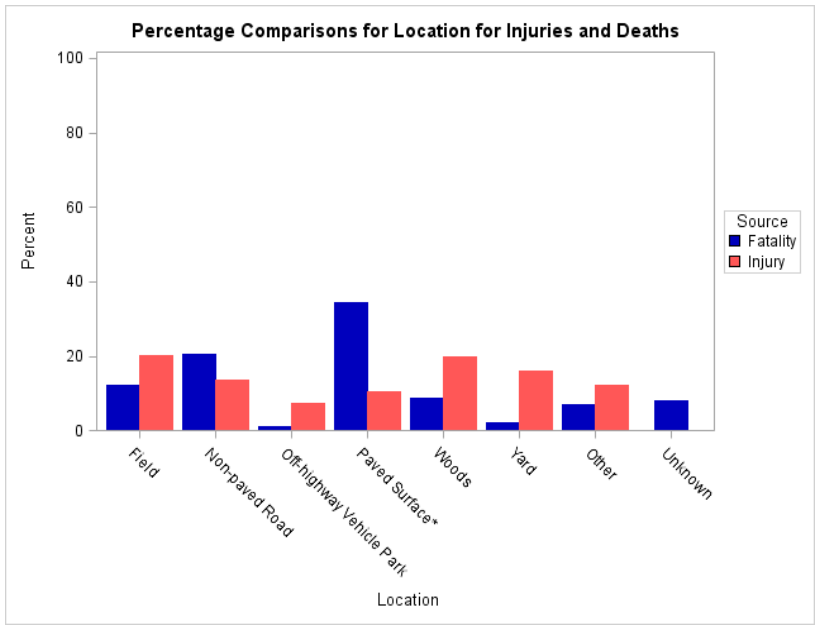

Percentage Comparisons for Driver's Age Group for Injuries and Deaths
Percent
100
80
60
40
20
0
<16
16-25
26-35
36-45
46+
Unknown
Driver's Age Group
Source
Fatality
Injury

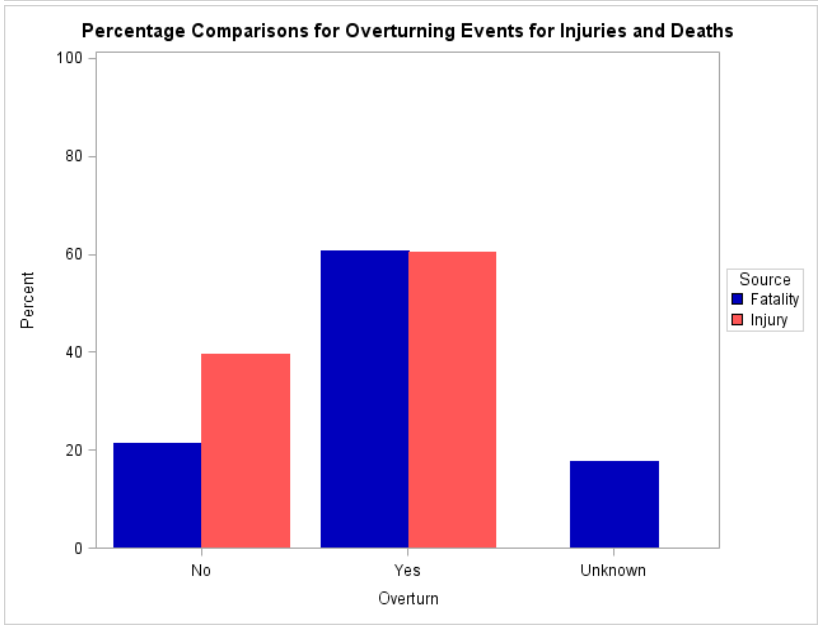

Percentage Comparisons for Driver's Sex for Injuries and Deaths
Percent
100
80
60
40
20
0
Male
Female
Unknown
Driver's Sex
Source
Fatality
Injury


Percentage Comparisons for Driver's Weight for Injuries and Deaths
Percent
100
80
60
40
20
0
<100 lbs
100-149 lbs
150-200 lbs
200+ lbs
Unknown
Driver's Weight
Source
Fatality
Injury


Percentage Comparisons for Driver's Alcohol Use for Injuries and Deaths
Percent
100
80
60
40
20
0
No
Yes
Unknown
Driver's Alcohol Use
Source
Fatality
Injury


Percentage Comparisons for Number of Riders for Injuries and Deaths
Percent
100
80
60
40
20
0
No Passengers (Driver Only)
1+ Passengers
Unknown
Number of Riders
Source
Fatality
Injury


Percentage Comparisons for Location for Injuries and Deaths
Percent
100
80
60
40
20
0
Field
Non-paved Road
Off-highway Vehicle Park
Paved Surface*
Woods
Yard
Other
Unknown
Location
Source
Fatality
Injury


Percentage Comparisons for Overturning Events for Injuries and Deaths
Percent
100
80
60
40
20
0
No
Yes
Unknown
Overturn
Source
Fatality
Injury

Section VI: Methodology

VI.A: Analysis Methodology for NEISS Special Study on ATV-Related Injuries

Follow-up surveys were attempted for all injuries recorded in NEISS from January 1, 2010 to August 31, 2010, that were reported to involve an ATV or UTV.[11] A total of 668 follow-up surveys were completed by CPSC contractors of the 2,018 injuries recorded in NEISS in the specified period where the product involved was identified as an ATV or UTV. The response rate of this survey is 33 percent. The nonresponse is attributed to a lack of a subject's contact information, the inability to make contact with a subject who had contact information available, or a subject's refusal to participate. Post-stratification was implemented to reduce nonresponse bias due to differences in sex, age category (<16, 16-25, 26-35, 36-45, and ≥46 years of age), and stratum. [4] [5] [6]

While unit nonresponse was handled by raking, hot deck imputation was implemented to handle the item nonresponse. Most questions in this study were multiple-choice questions. When a "Don't Know" or "Refused" response was indicated, this created an item nonresponse, or an "Unknown" response. In the analysis of the survey, if a question had less than 16 "Unknown" responses, these responses were imputed using closest neighbor imputation methods. [7]

For this study, only ATVs (excluding UTVs) that were in operation, where the victim was the driver or passenger on the ATV at the time of the incident, are of interest. Because the survey included a larger scope, domain analysis was used to ensure the design structure of survey was maintained while analyzing this subpopulation. Victims injured while on an operational ATV were placed in an in-scope domain, while all other victims, nonoperational incidents, and other types of vehicles excluded from the results of this study, were placed in an out-of-scope domain.

To ensure the variance estimates were calculated correctly, based on the design of NEISS and this survey, all hospitals (Primary Sampling Units in NEISS) in each stratum needed to be accounted for in the analysis. One observation was created with "fake" data for each hospital and classified in the out-of-scope domain for this study. That is, each of the created observations received a weight of 0.0001, a value for each variable of interest, and was place in the out-of-scope domain. Thus, the data generated did not affect the results of interest other than to aid in making correct variance calculations incorporating the design effect.

Variance estimates were obtained via the Taylor Series method. Due to the raking and the imputation methods, there could be problems with the Taylor Series method, where sources of variation are ignored. To check for this problem, a bootstrap method was used to test the variance estimates. The results indicated that the Taylor Series method was comparable to the resampling method. Thus, the Taylor Series method was used for all variance calculations.

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[11] CPSC staff considers an ATV to be an off-road, motorized vehicle having three or four low-pressure tires, a straddle seat for the operator, and handlebars for steering control. Off-road motor vehicles having steering wheels and either bench or bucket seats (*e.g.*, golf carts, dune buggies, recreational off-highway vehicles (ROVs), and certain types of utility vehicles), are not categorized as ATVs by CPSC staff, and may or may not be classified as a UTV.

All emergency department-treated injury estimates were rounded to the nearest hundred; thus, not all parts of the tables will sum to the total estimated injuries. Percentages were based off the raw estimates, not the rounded estimates. [8]

During data analysis, the analyst, on a case-by-case need, handled corrections to data entry problems. Categories were collapsed by the analyst based on low response rates. Categories labeled "Other" were analyzed and expanded into more categories that were deemed appropriate. For this study, classifications of youth ATVs were based on the engine size (cubic centimeters). This is an older classification system for youth ATVs, but data collection was completed near the time of the change of the classification system.[12] It is assumed that most of the ATVs involved in the incidents were ATVs classified under the older system. In addition, the information collected does not provide information for the classification of youth ATVs under the new system.

The p-values provided are from the Rao-Scott chi-square test for association between the two variables of interest, which accounts for the survey's design. Raw p-values are provided in the results, as well as the multiple-comparisons adjusted p-values, which were adjusted based on the step-down Bonferroni method. The results and discussion sections were based on the adjusted p-values.

VI.B: Analysis Methodology for ATV-Related Deaths Study

The CPSC's 2011 All-Terrain Vehicle Deaths (ATVD 2011) database consists of all ATV-related fatalities reported to CPSC staff through December 31, 2011. Characteristics of the victim, driver, and incident are captured for each fatality recorded in the ATVD. For further information about the variables available in the ATVD, see [9]. Note that the fatalities do not represent a statistical sample. Thus, results and conclusions drawn from the analysis of ATV-related fatalities should only be considered for those reported fatalities, and cannot be generalized to all ATV-related fatalities. Although, based on a comparison of the number of reported fatalities and the estimated number of fatalities that was based on the capture-recapture methodology, the number of reported fatalities is close to the estimated totals. Thus, there is a strong argument that the hazard patterns, victim, and driver characteristics captured in the ATVD are fairly representative of the overall picture of ATV-related fatalities. [1]

Since the years 2008 through 2011 are considered years where reporting is ongoing (see [1]), this report uses records where the year of death is 2005 through 2007, the three most recent years where reporting is considered complete. A 3-year span was considered to be more representative of the hazard patterns, victim, and driver characteristics for ATV-related deaths. However, when considering each of these years separately, each year had similar results. Only fatalities to the driver or passenger of the ATV were considered in scope for this analysis. Bystanders and drivers of other vehicles were excluded. Fatalities that involved a nonoperational ATV were excluded. Thus, totals for the years 2005 through 2007 may not match totals reported for these years in the ATV annual reports.

[12] The old classification system of youth versus adult ATVs is based on the engine size of the ATV. The current classification system of youth versus adult ATVs is based on the maximum speed of the ATV.

For this study, classifications of youth ATVs were based on the engine size (cubic centimeters). This is an older classification system for youth ATVs, but data collection was completed near the time of the change of the classification system. It is assumed that most of the ATVs involved in the incidents were ATVs classified under the older system. In addition, the information collected does not provide information for the classification of youth ATVs under the new system, which is based on maximum speed of the vehicle.

Additional analysis variables were created using information in ATVD, as needed. Age groups were created for the victims and drivers to match those in the injury analysis sections. Text searches for the cause of death were performed, and a body part/mechanism variable was created. Two of the categories for body part/mechanism for deaths parallel the body part values in the injury analysis section: head and torso. Cause of death listed as craniocerebral, subdural, neck, brain, *etc.*, are all listed as the head, which also includes neck injuries. The torso includes any part of the body that is below the neck, from the shoulders to the pelvis. Causes of death listed as trunk, spleen, pelvis, and chest are examples of those classified as the torso. Because the cause of death included other possibilities that did not fit into one of these three categories, five additional categories were created for fatalities: head and torso, multiple, asphyxia, other, and unknown. An example of head and torso injuries would be a cause of death listed as blunt force trauma to the head and chest. If both the head and torso were listed in the cause of death, then the body part is listed as head and torso. When the cause of death is listed as multiple blunt force trauma, or something similar, without listing a body part or parts, then the body part is identified as multiple. This category should be interpreted with this in mind. Mechanical or compressional asphyxia were common causes of deaths among ATV-related fatalities. Many were related to the torso; however, a small number involve the neck. Because this is potentially a hazard pattern separate from the other injury types, a category for asphyxia was created. Because this is not an actual body part but is instead a mechanism of death, the variable is referred to as body part/mechanism associated with the cause of death. The “other” category captures causes of death that were not specific about body part, such as blunt traumatic injuries or blunt force trauma or that have a small number of records, such as thermal injuries or exsanguination. Other entries for variables in the ATVD were cleaned and categorized by the analyst on an as needed basis.

VII. Works Cited

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