United States
Consumer Product Safety Commission

2023 Report of Deaths and Injuries Involving Off-Highway Vehicles with More than Two Wheels

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This report was prepared by the CPSC staff. It has not been reviewed or approved by, and may not necessarily reflect the views of, the Commission.

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Executive Summary

Reported Off-Highway Vehicle Related Fatalities

- CPSC staff is aware of 2,448 deaths associated with Off-Highway Vehicles (OHVs) that resulted from 2,384 incidents during the 3-year period from 2018 through 2020. As of September 2023, CPSC considers the year 2020 to be the most recent, complete year of reported fatalities.

- Of those 2,448 reported OHV-related deaths, CPSC staff associates 1,643 with all-terrain vehicles (ATVs), 635 with recreational off-highway vehicles (ROVs), and 56 with utility terrain vehicles (UTVs). For the remaining 114 deaths, CPSC staff does not know the vehicle classification, but concluded the vehicle involved was either a ROV or a UTV.

- Reported fatalities were distributed among these age groups, as follows: under 12 (5%), 12–15 (7%), 16–24 (15%), 25–34 (15%), 35–44 (14%), 45–54 (14%) and 55+ (30%).[1]

- Most of the 2,448 decedents were male (82%); 18% were female.[2]

- The most common fatality hazards associated with OHV-related deaths were overturns and collisions (with another vehicle or a stationary object, like a tree). OHV occupant(s) were frequently ejected in these types of incidents.

- There was a 33% increase in OHV-related deaths reported to CPSC for 2020 compared to 2019, from 744 to 990.

Off-Highway Vehicle-Related Emergency Department-Treated Injury Estimates

- Over the full 5-year period from 2018 through 2022, there were an estimated 504,400 emergency department-treated injuries in the United States that were associated with OHVs. This corresponds to an annual average of around 100,900 emergency department-treated injuries over the period.

- From 2018 to 2022, the estimated yearly rate of emergency department-treated, OHV-related injuries ranged from around 28–34 injuries per 100,000 people.

- There was no statistically significant evidence of a linear trend in estimated injuries for the 5-year period; however, there was a significant increase in estimated injuries between 2019 and 2020.

[1] There were 11 deaths among the 2,448 total where the victim's age was unknown.
[2] There were 6 deaths among the 2,448 total where the victim's gender was unknown.

- Estimated injuries were distributed among these age groups, as follows: under 12 (13%), 12–15 (14%), 16–24 (22%), 25–34 (19%), 35–44 (13%), 45–54 (9%) and 55+ (9%).

- Both 2020 and 2021 saw a rise in more serious injuries (cases that were admitted or treated and transferred to another hospital) when compared with the 2 previous years, 2018 and 2019. As noted in the previous report, the increase from 2019 to 2020 was statistically significant (p-value < 0.01), while the increase from 2020 to 2021 was not (p-value = 0.80). However, hospitalizations appeared to again decline from 2021 to 2022, although this year-to-year decrease was not statistically significant (p-value = 0.39). Overall, there was no statistically significant evidence of any linear trend in the estimated number of hospitalizations during the 5-year period.

In the most recent year's (2022) estimate for emergency department-treated injuries associated with OHVs, for all ages:

- The most common diagnoses were fractures (29%), contusions/abrasions (18%), and internal organ injuries (16%).
- The most common primary injured body parts were the head and neck (35%), the arms (shoulders to fingertips, 27%), the torso (19%), and the legs (17%).
- Most of the injured were males (68%); about one-third (32%) were females.
- Most were treated and released (76%) or hospitalized (21%).

2022 Special Study on OHV-Related Emergency Department-Treated Injuries

- By following up on on OHV-related NEISS injury cases from 2022, staff were able to obtain complete responses that provided additional information for 132 injury cases.

- Based on the information provided by the injury victims in the special study, staff computed a more refined injury estimate of 90,400 for 2022, compared to 94,700 in the original NEISS sample, which is based on information from the hospital medical record.

- ROVs and UTVs accounted for 28% of estimated injuries in the special study, compared to 14% of injuries based on NEISS product code classification.

- The OHV overturned in 66% of injuries, and the victim was ejected in 70% of injuries.

- Seventy-six percent of injuries involved the OHV driver, while 22% of injuries were to passengers.

- The victim reported wearing a helmet in 41% of injuries.

- Most (69%) injuries occurred on flat terrain, and 79% of injuries occurred on dry terrain.

Introduction

This report presents information collected by U.S. Consumer Product Safety Commission (CPSC) staff on deaths and injuries associated with the use of off-highway vehicles (OHVs) with more than two wheels. These OHVs can be defined in three different categories: All-Terrain Vehicles (ATVs), Recreational Off-Highway Vehicles (ROVs) or Utility Terrain Vehicles (UTVs). These three classifications of OHVs are described in further detail below.

ATVs within the scope of this report are defined as off-road, motorized vehicles with three or more low-pressure tires, a straddle seat for the operator, and handlebars for steering control. ROVs and UTVs have many similarities; they are both off-road vehicles with four or more tires. They differ from ATVs in that both ROVs and UTVs have non-straddle or "side-by-side" seating, automotive-type controls for steering, throttle and braking (*i.e.*, a steering wheel and pedals).[3]

For this report, ROVs are defined as motorized vehicles designed for off-highway use with the following features: four or more pneumatic tires designed for off-highway use; bench or bucket seats for two or more occupants; automotive-type controls for steering, throttle and braking; and a maximum vehicle speed exceeding 30 miles per hour (mph). ROVs are also equipped with rollover protective structures (ROPS), seatbelts and other restraints—like doors, nets and shoulder barriers—to help protect its occupants. (ROV NPR, 79 *Fed. Reg.* 68,964, November 19, 2014).

For this report, UTVs are defined very similarly to ROVs; however, their maximum speed does not exceed 25-30 mph, and compared to ROVs, they are generally equipped with larger cargo beds and may not always be equipped with ROPS, seatbelts, and other safety restraints.

In the late 1980s, the major ATV distributors agreed to stop distributing three-wheel ATVs. More recently, the Consumer Product Safety Improvement Act of 2008 enacted a statutory prohibition on the importation and distribution of new three-wheel ATVs in the United States (U.S. CPSC, 2008). Some ATVs, ROVs, and UTVs are sold with more than four wheels (either 5 or 6), but they have always held a very small proportion of the overall OHV market share. As such, almost all ATVs, ROVs, and UTVs currently in use are four-wheeled vehicles.

The purpose of this report is to present information regarding deaths and injuries involving the various types of OHVs (ATVs, ROVs, and UTVs). National estimates of U.S. hospital emergency department-treated injuries related to OHVs have been computed for the years 2018 through 2022. In addition, preliminary results from the special study mentioned in previous annual reports are presented for the year 2022. This report does *not* cover deaths and injuries related to all vehicles with off-road capability. For example, dune buggies, sand rails, golf carts, licensed motor vehicles (*i.e.*, sport utility vehicles, jeeps), and two-wheeled OHVs (*i.e.*, dirt bikes, off-road motorcycles) are all excluded[4] from the analyses and discussion that follow.

[3] Definition from ANSI/ROHVA 1 *American National Standard for Recreational Off-Highway Vehicles*.

[4] All incidents involving collisions or other interactions with OHVs, as defined above, are included, regardless of the type of the other vehicle involved.

Off-Highway Vehicle Fatalities[5]

This section provides an overview of OHV-related incidents occurring between 2018 and 2020 that resulted in one or more fatalities. Data are obtained from the Consumer Product Safety Risk Management System[6] (CPSRMS). It should be noted that CPSRMS data are considered anecdotal, and data collection is ongoing. Among the various types of reports included in CPSRMS are death certificates from the 50 states and the territories. Since there is generally a lag time of around 2 to 3 years between date of death and the date that the incident is reported to CPSC, staff considers the latest 3 years of data (2021–2023) to be incomplete, and thus, staff excluded those years from this report. This report provides an analysis of deaths that occurred between 2018 and 2020, the latest available 3 years with complete or nearly complete data.

As data in CPSRMS is considered anecdotal, for this section of the report, all references to fatal incidents or deaths should be assumed to be fatal incidents or deaths from fatal incidents "reported to CPSC."

Reported Deaths

As of September 2023, CPSC staff received reports of 2,384 fatal off-highway vehicle-related incidents that occurred during the 3-year period between 2018 and 2020, which resulted in 2,448 deaths. In rare cases, due to the delayed occurrence of death from injuries sustained during an OHV-related incident, the year that the incident occurred may precede the year of death. Since some incidents involve multiple fatalities, the total number of fatal *incidents* is less than the total number of *deaths*. Table 1 presents the current count of reported fatal OHV-related incidents by vehicle classification,[7] as detailed in the Introduction section.

Several in-scope fatalities from 2018 that were counted in the 2021 annual report were mistakenly excluded from the 2022 annual report. Additionally, many new OHV-related death certificates from 2018 were received by CPSC in late 2022. As such, all OHV-related fatal incidents that occurred in 2018 were re-analyzed to provide updated accurate counts for that year. The distribution of vehicle classifications for 2018 may still be subject to slight changes, as death certificates for 2018 were received by CPSC as recently as September 2023.

Three fatal incidents that occurred in 2019 were later determined to be out of scope; one such incident actually involved a motor vehicle customized for off-roading, another involved a dirt

[5] Staff includes in this report all reported fatal incidents involving a collision of an OHV (ATV, ROV, and/or UTV), even if the occupant(s) of the OHV survived, if at least one person, such as a pedestrian bystander or an occupant of another type of vehicle (*e.g.*, bicycle, dirt bike), suffered fatal injury. Several single fatality incidents reported collision of both an ATV and ROV, but staff allocated these incidents only to the classification corresponding to the type of vehicle occupied by the deceased, to ensure mutual exclusivity and correct incident totals.

[6] Fatal injury cases from the National Electronic Injury Surveillance System (NEISS) are also included in the CPSRMS database. See Appendix A for more information on reporting sources for fatal incidents included in CPSRMS.

[7] Staff classified fatalities reported as an "ATV," absent further information collection, as ATVs—although staff is aware that this descriptor, as mentioned in death certificates, MECAP reports or other sources, is not always accurate. Thus, some of the "ATV" fatalities classified in this report may have actually involved other type(s) of OHVs. Most of the incidents classified specifically as ROVs, UTVs, or "Unknown (ROV or UTV)" were so classified with the benefit of an in-depth investigation (IDI) and review in collaboration with CPSC engineering staff. Some combination of incident information collected, such as VIN, vehicle make and model, photographs, and/or other descriptions supported these determinations.

bike, and the fatality in another was determined to be unrelated to the ATV being operated. No new OHV-related fatalities in 2019 have been reported in CPSRMS since last year's report.

Finally, the vehicle classifications for the most recent year analyzed (2020) may also change in the future, as additional information regarding the vehicles involved becomes available.

Table 1: Reported Fatal Incidents Associated with Off-Highway Vehicles by Vehicle Classification and Incident Year, 2018–2020

	Vehicle Classification				
Year	**ATV**	**ROV**	**UTV**	**Unknown (ROV or UTV)**	**Total Fatal OHV Incidents**
2018	488	168	17	24	**697**
2019	494	183	18	28	**723**
2020	633	254	21	56	**964**
Total	**1,615**	**605**	**56**	**108**	**2,384**

Source: CPSRMS.

As mentioned, a single OHV-related incident may result in multiple fatalities. This was the case for at least 60 of the 2,384 reported fatal incidents (3%), of which 57 were double fatalities, 2 were triple fatalities, and 1 was a quadruple fatality. Table 2 presents the distribution of reported incidents involving multiple fatalities by vehicle classification for the entire 3-year period. An in-depth investigation revealed that one ATV-related double fatality in 2018 actually involved a dune buggy, which is out of the scope of this review; the counts below have been adjusted accordingly.

Table 2: Incidents Associated with OHVs Involving *Multiple* Reported Fatalities by Vehicle Classification and Number of Deaths Per Incident, 2018–2020

	Vehicle Classification				
Number of Fatalities Per Incident	**ATV**	**ROV**	**UTV**	**Unknown (ROV or UTV)**	**Total Multiple Fatality Incidents**
2 (Double Fatality)	26	26	0	5	**57**
3 (Triple Fatality)	1	1	0	0	**2**
4 (Quadruple Fatality)	0	0	0	1	**1**
Total	**27**	**27**	**0**	**6**	**60**

Source: CPSRMS.

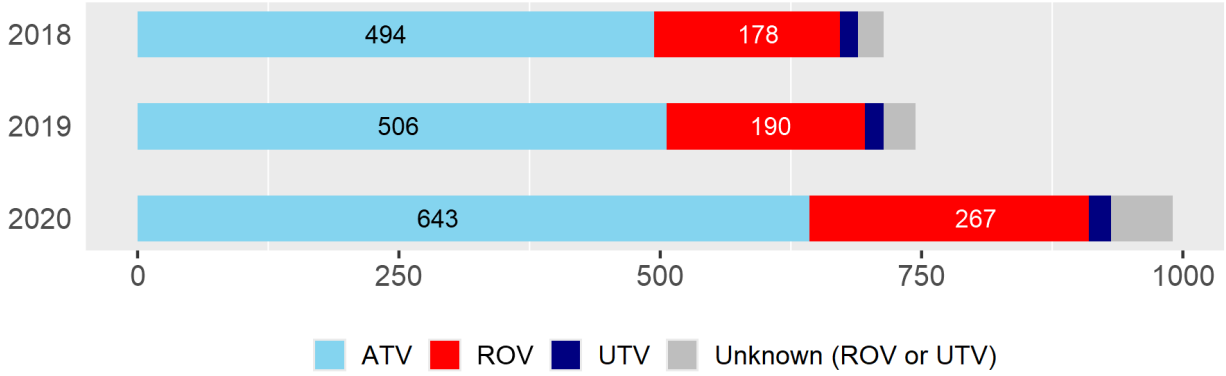
Table 3 and Figure 1 present the breakdown of reported OHV-related *fatalities* by incident year and vehicle classification, accounting for the multiple-fatality incidents presented in Table 2.

Table 3: Reported Total Deaths Associated with Off-Highway Vehicles by Vehicle Classification and Incident Year, 2018–2020

	Vehicle Classification				
Year	**ATV**	**ROV**	**UTV**	**Unknown (ROV or UTV)**	**Total Deaths**
2018	494	178	17	25	**714**
2019	506	190	18	30	**744**
2020	643	267	21	59	**990**
Total	**1,643**	**635**	**56**	**114**	**2,448**

Source: CPSRMS.

Figure 1: Reported OHV-Related Fatalities by Vehicle Classification and Incident Year, 2018–2020



Source: CPSRMS.

Reported Deaths by Incident State

Table 4 lists both the total number of fatal incidents and total deaths due to OHV-related incidents for all 50 states, as well as the percentage of OHV-related fatalities during the 3-year period (2018–2020) attributed to each state. States are listed in descending order of the number of reported deaths. The states with the highest number of reported deaths during the 3-year period were Pennsylvania (137), California (133), West Virginia (124), Kentucky (115), and Florida (104). Together, these five states accounted for 613 fatalities from 595 incidents, or around 25 percent of the total 2,448 fatalities from 2,384 incidents. As of September 2023, no fatal incidents occurring between 2018 and 2020 were reported from the District of Columbia, Puerto Rico, or other U.S. territories; as such, these locations are not included in either Table 4 or Figure 2.

Table 4: Reported OHV-Related Fatal Incidents and Total Deaths by Incident State, 2018–2020

State	Reported Fatal Incidents	Reported Deaths from Incidents	Percent of All Reported Deaths
Pennsylvania	134	137	5.6%
California	125	133	5.4%
West Virginia	121	124	5.1%
Kentucky	112	115	4.7%
Florida	103	104	4.2%
Tennessee	96	98	4.0%
Georgia	94	95	3.9%
Texas	93	94	3.8%
New York	87	89	3.6%
Missouri	84	84	3.4%
Ohio	79	82	3.3%
North Carolina	75	78	3.2%
Oklahoma	74	78	3.2%
Alabama	70	72	2.9%
Minnesota	70	71	2.9%
Louisiana	62	64	2.6%
Mississippi	60	64	2.6%
Arizona	57	61	2.5%
Michigan	52	52	2.1%
South Carolina	45	46	1.9%
Idaho	40	43	1.8%
Colorado	42	42	1.7%
Iowa	42	42	1.7%
Indiana	42	42	1.7%
Wisconsin	39	40	1.6%
Montana	37	37	1.5%
Oregon	37	37	1.5%
Virginia	35	37	1.5%
Illinois	33	33	1.3%
Kansas	33	33	1.3%
Alaska	32	33	1.3%
Maine	30	30	1.2%
Arkansas	28	29	1.2%
Wyoming	26	27	1.1%
Nevada	24	24	1.0%
Utah	21	21	0.9%
New Mexico	20	20	0.8%
North Dakota	18	19	0.8%
Nebraska	16	17	0.7%
Maryland	15	16	0.7%
Vermont	14	15	0.6%
New Jersey	14	14	0.6%
South Dakota	13	14	0.6%
Washington	12	13	0.5%
Massachusetts	9	9	0.4%
Connecticut	8	8	0.3%
New Hampshire	6	6	0.2%
Rhode Island	2	3	0.1%
Hawaii	2	2	0.1%
Delaware	1	1	<0.1%

Source: CPSRMS.
States are listed in descending order of total reported deaths between 2018 and 2020 from OHV-related incidents. Percentages may not sum to 100% due to rounding.

When reviewing state-level fatal incidents and death counts between 2018 and 2020, staff notes the following:

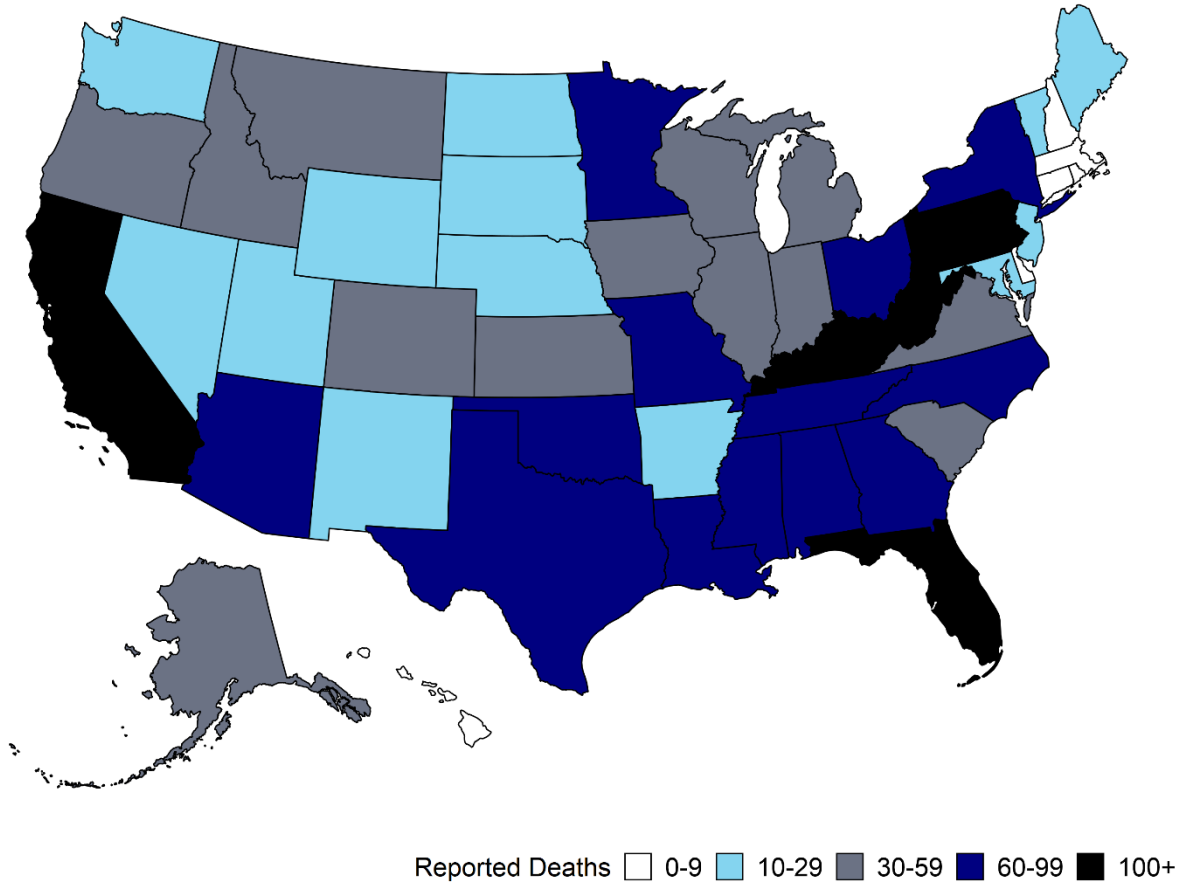
- Consistent with previous CPSC annual reports on both ATV-related and OHV-related deaths and injuries, the counts provided in Table 4 are *not* adjusted for state-level demographic characteristics (*i.e.*, total population, age distribution).

- Unlike CPSC annual reports on ATV-related deaths and injuries published prior to December 2020, the counts provided in Table 4 reflect the state and year in which the *incident* occurred, rather than the state and year in which the *death(s)* occurred.

- While CPSC considers reporting for 2018–2020 to be complete, death certificate data from Texas, Washington and Wisconsin for these 3 years are very limited compared to previous years. Thus, reporting is likely still incomplete for these states, and their fatal incident and death counts may increase in future annual reports.

Figure 2 provides a graphical overview of the total number of reported OHV-related deaths in each state between 2018 and 2020.

Figure 2: Reported OHV-Related Fatalities by Incident State, 2018–2020



Source: CPSRMS.

Reported Deaths of Children Compared with All Ages

Review of fatalities from OHV-related incidents found that 288 (12%) of the 2,448 decedents between 2018 and 2020 were under the age of 16, and 127 (5%) were under the age of 12. Among the decedents younger than 16, 44 percent were younger than 12. Table 5 provides a breakdown of the total number of reported fatalities by year for both the Under 16 and Under 12 age groups, as well as the corresponding percentages to the total number of reported fatalities for the overall period and each year. The yearly percentage of child decedents under the age of 16 who were also under the age of 12 is also provided.

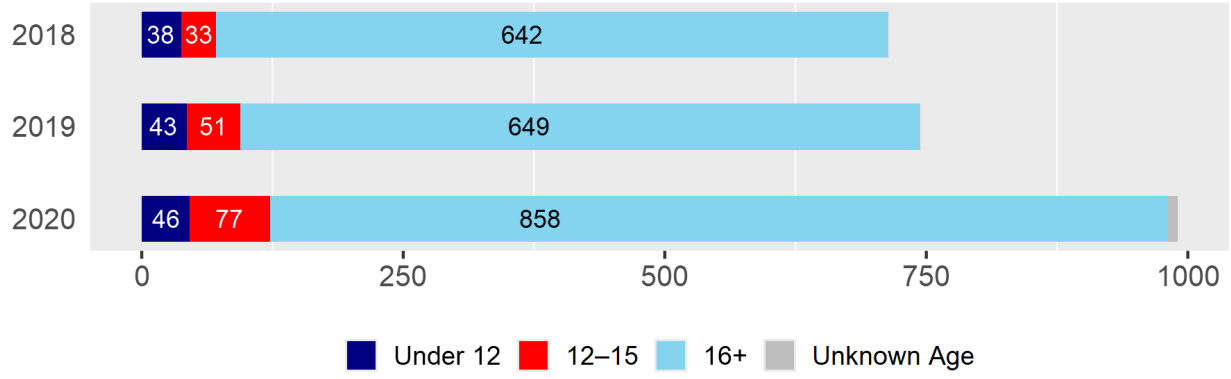
Table 5: Reported OHV-Related Fatalities for All Ages and Children's Age Groups, 2018–2020

	All Ages	Under 16 Years of Age		Under 12 Years of Age		
Year	Deaths	Deaths	Percent of All Deaths	Deaths	Percent of All Ages	Percent of Deaths under 16
2018	714	71	10%	38	5%	54%
2019	744	94	13%	43	6%	46%
2020	990	123	12%	46	5%	37%
Total	**2,448**	**288**	**12%**	**127**	**5%**	**44%**

Source: CPSRMS.

Figure 3 displays the distribution of OHV-related fatalities by year, divided into the following mutually exclusive age groups: Under 12, 12–15, 16 or over, and decedents of unknown age[8].

Figure 3: Reported OHV-Related Fatalities by Year & Children's Age Groups, 2018–2020



Source: CPSRMS.

[8] In both 2018 and 2019, there was one victim whose age was unknown. In 2020, there were 9 decedents with unknown age.

Reported Deaths of Various Age Groups

Table 6 presents the distribution of OHV-related fatalities by year, divided into various mutually exclusive age groups. Figure 4 presents a comparison of the distribution of decedent age groups for the 3-year period, with the estimated age distribution of the U.S. population in 2020.

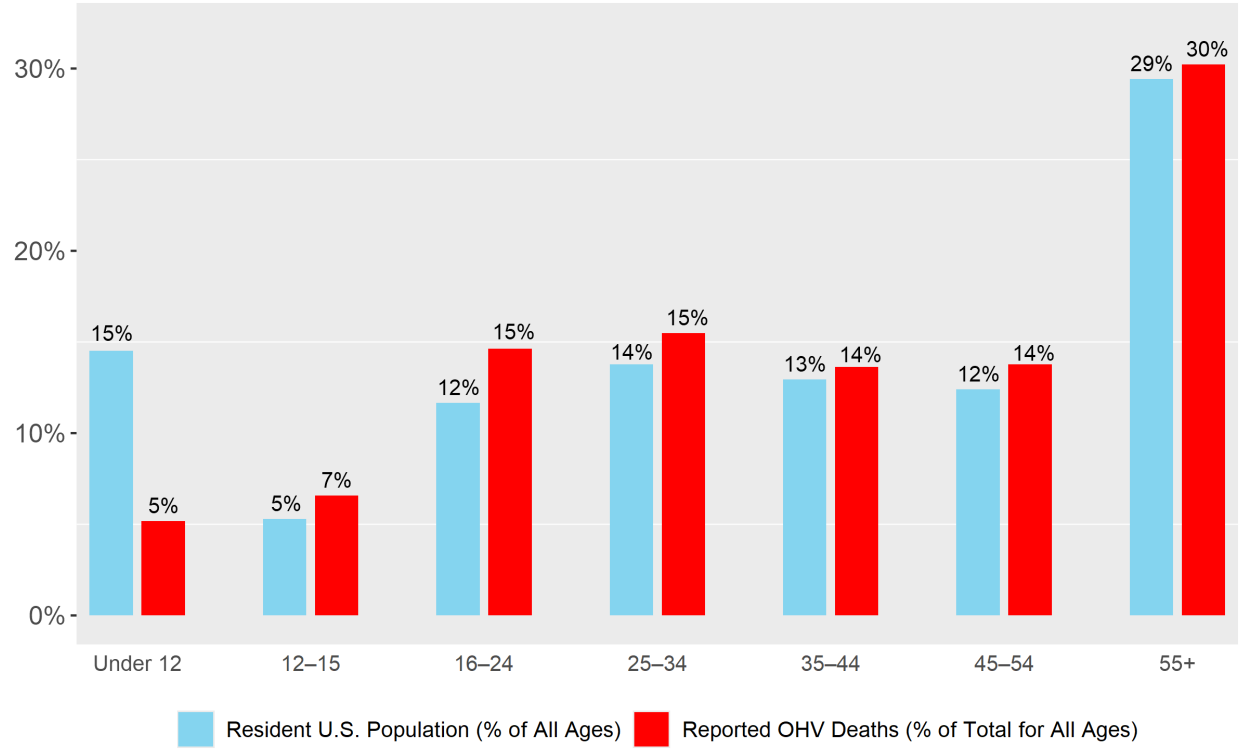
Comparing the age distributions for OHV-related fatalities and the U.S. population as a whole, the largest imbalances mostly appear in the younger age groups. Disproportionately fewer fatalities are reported among children under the age of 12, compared to their population representation. The opposite observation can be made for the 12–15, 16–24, and 45–54 age groups, albeit to a smaller degree. Staff does not know whether this is simply due to differences in OHV usage across age groups, or other factors.

Table 6: Reported OHV-Related Fatalities by Age Group, 2018–2020

	Age Group (in years)								
Year	**Under 12**	**12–15**	**16–24**	**25–34**	**35–44**	**45–54**	**55+**	**Unknown**	**Total**
2018	38	33	101	110	102	108	221	*1*	**714**
2019	43	51	113	100	92	107	237	*1*	**744**
2020	46	77	145	169	140	122	282	*9*	**990**
Total	**127**	**161**	**359**	**379**	**334**	**337**	**740**	***11***	**2,448**
Percent of Total	5%	7%	15%	15%	14%	14%	30%	<1%	

Source: CPSRMS.
Percentages may not sum to 100% due to rounding.

Figure 4: Reported OHV-Related Fatalities Per Year by Age Group, 2018–2020



Source: CPSRMS and U.S. Census Bureau.[9]

Summary of Reported Deaths by Gender, Race and Ethnicity

Males were disproportionately more likely to be represented in the reported OHV-related fatalities; between 2018 and 2020, around 82 percent of the 2,448 decedents were male, whereas about 18 percent were female. The proportion of male decedents ranged between 80 percent and 85 percent for the individual years, compared to 15 percent to 20 percent for females. In comparison, the U.S. population was estimated to be approximately 49 percent male and 51 percent female for each year during the 3-year period.

Table 7 presents the distribution of decedents' gender by age group for the entire 3-year period. Males constitute a substantial majority of fatalities in all age groups, and the gender imbalance appears to increase for the older age groups, where around 90 percent of decedents in the 55+ age group are male.

[9] Resident U.S. Population percentages are based on U.S. population estimates published by the U.S. Census Bureau for July 1, 2020, accessible here.

Table 7: Reported OHV-Related Fatality Gender by Age Group, 2018–2020

	Age Group (in years)							
Gender	**Overall**	**Under 12**	**12–15**	**16–24**	**25–34**	**35–44**	**45–54**	**55+**
Female	**18%**	27%	36%	26%	21%	14%	15%	10%
Male	**82%**	73%	64%	74%	79%	86%	85%	90%

Source: CPSRMS.
There were 12 fatalities where the victim's age and/or gender was not listed; these fatalities were not counted in this table.

Race data are somewhat incomplete for OHV-related fatalities between 2018 and 2020, with around 16 percent of reported deaths denoting an unknown or unspecified race. For the 3-year period, among the 2,448 reported deaths, at least 75 percent were White, at least 5 percent were Black/African-American and at least 4 percent were classified as another race (including Asian, American Indian/Alaska Native, Native Hawaiian/Pacific Islander, and unspecified other races).

Similar to data for race, data for ethnicity, defined as either Hispanic or non-Hispanic, are largely incomplete for the 3-year period, with around 92 percent of reported deaths denoting a non-Hispanic, unknown or unspecified ethnicity. Between 2018 and 2020, among the 2,448 reported deaths, at least 8 percent of the victims were Hispanic.

It should be reiterated that because CPSRMS data are anecdotal, the above distributions cannot be used to make inferences about *all* OHV-related fatalities in the United States.

Observed OHV Hazard Patterns

Overturning is a common hazard present in incidents involving all types of OHVs. An overturning vehicle report may specify that the vehicle overturned forward, backward, sideways (also known as a rollover), or in an unknown direction. Forward and backward overturns often occur while ascending or descending steep terrain. On flat terrain, when an OHV operator attempts to make a sharp turn, the OHV may roll over (overturn sideways). This can occur due to a variety of factors, such as driving at a high rate of speed, change in the terrain surface type (*i.e.*, from gravel to sand), and/or improper loading. However, rollovers can also occur on slanted or uneven terrain. Rollovers are especially consequential for ROVs; based on a previous review of 801 in-depth investigations (IDIs) of fatal ROV incidents,[10] more than two-thirds involved a rollover of the vehicle. About one-fifth of ROV fatalities in the same sample involved an attempt on *level* terrain to make a turn prior to rollover. Staff's review of historical ATV data[11] found that the ATV overturned in at least 65 percent of fatal incidents, but this also includes incidents involving other events, like collisions, which may have preceded the ATV

[10] CPSC staff analyses conducted in support of ROV Termination Package and Congressional Report, June 2020.
[11] Based on analysis of deaths in the All-Terrain Vehicle Death database for the years 2010 through 2013, when every death in the database had the primary hazard coded.

overturning. Overall, the review found that overturning as the primary hazard in around 38 percent of ATV fatalities.

Collisions are the other most frequently observed hazard associated with OHV-related fatalities. Incidents generally involve collisions with stationary objects (*e.g.*, trees, people, animals), or with vehicles, including other OHVs. Collisions are particularly common among ATV fatalities; the aforementioned review of ATV data found collisions to be the *primary* hazard in around 37 percent of fatalities. This figure does not include collisions that may have resulted from other hazards. At least 61 percent of ATV fatalities in the previous sample were with stationary objects, such as trees, guard rails, or mailboxes. More than 30 percent occurred with other vehicles. The remaining collisions involved striking animals (4%) or pedestrian bystanders (<1%). Similarly, collisions are a common hazard in ROV/UTV fatalities. From the aforementioned review of 801 IDIs for fatal incidents from ROVs, staff noted collisions (of any type) in around 16 percent of fatalities.

Hazards associated with OHV-related fatalities are not mutually exclusive; the fatality reports may describe scenarios that involve both overturning and collision, as well as combinations of other hazards. Additionally, other fatality hazards observed by staff include ***drowning*** from falling into a body of water, ***fire*** (typically from an ROV), being ***ejected*** or falling without substantial preceding events (*i.e.*, a collision and/or overturning), and less commonly, ***impalement*** from sticks or other debris penetrating an ROV or UTV (usually through the floorboard of the vehicle's underside).

Ejection of the occupant(s) appears to occur in most OHV-related fatalities. For ROV-related fatalities in particular, the aforementioned staff assessment of 801 IDIs found that more than 80 percent of decedents were ejected from the ROV (either fully or partially). For fatal incidents involving ATVs, which are not equipped with seatbelts or other restraints, the victims usually do not remain seated on the ATV after the incident.

Off-Highway Vehicle-Related Emergency Department-Treated Injuries

The analyses in this section are based on NEISS data that were originally coded as involving an ATV, ROV or UTV-related injury. Analysis of responses to the NEISS special study questionnaire, beginning on page 27, found that the medical record was in some instances inaccurate in coding the OHV involved when compared with the information provided to CPSC directly by the injury victims; accordingly, a more refined injury estimate for 2022 can be found in that section.

For the 5-year period from January 1, 2018 through December 31, 2022, there were an estimated 504,400 emergency department-treated injuries (an annual average of 100,900 injuries) involving off-highway vehicles in the scope of this report. These estimates are derived from NEISS injury cases that include at least one of the five product codes that are used to code ATVs, ROVs, and UTVs, as well as possibly other unspecified off-highway vehicles.

For this report, all references to “injuries” or “injury rates” should be assumed as “estimated emergency department-treated injuries” or “estimated rate of emergency department-treated injuries” for the referenced population group, respectively. Additionally, all references to “combined estimates” should be interpreted as estimates derived from unadjusted NEISS weights and original NEISS product code classifications (i.e., special study results not considered.)

Estimated Injuries by Product Code

Table 8 presents the distribution of injury estimates and corresponding NEISS sample sizes for the period 2018 through 2022, for each of the five product codes.

Table 8: Estimates of OHV-Related, Emergency Department-Treated Injuries by Product Codes, 2018–2022

Product Code	Product Code Description	Sample Size	5-Year Total (2018–2022)	Annual Average	Percent of Injuries
5044	Utility Vehicles (includes both ROVs and UTVs)	711	39,400	7,900	8%
3285	All-terrain vehicles (three-wheels only; exclusively off road)	112	5,600	**	1%
3286	All-terrain vehicles (four wheels, excluding dune buggies; exclusively off road)	6,166	303,300	60,700	60%
3287	All-terrain vehicles (number of wheels not specified; excluding dune buggies; exclusively off-road)	4,245	155,200	31,000	31%
3296	All-terrain vehicles (more than four wheels; exclusively off-road)	25	**	**	<1%
Combined	**Total (All of the above)**	**11,254***	**504,400***	**100,900**	**100%**

Source: NEISS.
Note: Calculations are based on unrounded estimates; rows may not sum to total due to presented estimates being rounded to the nearest 100.
* A very small proportion of these injury cases involved two or more vehicles; as such, they were coded with more than one of the product codes above. As a result, the sum of the sample sizes for each individual product code slightly exceeds the combined sample size of 11,254 injury cases.
** Estimate fails to meet NEISS reporting criteria because the estimate is less than 1,200. The CVs (coefficients of variation) for the estimates of the other four product codes (5044, 3285, 3286, 3287) range between 12 percent and 26 percent. More information about NEISS reporting criteria and calculation/interpretation of CVs can be found in Appendix A.

Estimates derived from each individual product code represent only the proportion that staff was able to classify under that product code, based on available information; as such, those estimates should not be presumed to represent all injuries associated with the product codes' corresponding vehicle types. CPSC staff is confident, however, in characterizing OHV injuries by using *total* estimates derived from combining all vehicle types defined by these five product codes.

Prior studies and other sources, including IDIs of OHV fatalities by CPSC staff, suggest that ROVs and UTVs, which product code 5044 encompasses, may often be mistakenly classified as ATVs (i.e., product codes 3285, 3286, 3287 or 3296) in injury narratives. Between 2018 and 2022, around 6 percent of the OHV injury cases (and around 8 percent of the estimated injuries) were classified under product code 5044. However, the proportions of both the injury cases (sample size) and the overall injury estimate attributable to product code 5044 have increased

year-over-year, as seen below in Table 8a. The year-over-year changes in estimated injuries between 2019 and 2021 are statistically significant, and there is also statistically significant evidence of a linear trend for the 5-year period (p-value < 0.01). It is unknown whether this trend can be explained by more accurate classification of the vehicles involved in these injury cases, an actual increased frequency of injuries involving ROVs and UTVs, relative to ATVs, or both.

Table 8a: Estimates of OHV-Related, Emergency Department-Treated Injuries by Product Code 5044: Utility Vehicles (ROVs and UTVs), 2018–2022

Year	Sample Size	Injury Estimate	Percent of Injuries
2018	61	3,500	4%
2019	87	**	5%
2020	140	7,500	7%
2021	197	10,500	10%
2022	226	12,900	14%
Total	**711**	**39,400**	**8%**

Source: NEISS.
** Estimate fails to meet NEISS reporting criteria because the CV exceeds 33 percent. The CVs for the other four years' estimates range between 15 percent and 27 percent. More information about NEISS reporting criteria and calculation/ interpretation of CVs can be found in Appendix A.

It may be the case that the number of injuries associated with UTVs and ROVs is still greater than estimated here; as such, the *actual* distribution of injuries involving these vehicle types should be considered unknown. To better understand any possible discrepancies between the distribution of injuries recorded in Table 8a and the *actual* distribution of injuries by vehicle type, CPSC staff began a follow-up special study in January 2022 that will continue through at least December 2024. Results of the special study for 2022 injury estimates can be found later in the "Special Study" section on page 27. However, for the years 2018 through 2021, without the benefit of this special study, staff is limited to providing injury estimates by the individual product codes, or as an overall combined estimate of all five OHV product codes.

Estimated Injuries for All Ages and Children's Age Groups

Table 9 presents the distribution by year of all estimated OHV-related injuries treated in U.S. hospital emergency departments between 2018 and 2022, along with individual annual distributions of such injuries among two children's age groups.

Table 9: Annual Estimates of OHV-Related, Emergency Department-Treated Injuries for All Ages and Children's Age Groups, 2018–2022

	All Ages	Under 16 Years of Age		Under 12 Years of Age		
Year	Estimated Treated Injuries	Estimated Treated Injuries	Percent of All Ages	Estimated Treated Injuries	Percent of All Ages	Percent of Children under 16
2018	95,000	24,900	26%	13,000	14%	52%
2019	96,000	25,800	27%	12,900	13%	50%
2020	112,300	30,500	27%	14,400	13%	47%
2021	106,600	30,500	29%	14,600	14%	48%
2022	94,700	25,600	27%	12,200	13%	48%
Total	**504,400**	**137,300**	**27%**	**67,000**	**13%**	**49%**

Source: NEISS.
Note: Calculations are based on unrounded estimates; rows may not sum to total due to presented estimates being rounded to the nearest 100. The coefficients of variation (CVs) for the injury estimates in this table range from around 12 percent to 19 percent. More information about calculation and interpretation of CVs can be found in Appendix A.

The 17-percent increase between 2019 and 2020, from 96,000 to 112,300 injuries, is statistically significant (p-value = 0.02). However, the net difference between the total estimates in the start year (2018) and end year (2022) of the examined time frame was not found to be statistically significant (p-value = 0.98). In addition, there was no significant statistical evidence of a linear trend in estimated injuries for the overall 5-year period (p-value = 0.99).

Between 2018 and 2022, children under 16 years represented around 27 percent of all estimated injuries, while children under 12 years made up around 13 percent of all estimated injuries and 49 percent of injuries for children under 16. Additionally, for both the Under 16 and Under 12 children's age groups, none of the year-to-year changes in estimated injuries were found to be statistically significant.

Estimated Injuries by Various Age Groups

Table 10 presents a breakdown, by specific age groups, of the OHV-related, emergency department-treated injuries between 2018 and 2022.

Table 10: Annual Estimates of OHV-Related, Emergency Department-Treated Injuries by Age Group, 2018–2022

	Age Group (in years)							
Year	**Under 12**	**12–15**	**16–24**	**25–34**	**35–44**	**45–54**	**55+**	**Total**
2018	13,000	11,900	21,500	18,600	12,700	8,600	8,600	**95,000**
2019	12,900	12,900	23,900	17,800	12,000	8,100	8,200	**96,000**
2020	14,400	16,100	24,100	23,700	15,600	9,700	8,700	**112,300**
2021	14,600	15,900	22,400	18,500	15,000	8,200	11,900	**106,600**
2022	12,200	13,400	20,000	16,700	12,600	9,600	10,200	**94,700**
Total	**67,000**	**70,300**	**111,900**	**95,300**	**68,000**	**44,300**	**47,700**	**504,400**
Percent of Total	13%	14%	22%	19%	13%	9%	9%	

Source: NEISS.
Note: Calculations are based on unrounded estimates; rows may not sum to total due to presented estimates being rounded to the nearest 100. Coefficients of variation (CVs) for the injury estimates in this table range from 10 percent to 20 percent. More information about calculation and interpretation of CVs can be found in Appendix A.

The following statistically significant changes were found in comparing the year-to-year injury estimates within each individual age group:

For the 25–34 age group:

- The 33% increase between 2019 and 2020, from 17,800 to 23,700 (p-value < 0.01).
- The 22% decrease between 2020 and 2021, from 23,700 to 18,500 (p-value < 0.01).

For the 55 and older age group:

- The 37% increase between 2020 and 2021, from 8,700 to 11,900 (p-value = 0.04).

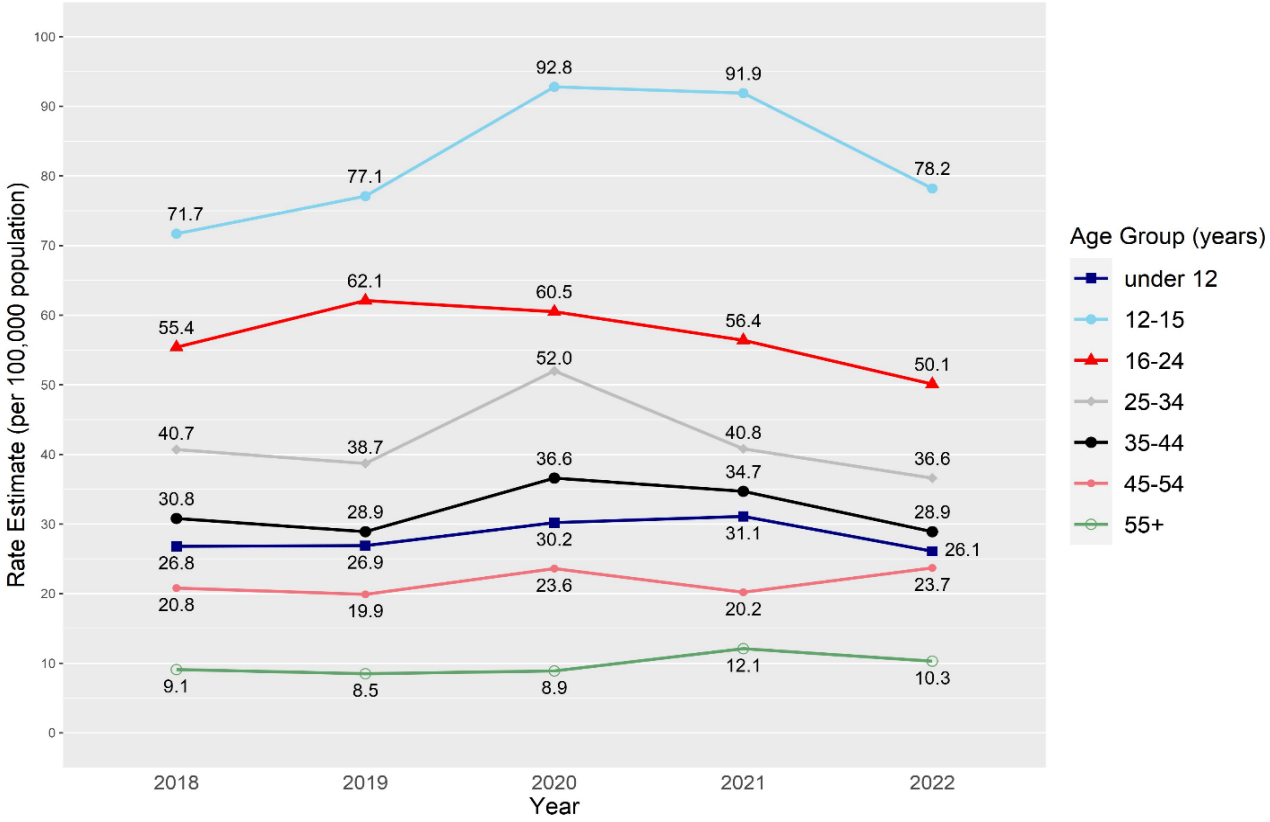
When comparing only the start year (2018) and end year (2022) of the analysis, the net differences in injury estimates were found not to be statistically significant for all the age groups above. In addition, there was no statistical evidence of a linear trend in estimated injuries during the 5-year period for any of the age groups.

Changes in the age demographics of the U.S. population over time likely affect the estimated number of injuries for the age groups above. According to data by the U.S. Census Bureau, the number of persons aged 55 years or older in the United States increased from an estimated 94.5 million to 99.9 million between 2018 and 2022, and the number of persons between ages

35 and 44 increased from an estimated 41.2 million to 43.7 million between 2018 and 2022. The changes in population estimates for other age groups were relatively small in magnitude, especially for the groups that included children and people under 35 years of age.

Figure 5 provides a normalized comparison by population size of the injury estimates displayed in Table 10, by age group. Injury rates are expressed as injuries per 100,000 population, based on yearly population estimates published by the U.S. Census Bureau.[12] Younger age groups tend to have higher injury rates than the older age groups, with the clear exception being the under 12 years age group.

Figure 5: Annual OHV-Related Hospital Emergency Department-Treated Injury Rate Estimates by Age Group in Years, 2018–2022



Source: NEISS and U.S. Census Bureau.
Note: Injury rates expressed as estimated injuries per 100,000 estimated population on July 1 of each year. Estimated injury rates for the overall population by year are computed in Table 11.

Estimated Injuries by Gender

Table 11 provides the distribution of estimated OHV-related, emergency department-treated injuries by gender between 2018 and 2022. The distribution of injuries by gender during the 5-year period was roughly the same every year, with males constituting a disproportionately high proportion of overall injuries (68%). In comparison, for each year between 2018 and 2022,

[12] Tables for population estimates published by the U.S. Census Bureau may be found here for 2018 and 2019, and here for 2020-2022.

males were roughly 49–50 percent of the estimated U.S. population, while females made up around 50–51 percent. Consequently, despite males having more than twice the estimated injury rate as females each year, the changes in their injury rates, relative to the overall injury rate, are very similar, as seen in Table 11.

Furthermore, the estimated gender distribution by age group was largely consistent for each year; males generally made up around two-thirds of injuries for the age groups under 35, and this proportion gradually increased for older age groups, with males consisting of around 75 percent to 80 percent of injuries for the 55+ age group.

Table 11: Annual Estimates of OHV-Related, Emergency Department-Treated Injuries by Gender, 2018–2022

Year	Overall		Male			Female		
	Estimated Treated Injuries	Estimated Overall Injury Rate	Estimated Treated Injuries	Percent of All Injuries	Estimated Injury Rate	Estimated Treated Injuries	Percent of All Injuries	Estimated Injury Rate
2018	95,000	29.1	65,700	69%	40.8	29,300	31%	17.7
2019	96,000	29.2	65,900	69%	40.8	30,000	31%	18.0
2020	112,300	33.9	75,800	68%	46.1	36,400	32%	21.8
2021	106,600	32.1	72,200	68%	43.9	34,300	32%	20.5
2022	94,700	28.4	64,200	68%	38.8	30,600	32%	18.2
Total	**504,400**		**343,900**	**68%**		**160,600**	**32%**	

Source: NEISS and U.S. Census Bureau.
Note: Calculations are based on unrounded estimates, but rows may not sum to total due to presented estimates being rounded to the nearest 100. Injury rates are expressed as estimated injuries per 100,000 estimated population for July 1 of each year. The coefficients of variation (CVs) for the injury estimates in this table range from 11 percent to 15 percent.

The 15-percent increase in estimated injuries for males between 2019 and 2020, from 65,900 to 75,800, was the only statistically significant year-over-year change for either gender (p-value = 0.03). The net differences between the estimates in the start year (2018) and end year (2022) of the examined time frame were not statistically significant for either males or females, and there was also no statistical evidence of a linear trend in estimated injuries for either gender during the 5-year period.

Estimated Injuries by Race and Ethnicity

Table 12 provides an overview of the distribution of injuries by race. More than 25 percent of both overall and annual estimated injuries are coded as having unknown or unspecified race. Among the estimated 372,800 injuries from 2018 to 2022 with *known* race, Whites constitute around 84 percent of injuries, while making up around 76 percent of the U.S. population. In contrast, Blacks/African-Americans constitute around 9 percent of injuries, while making up around 13 percent of the population. Other races constitute the remaining 6 percent of injuries,

while making up around 11 percent of the population.[13] There was limited fluctuation year over year in the known racial distribution for OHV-related injuries.

Table 12: Annual Estimates of OHV-Related, Emergency Department-Treated Injuries by Race, 2018–2022

	Race Information Available							
	Overall Known	White		Black		Other*	Race Information Missing	
Year	Estimated Treated Injuries	Estimated Treated Injuries	Percent of Injuries	Estimated Treated Injuries	Percent of Injuries	Percent of Injuries	Estimated Number of Injuries	Percent of *All* Injuries
2018	70,400	60,300	86%	5,400	8%	7%	*24,500*	*26%*
2019	70,100	62,000	88%	5,700	8%	3%	*25,800*	*27%*
2020	83,100	70,000	84%	9,100	11%	5%	*29,200*	*26%*
2021	78,800	63,500	81%	8,100	10%	9%	*27,800*	*26%*
2022	70,400	58,400	83%	8,300	12%	5%	**	*26%*
Total	**372,800**	**314,200**	**84%**	**36,600**	**10%**	**6%**	***131,600***	***26%***

Source: NEISS.
*This race category includes victims classified as Asian, American Indian/Alaska Native, Native Hawaiian/Pacific Islander, biracial/multiracial, or any other non-missing race classification besides White and Black/African-American. Estimated overall and annual injuries for this category fail to meet NEISS reporting criteria (CV greater than 33 percent). CVs for the other estimates range between 14 percent and 31 percent.
** Estimate fails to meet NEISS reporting criteria (CV greater than 33 percent).

Among cases with available race information, there were no statistically significant year-to-year changes in estimated injuries among Whites. Among Blacks, the 59% increase between 2019 and 2020 was found to be statistically significant (p-value < 0.01). However, due to the large proportion of injuries with missing race, it is important to note that these increases are only influenced by cases where race information is available; no inferences can be drawn about the race distribution among injuries where race information is unspecified or unknown.

Ethnicity data for injuries was added to the NEISS database in mid-2018. Thus, around 91 percent of OHV-related injuries in 2018 were of unspecified or unknown ethnicity. For the remaining years, at least 23 percent of estimated injuries each year were of unknown ethnicity. Overall, around 38% of the estimated injuries between 2018 and 2022 were to victims of unknown ethnicity; as such, injury rates by ethnicity or race/ethnicity groups cannot be accurately computed. Between 2018 and 2022, among injuries with known ethnicity, around 12 percent can be classified as Hispanic, although the overall and annual estimates do not meet NEISS reporting criteria (CV greater than 33 percent); the remaining 88 percent (275,800

[13] Based on annual July 1 U.S. population estimates by race, published by the U.S. Census Bureau. Estimates for 2018 and 2019 can be found here; estimates for 2020–2022 can be found here.

injuries) can be classified as non-Hispanic. In comparison, around 19 percent of the total U.S. population were estimated to be Hispanic, and 81 percent non-Hispanic, in 2022.[14]

Estimated Injuries by Disposition, Diagnosis, and Injured Body Part

Figure 6 provides an overview of the *total* estimated OHV-related injuries by disposition, diagnosis, and injured body part,[15] by specifically comparing the respective injury distributions for the latest year of the analysis (2022) with the average of the previous 4 years (2018–2021). The very small proportion of fatal cases that were used in the estimate for the "Other" disposition were also counted in the earlier "Off-Highway Vehicle Fatalities" section.

Of the 5-year estimated total of 504,400 emergency department-treated injuries, staff categorized the majority—approximately 79 percent of injuries between 2018 and 2021, and 76 percent in 2022—as "treated and released." Hospitalizations[16] represented around 18 percent of estimated injuries between 2018 and 2021, and around 21 percent in 2022. In comparison with the first two years of the time frame (2018–2019), there appears to be a rise in estimated hospitalizations in 2020 and 2021. In particular, the increase in estimated injuries requiring hospitalization from 14,800 in 2019 to 21,500 in 2020 was statistically significant (p-value < 0.01). However, estimated hospitalizations decreased from 22,100 in 2021 to 19,400 in 2022, although this decline was not statistically significant (p-value = 0.39).

Staff categorized the various coded diagnoses into the following groups: fractures, contusions or abrasions, strains or sprains, internal organ injuries, lacerations or other injuries (including, but not limited to, concussions, dislocation, hematoma and general pain). In both periods, the most common diagnoses were fractures (around 29 percent in both periods) and contusions/abrasions (20% from 2018–2021, 18% in 2022).

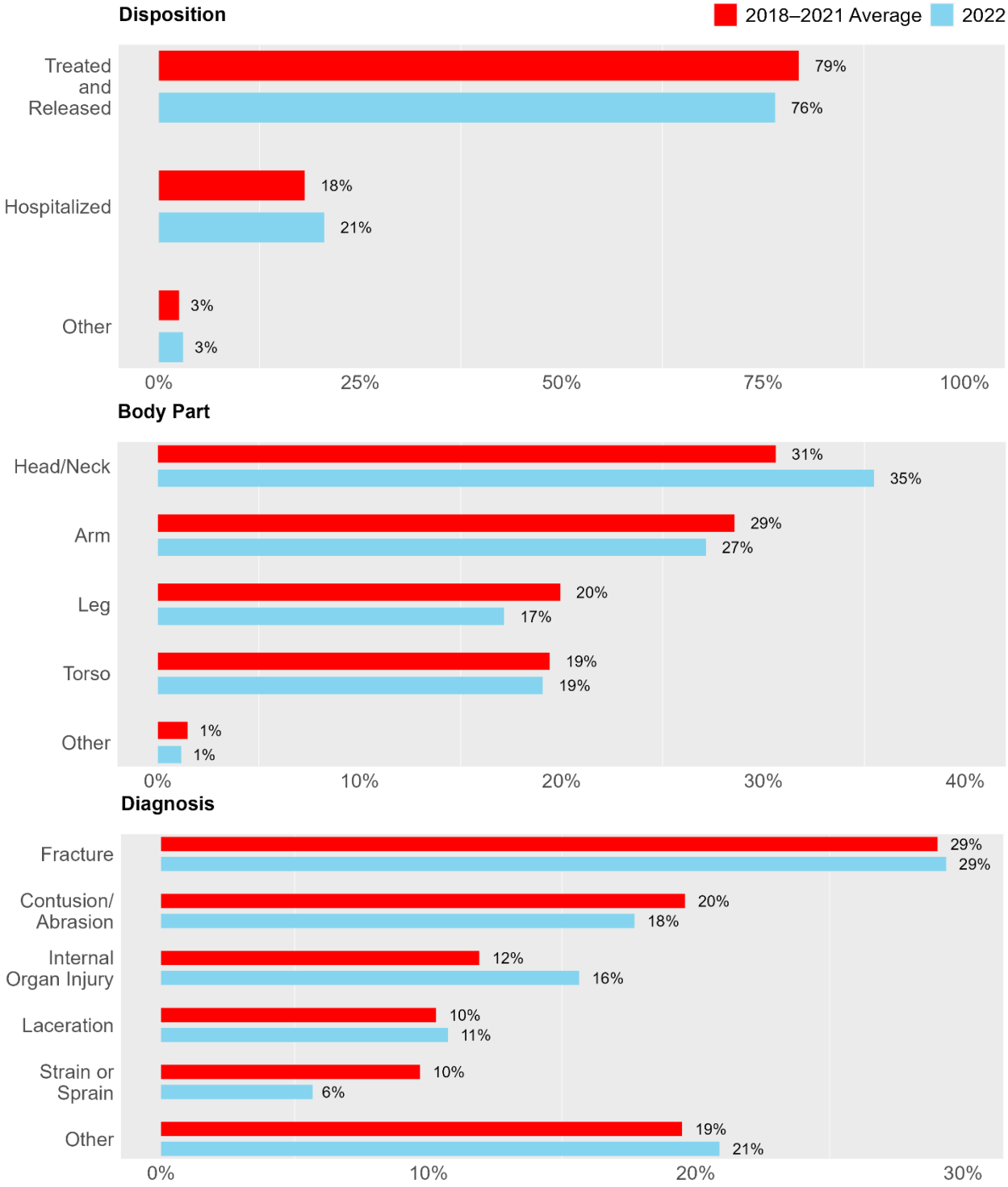
Staff categorized the various body parts into the following areas: head and neck, arm, leg, torso and other (which made up less than 2 percent of overall estimated injuries). Most injuries for both periods were located in either the head and neck (31% from 2018–2021, 35% in 2022) or arms (29% from 2018–2021, 27% in 2022).

[14] Based on published U.S. Census Bureau estimates for July 1, 2022, accessible here.

[15] Beginning in 2018, NEISS allowed the coding of up to two diagnoses and body parts per injury case. For this analysis, only the first diagnosis and first injured body part listed were considered. A small proportion of cases were with more than one injury diagnosis or injured body part.

[16] Defined as injured patient being "treated and transferred to another hospital" or "treated and admitted for hospitalization (within same facility)."

Figure 6: OHV-Related, Emergency Department-Treated Injuries for All Ages, By Disposition, Diagnosis and Body Part – Comparison of 2018–2021 and 2022 Distributions



Source: NEISS.
Note: Percentages may not add up to 100% due to rounding.

Special Study for OHV-Related Injuries (2022)

While this annual report has historically provided annual distributions of OHV-related *fatalities* by vehicle type, OHV-related *injuries* have been presented as either a combined estimate or separate estimates by individual product codes. This is due to CPSC staff conducting IDIs for almost all OHV-related fatality reports in CPSRMS, but not for OHV-related injury cases in NEISS; completed IDIs often provide information on the OHV type, brand or model, which allows staff to verify the product involved as an ATV, ROV, UTV, or unknown (either an ROV or UTV). However, starting in January 2022, CPSC staff began a full-scale special study for OHV-related NEISS injury cases by inviting the injury victims to participate in a follow-up interview or online survey.

The motivation of this ongoing special study is to better understand the true distribution of estimated injuries between ATVs, ROVs and UTVs in NEISS. Historically, compared with the distribution of OHV-related *fatalities* by vehicle type, the distribution of OHV-related *injuries* is dominated by injuries coded as involving ATVs (although the distribution of OHV-related fatalities should be considered anecdotal). For example, while 32% of OHV-related *fatalities* reported to CPSC between 2018 and 2020 were *confirmed* to involve either an ROV or UTV, only 8% of OHV-related *injuries* between 2018 and 2022 were *coded* as involving an ROV or UTV. Furthermore, among completed IDIs involving an ROV or UTV, the vehicle involved in the incident was described as an ATV in the original death certificate or fatality report around 75% of the time. This suggests that without the benefit of a follow-up investigation, original vehicle classifications for either fatality reports or injury cases may be unreliable, and that “ATV” is frequently used as a catch-all term in incident narratives for OHVs with more than 2 wheels.

Special study assignments were created for 1,963 of the 2,010 OHV-related injury cases recorded in NEISS in 2022. The 23 NEISS cases that were coded with product code 3285 (ATV with 3 wheels) were excluded from assignment in the special study. This is because the original purpose of the special study was to better understand the misclassification of ROVs or UTVs, which have 4 or more wheels, as ATVs (and possibly vice versa). Three NEISS cases in 2022 involved a fatality and were therefore not included in the special study. Lastly, 21 cases were unable to be assigned due to technical issues. Of the 1,963 questionnaires administered to injury victims, 125 were determined to be sufficiently complete and in-scope; 7 were determined to be completed but out-of-scope; and 10 were determined to be either too incomplete and/or out-of-scope. No responses were received from the remaining 1,821 assignments. The analyses in this section apply to estimated injuries in 2022 only, as follow-up assignments were not conducted for injury cases occurring prior to 2022.

Any references in this section, as well as later sections of the report, to “NEISS product code” and “NEISS weight” should be assumed as the *original* product code and weight associated with the injury case in NEISS, respectively, and not the product code and adjusted weight that would be assigned to the verified product.

Table 13.1 shows the number of injuries by verified product (from available information about the vehicle's classification, brand, model or maximum speed provided by the respondent[17]) and the NEISS product code, based on the 132 completed special study responses. All but one of the 88 responses verified to have involved ATVs had 4 wheels.

Table 13.1: NEISS Product Code vs. Verified Product from Special Study Responses

		NEISS Product Code*			
Verified Product	**Overall**	**3286**	**3287**	**3296**	**5044**
3-Wheeled ATV	**1**	1	0	0	0
4-Wheeled ATV	**87**	50	33	1	3
ROV	**27**	7	8	0	12
UTV	**6**	2	1	0	3
Unknown (ROV or UTV)	**5**	2	1	0	2
OHV with < 3 Wheels**	**6**	3	3	0	0
Total	**132**	**65**	**46**	**1**	**20**

Source: NEISS (2022).
* See Table 8 above for NEISS product code definitions.
** Reported as either a dirt bike or motorcycle (not in the scope of this report).

Table 13.2 provides a comparison of the distribution of estimated injuries by vehicle classification from the original NEISS sample and special study. Due to the small sample size resulting from the low survey response rate, ROVs, UTVs and "Unknown (ROV or UTV)" are combined into a single classification (ROV or UTV). The injury estimates from the special study are calculated from adjusted weights; more details on how the adjusted weights were derived can be found in Appendix B.

[17] See Questions Q10, Q11, Q13, Q20, Q21, Q24, Q25 and Q28 in Appendix B for specific phrasing of questions and possible responses.

Table 13.2: Distribution of Estimated Emergency Department-Treated Injuries by Vehicle Classification

	NEISS			Special Study		
Vehicle Classification	**Cases**	**Treated Injuries**	**%**	**Cases**	**Treated Injuries**	**%**
ATV with > 3 Wheels	1761	80,600	85%	87	62,200	66%
ROV or UTV	226	12,900	14%	38	26,100	28%
ATV with 3 Wheels	23	**	1%	1	**	<1%
Out of Scope* OHVs	0	0	0%	6	4,400	5%
Total	**2,010**	**94,700**	**100%**	**132**	**93,600**	**100%**

Source: NEISS (2022).
* Product is out of the scope of this report, but in CPSC jurisdiction.
** Estimate fails to meet NEISS reporting criteria because the estimate is less than 1,200.

Table 13.3 provides a breakdown of the calculation of a more refined injury estimate for 2022, using the information presented in Tables 13.1 and 13.2. The modified total of 90,400 represents all injuries involving ATVs with at least 3 wheels, ROVs, and UTVs. This new estimate is smaller than the original NEISS estimate of 94,700, as the special study revealed that a small proportion (5%) of injuries originally coded as involving an ATV, ROV or UTV actually involved a product out of the scope of this report (i.e., dirt bikes or motorcycles). This method of computing a more refined injury estimate is only applicable to the 2022 NEISS data, and should not be generalized to previous years' estimates, especially given the relatively small sample size; it is unknown what proportion of yearly injuries prior to 2022 are out of scope.

Table 13.3: Components of Refined Estimate of Emergency Department-Treated Injuries (2022)

Vehicle Classification	Estimate Source	Estimated Treated Injuries
ATV with > 3 Wheels	Special Study	62,200
ROV or UTV	Special Study	26,100
ATV with 3 Wheels	Special Study	**
ATV with 3 Wheels	NEISS	**
Total		**90,400**

Source: NEISS (2022).
See Appendix B for calculation details.
** Estimate fails to meet NEISS reporting criteria because the estimate is less than 1,200.

The special study questionnaire attempts to gather as much relevant information as possible regarding the OHV incidents, although all questions were optional. Distributions of certain factors and characteristics of the incidents, injuries, and victims involved were computed via the

adjusted weights and survey responses. Specific phrasing of these questions and their possible responses can be found in Appendix B. Staff excluded the 7 completed but out of scope submissions for Tables 13.4 through 13.18, as the verified products were either two or three-wheeled OHVs, which are out of the scope of this report and excluded from the special study, respectively. As such, the distributions in the below tables should only be generalized to ATVs, ROVs and UTVs with 4 or more wheels; there were an estimated 88,300 injuries from these OHVs in 2022.

Due to the logical flow of the survey, some questions were not presented to the respondent based on selection, or lack of selection, of certain answer choices to previous questions; for example, because an ATV by definition does not carry seatbelts, questions regarding seatbelt usage were only presented to victims that identified the incident vehicle as a ROV or UTV. As such, questions where a substantial proportion of responses were missing are not presented below. In some cases, missing information can be derived from the incident narrative provided in the questionnaire, depending on how specific the description of events is (see Q36 in Appendix B). The total number of missing responses to the below questions, and the injury estimate associated with them, is provided in the "Unknown or Not Stated" row[18]; the percentage for this row indicates the percentage of injuries in 2022 that were estimated to have an unknown or unspecified response to the corresponding question.

Table 13.4 presents the distribution of OHV-related injuries by whether the OHV was in operation when the injury occurred. Not surprisingly, a large majority of OHV injuries (98% of known responses) occurred when the vehicle was in operation.

Table 13.4: Distribution of Emergency Department-Treated Injuries by Operation of OHV at Time of Injury

In Operation?	#	Estimated Treated Injuries	% of Known	% of Total
Yes	119	84,000	98%	95%
No	2	1,900	2%	2%
Unknown or Not Stated	*4*	*2,400*		*3%*
Total	**125**	**88,300**	**100%**	**100%**

Source: NEISS (2022).
Based on responses to special study survey question Q35 (see Appendix B).

[18] Includes submissions where the narrative did not provide sufficient information in lieu of a missing response, or instances where a response is not applicable (e.g., a victim that was a bystander was not asked if he/she was wearing a helmet).

Table 13.5 presents the distribution of OHV-related injuries by the reported purpose of OHV use when the incident occurred. The majority of injuries (87% of known responses) occurred during recreational activities.

Table 13.5: Distribution of Emergency Department-Treated Injuries by Purpose of OHV Use at Time of Accident

Activity	#	Estimated Treated Injuries	% of Known	% of Total
Recreational	91	61,500	87%	70%
Occupational*	11	8,900	13%	10%
Unknown or Not Stated	*23*	*17,900*		*20%*
Total	**125**	**88,300**	**100%**	**100%**

Source: NEISS (2022).
Based on responses to special study survey question Q33 (see Appendix B).

Table 13.6 presents the distribution of OHV-related injuries by whether a collision occurred, and if so, what the OHV collided with. Among known responses, a small majority of injuries (55%) involved some sort of collision with a stationary object, terrain or another vehicle. Of the injuries involving a collision, around 94% involved a stationary object or terrain, compared to 6% with another vehicle. It should be noted that, in many of the responses where the victim did not specify if a collision had occurred (Unknown or Not Stated), the incident narrative provided by the victim suggested that the incident likely did not involve a collision. However, it is possible that narratives may not always provide a complete summary of the incident, and furthermore, victims had different definitions for what constituted a collision (e.g., some reported hitting a road bump or patch of dirt as a collision, while others did not).

Table 13.6: Distribution of Emergency Department-Treated Injuries by Collision (If Any) Type

Activity	#	Estimated Treated Injuries	% of Known	% of Total
Stationary Object / Terrain	48	32,600	52%	37%
Another Vehicle	6	2,200	3%	2%
Nothing	37	28,500	45%	32%
Unknown or Not Stated	*34*	*25,000*		*28%*
Total	**125**	**88,300**	**100%**	**100%**

Source: NEISS (2022).
Percentages may sum to 100% due to rounding.
Based on responses to special study survey question Q41 (see Appendix B).

Table 13.7 presents the distribution of OHV-related injuries by whether the vehicle overturned during the incident. Around two-thirds of injuries (66% of known responses) involved the vehicle overturning.

Table 13.7: Distribution of Emegency Department-Treated Injuries by Occurrence of Overturning

Vehicle Overturned?	#	Estimated Treated Injuries	% of Known	% of Total
Yes	67	51,300	66%	58%
No	42	26,800	34%	30%
Unknown or Not Stated	*16*	*10,200*		*12%*
Total	**125**	**88,300**	**100%**	**100%**

Source: NEISS (2022).
Based on responses to special study survey question Q43 (see Appendix B).

Table 13.8 provides the distribution of OHV-related injuries by the number of passengers in the vehicle at the time of the incident. Most injuries (59% of known responses) occurred where the driver was the only occupant, while 41% of injuries occurred while the OHV had between 1 and 5 passengers.

Table 13.8: Distribution of Emergency Department-Treated Injuries by Number of Passengers in Vehicle

Number of Passengers	#	Estimated Treated Injuries	% of Known	% of Total
No Passengers	66	50,600	59%	57%
One	39	22,600	26%	26%
2 or more	17	13,000	15%	15%
Unknown or Not Stated	*3*	*2,000*		*2%*
Total	**125**	**88,300**	**100%**	**100%**

Source: NEISS (2022).
Based on responses to special study survey question Q46 (see Appendix B).

Table 13.9a presents the distribution of OHV-related injuries by the role of the victim in the incident. Over three-quarters of injuries (76% of known responses) were to the driver; this includes injuries where the driver was the only occupant in the vehicle.

Table 13.9a: Distribution of Emergency Department-Treated Injuries by Role of Victim

Role	#	Estimated Treated Injuries	% of Known	% of Total
Driver	81	60,600	76%	69%
Passenger	33	17,600	22%	20%
Bystander	2	1,900	2%	2%
Unknown	*9*	*8,200*		*9%*
Total	**125**	**88,300**	**100%**	**100%**

Source: NEISS (2022).
Based on responses to special study survey question Q44 (see Appendix B).

Table 13.9b presents the distribution of OHV-related injuries by the role of the victim in the incident for incidents involving at least a driver *and* a passenger. This distribution is derived from a subset of the 56 special study responses in Table 13.8 that indicated at least 1 passenger being present in the vehicle at the time of the incident. In contrast to the above distribution, for incidents involving a driver and at least 1 passenger, the passenger was more frequently the injury victim (59% of known responses).

Table 13.9b: Distribution of Emegency Department-Treated Injuries in OHVs with 1 or More Passengers

Role	#	Estimated Treated Injuries	% of Known	% of Total
Driver	18	11,300	38%	32%
Passenger	31	17,300	59%	49%
Bystander	1	**	3%	3%
Unknown	*6*	*6,100*		*17%*
Total	**56**	**35,600**	**100%**	**100%**

Source: NEISS (2022).
Percentages may not sum to 100% due to rounding.
Based on responses to special study survey questions Q44 and Q46 (see Appendix B).

Table 13.10 presents the distribution of OHV-related injuries by whether the victim was ejected from the OHV, either partially or fully. A large majority of injury victims (81% of known responses) were either partially or fully ejected from the vehicle.

Table 13.10: Distribution of Emergency Department-Treated Injuries by Ejection of Victim

Victim Ejected?	#	Estimated Treated Injuries	% of Known	% of Total
Yes	64	44,100	81%	50%
No	12	10,500	19%	12%
Unknown or Not Stated	*49*	*33,700*		*38%*
Total	**125**	**88,300**	**100%**	**100%**

Source: NEISS (2022).
Based on responses to special study survey questions Q52 and Q83 (see Appendix B).

Table 13.11 presents the distribution of OHV-related injuries by victim helmet usage. Among the known responses, the victim was reported to be wearing a helmet in 41% of injuries.

Table 13.11: Distribution of Emergency Department-Treated Injuries by Victim Helmet Usage

Helmet Worn?	#	Estimated Treated Injuries	% of Known	% of Total
Yes	37	26,100	41%	30%
No	58	37,700	59%	43%
Unknown or Not Stated	*30*	*24,500*		*28%*
Total	**125**	**88,300**	**100%**	**100%**

Source: NEISS (2022).
Based on responses to special study survey questions Q70 and Q101 (see Appendix B).

Table 13.12 presents the distribution of OHV-related injuries by incident location. The majority of injuries (70% of known responses) occurred on either non-paved surfaces or trails, fields, yards or in the woods.

Table 13.12: Distribution of Emergency Department-Treated Injuries by Location

Location	#	Estimated Treated Injuries	% of Known	% of Total
Non-Paved Surface or Trail	37	31,200	37%	35%
Field / Yard	46	27,800	33%	31%
Paved Surface or Trail	24	12,800	15%	14%
Woods	13	12,300	15%	14%
Unknown or Not Stated	*5*	*4,200*		*5%*
Total	**125**	**88,300**	**100%**	**100%**

Source: NEISS (2022).
Estimates may not sum to totals due to rounding. Percentages may sum to 100% due to rounding.
Based on responses to special study survey questions Q104 and Q105 (see Appendix B).

Table 13.13 presents the distribution of OHV-related injuries by the slope of the terrain on which the incident occurred. The majority of injuries (69% of known responses) occurred on flat terrain, while the remaining injuries (31% of known responses) occurred on either a gentle or steep slope.

Table 13.13: Distribution of Emergency Department-Treated Injuries by Terrain Slope

Terrain	#	Estimated Treated Injuries	% of Known	% of Total
Flat	77	53,600	69%	61%
Gentle Slope	29	18,800	24%	21%
Steep Slope	7	5,700	8%	6%
Unknown or Not Stated	*12*	*10,100*		*11%*
Total	**125**	**88,300**	**100%**	**100%**

Source: NEISS (2022).
Estimates may not sum to totals due to rounding. Percentages may not sum to 100% due to rounding.
Based on responses to special study survey question Q106 (see Appendix B).

Table 13.14 presents the distribution of OHV-related injuries by the type of terrain on which the incident occurred. Dirt or mud were the most common terrain types for OHV injuries (38% of known responses), followed by grass (29%), gravel or rock (21%) and pavement (12%).

Table 13.14: Distribution of Emegency Department-Treated Injuries by Terrain Type

Terrain	#	Estimated Treated Injuries	% of Known	% of Total
Dirt or Mud	39	31,900	38%	36%
Grass	37	24,000	29%	27%
Gravel or Rock	22	17,400	21%	20%
Pavement	19	9,900	12%	11%
Unknown or Not Stated	*7*	*5,000*		*6%*
Total	**125**	**88,300**	**100%**	**100%**

Source: NEISS (2022).
Estimates may not sum to totals due to rounding.
Based on responses to special study survey question Q109 (see Appendix B).

Table 13.15 presents the distribution of OHV-related injuries by the condition of the terrain on which the incident occurred. A majority of injuries (79% of known responses) occurred on dry terrain.

Table 13.15: Distribution of Emergency Department-Treated Injuries by Terrain Condition

Terrain	#	Estimated Treated Injuries	% of Known	% of Total
Dry	96	65,100	79%	74%
Wet	17	14,200	17%	16%
Icy/Snowy	3	2,800	3%	3%
Unknown or Not Stated	*9*	*6,200*		*7%*
Total	**125**	**88,300**	**100%**	**100%**

Source: NEISS (2022).
Based on responses to special study survey question Q111 (see Appendix B).

Table 13.16 presents the distribution of OHV-related injuries by the speed that the OHV was traveling at (in mph) when the incident occurred. While the majority of special study respondents (65% of all responses) did not know or did not state the vehicle's speed, among the injuries represented by the known responses, a slightly majority (54%) were traveling below 25 mph.

Table 13.16: Distribution of Emergency Department-Treated Injuries by Vehicle Speed at Time of Incident

Speed (mph)	#	Estimated Treated Injuries	% of Known	% of Total
0 – 24	21	16,700	54%	19%
25+	21	14,100	46%	16%
Unknown or Not Stated	*83*	*57,500*		*65%*
Total	**125**	**88,300**	**100%**	**100%**

Source: NEISS (2022).
Based on responses to special study survey question Q116 (see Appendix B).

Table 13.17 presents the distribution of OHV-related injuries by if the OHV's lights were on at the time of the incident. Lights provide safety utility in both dimly lit (making it easier to see potential collision and overturning hazards) and well lit situations (making it easier to spot oncoming vehicles). A majority of injuries (67% of known responses) occurred when the lights were turned off. However, it is unknown what percentage of such injuries occurred during the day, as the special study did not include questions regarding the time at which the injury occurred.

Table 13.17: Distribution of Emergency Department-Treated Injuries by Use of Vehicle Lights

Lights On?	#	Estimated Treated Injuries	% of Known	% of Total
Yes	33	26,100	33%	30%
No	78	53,200	67%	60%
Unknown or Not Stated	*14*	*8,900*		*10%*
Total	**125**	**88,300**	**100%**	**100%**

Source: NEISS (2022).
Estimates may not sum to totals due to rounding.
Based on responses to special study survey question Q117 (see Appendix B).

Table 13.18 presents the distribution of OHV-related injuries by if the OHV driver had consumed alcohol prior to the incident. A majority of injury victims (95% of known responses) said that the driver had not consumed alcohol.

Table 13.18: Distribution of Emergency Department-Treated Injuries by Alcohol Consumption

Driver had alcohol?	#	Estimated Treated Injuries	% of Known	% of Total
Yes	6	4,400	5%	5%
No	112	79,500	95%	90%
Unknown or Not Stated	*7*	4,400		*5%*
Total	**125**	**88,300**	**100%**	**100%**

Source: NEISS (2022).
Based on responses to special study survey question Q119 (see Appendix B).

Discussion

OHV-Related Deaths and Injuries

It is unclear the extent that the COVID-19 pandemic impacted the reported death counts in 2020, and estimated injuries between 2020 and 2022. Relative to 2019, there was a 33-percent increase in OHV-related fatalities occurring in 2020 that were reported to CPSC. However, due to the anecdotal nature of CPSRMS data, it is unknown if this difference can be attributed more to increased outdoor activity during the pandemic, or to a greater volume of incident reports. OHV-related injuries increased in 2020 and 2021, during the height of the pandemic; the 17% increase in injuries between 2019 and 2020 was statistically significant, and injuries remained elevated in 2021, close to the annual estimates between 2015 and 2017 (108,100–115,500). However, estimated injuries have since decreased 11 percent between 2021 and 2022 to 94,700, similar to the annual estimates in 2018 and 2019.

After reaching a high of 1,145,000 in 2004, ATV sales declined steadily until 2018, to an estimated 352,000 per year.[19] Only more recently have ATV sales increased (by around 6 percent between 2018 and 2019). Except from 2009 to 2010, during the financial crisis, combined ROV and UTV sales have increased steadily, from 38,000 in 1994, to 469,000 in 2019. Combined ROV and UTV sales first exceeded ATV sales in 2013, and they have done so every year since. In 2020, the last year for which CPSC has data, both ATVs and ROVs/UTVs experienced a significant, perhaps pandemic-related, increase in sales volume. Between 2019 and 2020, ATV sales increased 16 percent to 433,000 vehicles, while ROV/UTV sales increased 31 percent to 614,000 vehicles. However, the lifespan and use of these products is uncertain. Accordingly, in the end, the effect of exposure (as a function of riders and miles and time) on deaths and injuries is unclear.

Due to the relatively modest influence (*i.e.*, small sample size) of the UTV/ROV product code (5044) on the overall OHV injury estimates, staff's injury analysis, limited to the combination of the five OHV-related product codes, is overwhelmingly dominated by the ATV product codes. For example, the comparisons of disposition, diagnosis, and body part distributions for 2018 through 2021 and 2022, presented earlier in Figure 6, represent almost the same percentages as if staff had entirely omitted the injury cases with the UTV/ROV product code. Conversely, these may not represent the actual distributions of injuries involving UTVs and ROVs, as suggested by a separate analysis restricted to injury cases specifically classified using the UTV/ROV product code for some body parts and diagnoses. More notably, the analysis constrained to injury cases classified as involving UTVs/ROVs suggests statistically significant increases in injuries that are proportionally much greater than what is observed for OHVs as a whole.

The product code 3287 for ATVs with an unknown number of wheels accounts for 31 percent of the total OHV injury estimates from 2018 through 2022. For injuries treated between 2018 and 2022, staff estimates that 2 percent of the cases may be imputed as involving vehicles having 3,

[19] Based on recent correspondence with staff from CPSC's Directorate for Economics. Figures include Motorcycle Industry Council (MIC) member and non-member production; previous years' analyses included only MIC member production.

5, or 6 wheels, while the remaining 98 percent of cases may be imputed as having involved 4-wheeled vehicles. This is based on the current distributions of the other ATV product codes specifying the numbers of wheels as 3, 4, or more (3285, 3286, and 3296, respectively). However, historical knowledge and the 2022 special study results suggest that some minority proportion of these cases correspond to misclassified ROVs, UTVs, or 2-wheeled OHVs. Similarly, staff expects some misclassifications among a minority proportion of cases coded as 4-wheeled ATVs (product code 3286). Although staff can reliably impute vehicles for the number of wheels from currently available data, staff can only compute adjustments for misclassification errors between ATV and ROVs/UTVs, based upon survey data. The reallocation of sample cases coded as ATV injuries into the smaller ROV/UTV product category could substantially increase the ROV/UTV injury estimates. However, any resulting "corrected" estimates for ROVs/UTVs would be especially sensitive to variations in the rate of reallocation computed from the survey data used.

Staff is aware that the more an estimate relies upon correction/adjustment, the more the estimate can be influenced by any imperfections with the method used for the correction/adjustment. Annual reports prior to 2020, which were concerned only with estimates for ATVs, were less sensitive to any subtle inaccuracies in adjustment factors. However, the 2010 ATV special study results (Garland, 2011) are not applicable for the ROV/UTV data because:

1. Substantial changes have occurred in the marketplace and market share for the various vehicle types since the time of prior surveys.
2. Staff observed error frequency in vehicle classification from fatality incident data (i.e., among investigated fatalities involving an ROV, about 75 percent are described in the associated death certificate as an "ATV").
3. Relative magnitude of the uncorrected estimates for ROVs/UTVs have small sample sizes and can be more sensitive to any imperfections in the adjustment factors.

Special Study

Around 14% of OHV-related injuries were attributed to ROVs or UTVs in the original NEISS data for 2022, while the special study estimates that around 29% of in-scope OHV-related injuries in 2022 could be attributed to ROVs or UTVs. Although the special study results provided strong evidence that the NEISS injury estimate for ROVs and UTVs may be a substantial underestimate, staff is unable to generalize this result to previous years. This is due to significant changes in the distribution of the OHV-related product codes over the years; as shown in Table 8a, there is a statistically significant positive linear trend in injuries associated with product code 5044 (ROVs and UTVs) between 2018 and 2022. It is unknown whether this can be attributed to more accurate medical records, a greater frequency of ROV or UTV-related injuries, or a combination of these two factors.

The special study provides some insight into how injury cases with product code 3287 (ATVs with an unspecified number of wheels) can be imputed amongst the four other OHV product codes in the scope of this report. In the section directly above, it was estimated that 98 percent of such cases could be imputed as 4-wheeled ATVs, while the remaining 2 percent could be

imputed as ATVs with 3, 5 or 6 wheels. This approximation assumes that none such injury cases are ROVs misclassified as ATVs; but among the 46 special study injury cases with product code 3287, 33 were determined to be 4-wheeled ATVs, 10 were determined to be ROVs or UTVs, and 3 were determined to be out-of-scope vehicles. Given the limited sample size, staff cannot use these results to impute injury cases where the number of wheels on the vehicle was unknown. However, this finding does suggest, as mentioned above, that not all cases with product code 3287 are ATVs; in fact, such cases may involve not only ROVs or UTVs, but may also involve a small proportion of vehicles not in the scope of this report.

The special study also revealed that a few injury cases originally classified under product code 5044 actually involved ATVs; this further suggests that, in the absence of a corresponding special study, OHV-related injuries in NEISS should be interpreted as a combined estimate of all five product codes. However, it is possible that these combined estimates may overrepresent the true number of OHV-related injuries, as a small proportion of the special study responses indicated that the vehicle involved an OHV out of the scope of this report (e.g., dirt bikes). It should also be noted that while special study responses provide valuable insight into the context of an OHV-related injury, they are usually not as specific or thorough as IDIs conducted by CPSC staff. The responses are entirely dependent on the victim's narration of the sequence of events and details about their injuries and the OHV involved; in cases involving severe injuries requiring extended hospitalization, victims were usually unable to recall the scenario surrounding the injury. On the other hand, IDIs for OHV-related fatalities can collect information from multiple sources, including police reports, coroner reports, incident photos or contact with next of kin. Lastly, the low response rate relative to the number of special study assignments does limit the reliability of the adjusted estimates due to heavily increased variance. Nevertheless, this annual report will continue to present ATV, ROV, and UTV injury estimates as combined OHV-related injury estimates based on NEISS product code classification, with separate analyses and refined estimates for years where special study data are available.

Appendix A: Deaths and Injuries Methodology

This appendix describes the methodologies used to count OHV-related deaths in CPSRMS and estimate injuries from NEISS, as well as other information used to develop the analyses in the report, excluding the special study.

OHV-Related Deaths

In-Scope OHV-Related Fatalities

All fatality data used for this report are received through the CPSRMS database. Sources that report information about OHV-related fatalities include state death certificates, Medical Examiners and Coroners Project (MECAP) reports, CPSC staff-conducted in-depth investigations (IDIs) and various news sources. NEISS injury cases resulting in fatality are also reported through CPSRMS.

A fatality in CPSRMS was considered an "in-scope, OHV-related fatality" for this report if it resulted from an unintentional incident involving an OHV (ATV, ROV, or UTV) that was in operation at the time of the incident. Because of the difficult nature of determining whether a fatal OHV incident was for occupational or non-occupational use, staff included occupational *fatalities* in both the death counts and injury estimates. Fatal unintentional incidents that were preceded by known medical events (*e.g.*, stroke, seizure, syncopal episode) were ruled to be *not* in-scope; however, such descriptions in incident narratives were rare.

ICD-10 codes (V86.X) characterizing the external cause of death as "ATV-related" include fatalities resulting from all specialty motor vehicles intended primarily for off-road use (World Health Organization, 2007). Thus, this set of ICD-10 codes captures other types of off-highway vehicles as well, such as dune buggies, dirt bikes, ROVs and UTVs. Through in-depth investigations (IDIs), CPSC staff attempts to verify the involved vehicles were indeed ATVs (i.e., motorized vehicles intended for off-road use and having three, four, or more low-pressure tires, a straddle seat for the operator, and handlebars for steering control). A large majority of fatal OHV-related incidents have completed accompanying IDIs; however, for fatal incidents without an IDI or a terminated IDI, staff relies on primary sources, such as news clips or death certificates, to identify the vehicle(s) involved. It is uncommon, but certainly possible, that a future IDI for such incidents will determine that the involved vehicle(s) are not within the scope of this report (*i.e.*, not an OHV with two or more wheels). As additional information becomes available, which either corroborates or contradicts the currently available information, staff will update the data presented in this report, accordingly.

In addition, for incidents where staff cannot determine the specific type of off-highway vehicle, staff counts the death as an ATV-related fatality. This assumption for this report, and previous reports regarding ATVs and OHVs, may also result in an overestimate of ATV-related deaths.

CPSC staff frequently receive reports for the same incident from multiple different sources. In this case, these reports may match fatal incidents that were already counted in a previous annual report, or they may be reporting on fatal incidents that were counted for the first time in

the current annual report. For example, CPSC may receive a report of a fatality from the Medical Examiners and Coroners Alert Project (MECAP) that was already entered into CPSRMS from a prior news media report. As a result, staff compares reports from all sources to identify and consolidate reports regarding identical incidents, such that each unique incident is only counted once throughout the analysis.

OHV-Related Injury Estimates

Estimation of Emergency Department-Treated Injuries Associated with OHVs

All injury estimates in this report are derived from data collected through CPSC's NEISS database, a probability sample of U.S. hospitals with 24-hour emergency departments and with more than six beds (Schroeder and Ault, 2001a and 2001b). Thus, it is important to note that OHV-related injury estimates in the scope of this report should only represent injuries that were treated in such emergency departments. OHV-related injuries that were not treated in such U.S. hospital emergency departments are not collected in the NEISS sample, and are thus, excluded from all estimates in this report.

A NEISS case was determined to be an "in-scope, OHV-related injury" if the incident involved any non-occupational and unintentional use of the OHV, regardless of whether the victim was operating the OHV at the time of the incident. For example, victims could and did include passengers and bystanders. It is important to note that NEISS does not collect occupational injuries; this distinction should be made when comparing the definition of "in-scope, OHV-related injuries" for NEISS cases to the above definition of "in-scope, OHV-related fatalities" for CPSRMS incidents.

No adjustment factors were used in the injury estimates for this year's annual report, aside from the special study estimates (see Appendix B). Adjustment factors were used in older annual reports and discussed in Levenson (2003, 2005) and Garland (2011); they were added specifically to exclude other types of OHVs misclassified as ATVs. Since the focus on this annual report has shifted from ATVs only to all OHVs, the use of such adjustment factor was not deemed necessary; continued use of such adjustment factors would likely have excluded incidents that actually involved ROVs or UTVs.

Coefficients of Variation and NEISS Reporting Criteria

The coefficient of variation (CV) is derived by dividing an estimate's standard deviation by the estimate itself and is expressed as a percentage. Schroeder and Ault (2001a) and Schroeder and Ault (2001b) detail the process of calculating NEISS estimates and their variances. A NEISS estimate is only reportable if the sample size of injury cases exceeds 20, the estimate itself is greater than 1,200, *and* the coefficient of variation for the estimate does not exceed 0.33, or 33 percent.

Injury Rate Estimates

The injury rate estimates are expressed as per 100,000 population for the relevant subpopulation for the time frame of interest. For example, the injury rate estimates for age groups in a given year are calculated by dividing the total number of estimated OHV-related

injuries for each age group by the U.S. Census Bureau's population estimate for the corresponding age group for that year. Data from the U.S. Census Bureau reflects population estimates for July 1 of each year.

Differences in Yearly Estimates

The statistical significance of changes in year-to-year injury estimates is assessed using a two-tailed z-test. As such, no specific direction of change (increase or decrease) is assumed when comparing estimated injuries between individual years.

Appendix B: Special Study Methodology

This appendix describes the methodologies used to analyze the 2022 special study responses, including the computation of adjusted NEISS weights and specific phrasing of survey questions and their possible responses.

Special Study

Adjustment of NEISS Weights

The distribution of key demographic variables (namely age group, gender, race, and hospital stratum[20]) was found to be similar between the 2022 NEISS sample and special study respondents (i.e., limited non-response bias). However, staff found there was some amount of non-response bias by NEISS product code. As such, the weights for the special study responses were adjusted as follows.

The adjusted (i.e., post-stratified) weight for any in-scope injury case in the special study population with NEISS product code 3286, 3287, or 3296 was computed using the following formula:

Adjusted Weight = $W_1 * A_1 / A_2$, where:

W_1 = NEISS weight for the injury case

A_1 = estimated injuries in NEISS sample with product codes 3286, 3287, or 3296

A_2 = estimated injuries for special study cases with product codes 3286, 3287, or 3296

For 2022, A_1 = 80,637.56 and A_2 = 5,720.67.

The adjusted (i.e., post-stratified) weight for any in-scope injury case in the special study population with NEISS product code 5044 was computed using the following formula:

Adjusted Weight = $W_2 * U_1 / U_2$, where:

W_2 = NEISS weight for the injury case

U_1 = estimated injuries in NEISS sample with product code 5044

U_2 = estimated injuries for special study cases with product code 5044

For 2022, U_1 = 12,913.74 and U_2 = 1,142.68.

For example, an injury case in the special study that represented an estimated 5.8342 injury cases in 2022 would have a post-stratified weight of 81.98 estimated injuries (5.8342 * 80,637.56 ÷ 5,720.67) if originally coded as a non-3-wheeled ATV (3286, 3287 or

[20] Hospital size, defined as the total number of emergency room visits reported by the hospital, and categorized into children's, small, medium, large, or very large (See Schroeder and Ault, 2001b).

3296), and a post-stratified weight of 65.93 estimated injuries (5.8342 * 12,913.74 ÷ 1,142.68) if originally coded as an ROV or UTV (5044).

Estimate Reporting Criteria

Standard NEISS reporting criteria (see Appendix A) requires an estimate to be computed from at least 20 injury cases. For special study estimates, due to the relatively low number of responses, this criterion is not considered. The low sample size of special study injury cases results in the post-stratified weights having a heavily inflated coefficient of variation (CV) that may exceed the maximum threshold of 0.33 from the standard NEISS reporting criteria. This criterion is thus also not considered when reporting special study estimates. However, consistent with standard NEISS reporting criteria, estimates under 1,200 are not shown.

Calculation of Refined Injury Estimate

As product code 3285 (ATVs with 3 wheels) is excluded from special study assignment and thus the above weight adjustment calculation for ATV-related injury cases, the special study only represents injuries involving products originally classified into product codes 3286, 3287, 3296 (ATVs with at least 4 wheels, or ATVs where number of wheels is unspecified) or 5044 (ROVs and UTVs). However, the special study responses may reveal one of three possibilities about the actual (verified) product involved:

- **Scenario 1:** The verified product is an ATV, ROV or UTV with at least 4 wheels.
  In this case, the original product code may or may not have been correct, but the verified product is in-scope and can be classified into one of the four product codes represented in the special study assignment (3286, 3287, 3296, 5044).

- **Scenario 2:** The verified product is an ATV with 3 wheels.
  In this case, the original product code did not correctly classify the product, but the product is still in the scope of this report; this injury case would not have been assigned to the special study if the medical record's product code was correct.

- **Scenario 3:** The verified product is an OHV that is not in the scope of this report (e.g., dirt bike).
  In this case, the sum of the adjusted weights of these responses is not counted in the overall estimate, as they do not represent ATV, ROV or UTV injuries.

Since the special study can only provide an estimate of 3-wheeled ATV injuries when the original product code did not correctly classify the product (Scenario 2), staff must rely on the 2022 NEISS data with product code 3285 to compute the remaining estimate of injuries associated with 3-wheeled ATVs.

Thus, the refined estimate consists of the below 4 components:

$$\text{Estimate} = \sum_{\square}^{A} W_{adj} + \sum_{\square}^{B} W_{adj} + \sum_{\square}^{C} W_{NEISS} - \sum_{\square}^{D} W_{adj}\text{, where:}$$

A = Special study cases that were verified to be an ATV, ROV or UTV with 4 or more wheels

B = Special study cases that were verified to be an ATV with 3 wheels

C = NEISS cases with product code 3285, and thus not assigned to the special study

D = Special study cases that were verified to be an out-of-scope product

W_{adj} = Adjusted weight computed for special study case

W_{NEISS} = NEISS weight

Specific Special Study Survey Questions

This section details the questions relied for the report (i.e., that were used to identify the vehicle type involved in the injury incident, and to create Tables 13.1 through 13.18). See notes under each table for specific question(s) analyzed to generate that table. Note that these questions were not necessarily presented to respondents in order by question number.

Q13. According to our records from the National Electronic Injury Surveillance System the injured person was seen on {injury date} in the emergency department at {hospital name} for an injury that involved an Off Road or All Terrain Vehicle. Is that correct?

o Yes
o No
o Don't know

Q14. What information is incorrect from the statement above?

▢ Different date
▢ Different hospital
▢ (I/the victim) did not receive treatment in a hospital emergency department for Off Road or All Terrain Vehicle injury

Q36. Please describe the sequence of events of the accident. *Note: Enter DK for "Don't know."*

Q10. As part of this study, we are trying to determine the types of vehicles involved in these accidents. An ATV is an off-road vehicle with at least 3 or 4 low-pressure tires, a seat designed to be straddled by the operator, and handlebars for steering. For this study, a vehicle is not considered an ATV if it has a steering wheel, bench or bucket seats, or seat belts. Was the vehicle involved in the accident an ATV?

o Yes
o No
o Don't know
o Refused

Q11. How many wheels did the ATV have? *Note: If "Other", please specify how many wheels.*

o Three
o Four
o Six
o Other _____
o Don't know
o Refused

Q13.2. Which company manufactured the ATV?

Q15. What is the model name and/or number of the ATV?

Q20. A utility vehicle or recreational off-highway vehicle, also called side-by-side, is a four- or more wheeled vehicle with bench or bucket seats equipped with seat belts, a steering wheel, and foot pedals. Recreational Off-highway Vehicles also have a rollover protective structures, also called a roll cage. A dune buggy, sand rail, and go cart are not considered utility vehicles or recreational off-highway vehicles. Was the vehicle involved in the accident a utility Vehicle or a Recreational Off-highway Vehicle? *Note: A UTV or ROV is sometimes called a side-by-side. If the vehicle was a side-by-side, mark "Yes".*

o Yes
o No
o Don't know
o Refused

Q21. What type of vehicle[21] was involved in the accident? *Note: Enter in "Other" responses into the text field.*

o Dirt bike
o Dune buggy
o Go cart
o Other _____
o Don't know
o Refused

Q23. Was the vehicle equipped with a rollover protective structure, like a roll bar or roll cage?

o Yes
o No
o Don't know
o Refused

Q24. Which company manufactured the (utility or Recreational Off-Highway) vehicle?

Q26. What is the model of the (utility or Recreational Off-Highway) vehicle?

[21] This question was only prompted when respondents stated that the involved vehicle was neither an ATV, ROV or UTV.

Q28. Can the vehicle obtain speeds greater than 30 miles per hour?

o Yes
o No
o Don't know
o Refused

Q35. Was the vehicle in operation when the accident occurred?

o Yes (The vehicle was being operated at the time of the accident.)
o No (The vehicle was in transport, being repaired, or otherwise not being operated at the time of the accident.)
o Don't know
o Refused

Q33. Which of the following choices best describes how the vehicle was being used at the time of the accident? Note: If "other", please specify the other type of activity in the provided text box.

o Recreational purposes
o Farming or ranching
o Other business or occupational tasks
o Household chores
o Yard or garden work
o Other _____
o Don't know
o Refused

Q41. What was hit or what hit the vehicle? Note: If "other", please enter the "other" answer into the provided text box.

o Car
o Truck or SUV
o Van
o UTV or ROV
o ATV
o Stationary object; for example, a tree, rock, building, etc.
o Other _____
o Don't know
o Refused

Q43. Did the vehicle overturn, even if only to one side?

o Yes
o No
o Don't know
o Refused

Q44. Were you/was your child (fill in the appropriate terminology) the... Note: If "other", please fill in the specified "other" response using the provided text box. Example: right front passenger, middle rear passenger, in cargo area, etc.

o Driver
o Passenger
o Bystander
o Other _____
o Don't know
o Refused

Q46. How many passengers, not including the driver, occupied the vehicle at the time of the accident?

o 0 (No passengers)
o 1
o 2
o 3
o 4
o 5
o 6
o More than 6
o Don't know
o Refused

Q52. Did the driver or any part of the driver's body leave the interior portion of the vehicle during the accident? *Note: In other words, was the driver ejected, either partially or fully? Partially or fully are answered as "yes".*

o Yes
o No
o Don't know
o Refused

Q83. Did the passenger or any part of the passenger's body leave the interior portion of the vehicle during the accident? *Note: In other words, was the passenger ejected, either partially or fully?*

o Yes
o No
o Don't know
o Refused

Q70. Was the driver wearing a helmet at the time of the accident?

o Yes
o No
o Don't know
o Refused

Q101. Was the passenger wearing a helmet at the time of the accident?

o Yes
o No
o Don't know
o Refused

Q104. Which of the following choices best describes the location of the accident?

o Paved road
o Non-paved road
o Paved surface that is not a road, like a driveway or a parking lot
o Field
o Yard
o Woods
o Off-highway vehicle park
o Other
o Don't know
o Refused

Q105. Please specify the "other" location.

Q106. Which of the following best describes the slope of the terrain being traveled?

o Flat
o Gentle slope
o Steep
o Don't know
o Refused

Q109. Which of the following choices best describes the surface of the terrain? *Note: If "other", please enter the response in the provided text box.*

o Pavement
o Gravel
o Dirt
o Sand
o Mud
o Grass
o Other _____
o Don't know
o Refused

Q111. Which of the following best describes the condition of the terrain? *Note: If "other", please enter the response in the provided text box.*

o Dry
o Wet
o Icy
o Snowy
o Other _____
o Don't know
o Refused

Q116. What would you estimate the speed of the vehicle at the time of the accident?

o Less than 5 miles per hour (mph)
o 5 to 9 mph
o 10 to 14 mph
o 15 to 19 mph
o 20 to 24 mph
o 25 or more mph
o Don't know
o Refused

Q117. Were any lights in use at the time of the accident?

o Yes
o No
o Vehicle not equipped with lights
o Don't know
o Refused

Q119. The answer to the following question will be kept confidential. Did the driver have any alcoholic beverages prior to the accident?

o Yes
o No
o Don't know
o Refused

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