United States
Consumer Product Safety Commission

2022 Report of Deaths and Injuries Involving Off-Highway Vehicles with More than Two Wheels

May 2023

Chao Zhang
Directorate for Epidemiology
Division of Hazard Analysis
U.S. Consumer Product Safety Commission
4330 East West Highway
Bethesda, MD 20814

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.

Table of Contents

Executive Summary

Reported Off-Highway Vehicle Related Fatalities

- CPSC staff is aware of 2,178 deaths associated with Off-Highway Vehicles (OHVs) that resulted from 2,126 incidents during the 3-year period from 2017 through 2019. As of September 2022, CPSC considers the year 2019 to be the most recent, complete year of reported fatalities.

- Of those 2,178 reported OHV-related deaths, CPSC staff associates 1,513 with all-terrain vehicles (ATVs), 537 with recreational off-highway vehicles (ROVs), and 49 with utility terrain vehicles (UTVs). For the remaining 79 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 (6%), 12–15 (7%), 16–24 (15%), 25–34 (14%), 35–44 (13%), 45–54 (14%) and 55+ (30%).

- Most of the 2,178 decedents were male (83%); 17% were female.[1]

- 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.

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

- Over the full 5-year period from 2017 through 2021, there were an estimated 517,700 emergency department-treated injuries in the United States that were associated with OHVs. This corresponds to an annual average of around 103,500 emergency department-treated injuries over the period.

- From 2017 to 2021, the estimated yearly rate of emergency department-treated, OHV-related injuries ranged from around 29–34 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 decrease in estimated injuries between 2017 and 2018.

- Estimated injuries were distributed among these age groups, as follows: under 12 (13%), 12–15 (14%), 16–24 (23%), 25–34 (19%), 35–44 (13%), 45–54 (9%) and 55+ (9%).

[1] There was 1 death among the 2,178 total where the victim's gender was unknown.

In the most recent year's (2021) estimate for emergency department-treated injuries associated with OHVs, for all ages:

- The most common diagnoses were fractures (29%), contusions/abrasions (19%), and internal organ injuries (14%).
- The most common primary injured body parts were the head and neck (33%), the arms (shoulders to fingertips, 27%), the legs (20%), and the torso (19%).
- Most of the injured were males (68%); about one-third (32%) were females.
- Most were treated and released (77%) or hospitalized (21%).
- 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 earlier 3 years, 2017–2019. As noted in the previous report, the increase from 2019 to 2020 was statistically significant (p-value < 0.01). However, the increase from 2020 to 2021 was not statistically significant (p-value = 0.80). Furthermore, there was no statistically significant evidence of any linear trend in the estimated number of hospitalizations during the overall 5-year period.

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).[2]

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 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). Only a very small proportion of 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). Additionally, national estimates of U.S. hospital emergency department-treated injuries related to OHVs have been computed for the years 2017 through 2021. 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[3] from the analyses and discussion that follow.

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

[3] 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[4]

This section provides an overview of OHV-related incidents occurring between 2017 and 2019, that resulted in one or more fatalities. Data are obtained from the Consumer Product Safety Risk Management System[5] (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 (2020–2022) to be incomplete, and thus, staff excluded those years from this report. This report only provides an analysis of deaths that occurred between 2017 and 2019, 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 2022, CPSC staff received reports of 2,126 fatal off-highway vehicle-related incidents that occurred during the 3-year period between 2017 and 2019, which resulted in 2,178 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,[6] as detailed in the Introduction section.

Counts of total reported deaths and fatal incidents have not changed for 2017. However, further review of incidents reported to have occurred in 2018 revealed that 3 fatal incidents (1 involving an ATV, and 2 involving a ROV), each resulting in a single fatality, actually occurred in 2019. Additionally, 14 other single-fatality incidents (13 classified as involving an ATV, 1 as involving either a ROV or UTV) that occurred in 2018, through the in-depth investigation (IDI) screening process by CPSC staff, were later determined not to be OHV-related.

---

[4] Staff includes reported fatal incidents involving a collision of an OHV (ATV, ROV, and/or UTV) in this report, 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.

[5] 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.

[6] 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 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.

The 13 ATV-related incidents were either determined to be misclassifications of other vehicles (*i.e.*, motorcycles, dirt bikes or pickup trucks) as ATVs, or deemed to have occurred outside the United States. The single ROV or UTV-related incident involved a vehicle that had been heavily modified, and thus, out of scope for this review. Fatal incident and death counts in this section for 2018 have been changed to reflect the updated information. Furthermore, it is plausible that the vehicle classifications for the most recent year analyzed (2019) may 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, 2017–2019.

	Vehicle Classification				
Year	**ATV**	**ROV**	**UTV**	**Unknown (ROV or UTV)**	**Total Fatal OHV Incidents**
2017	520	175	16	25	**736**
2018	467	159	15	23	**664**
2019	499	181	18	28	**726**
Total	**1,486**	**515**	**49**	**76**	**2,126**

Source: CPSRMS.

As mentioned, a single OHV-related incident may result in multiple fatalities. This was the case for at least 49 of the 2,126 reported fatal incidents (2%), of which 47 were double fatalities, 1 was a triple fatality, 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.

Table 2: Incidents Associated with OHVs Involving *Multiple* Reported Fatalities by Vehicle Classification and Number of Deaths Per Incident, 2017–2019.

	Vehicle Classification				
Number of Fatalities Per Incident	**ATV**	**ROV**	**UTV**	**Unknown (ROV or UTV)**	**Total Multiple Fatality Incidents**
2 (Double Fatality)	27	17	0	3	**47**
3 (Triple Fatality)	0	1	0	0	**1**
4 (Quadruple Fatality)	0	1	0	0	**1**
Total	**27**	**19**	**0**	**3**	**49**

Source: CPSRMS.

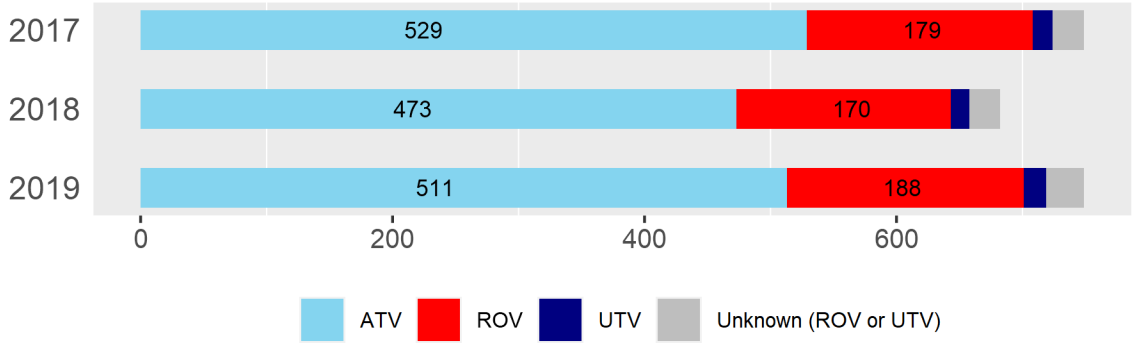
Table 3 and Figure 1 present the breakdown of reported OHV-related *fatalities* by incident year and vehicle classification, accounting for the multiple-fatality incidents presented in Table 2.

Table 3: Reported Total Deaths Associated with Off-Highway Vehicles by Vehicle Classification and Incident Year, 2017–2019.

	Vehicle Classification				
Year	**ATV**	**ROV**	**UTV**	**Unknown (ROV or UTV)**	**Total Deaths**
2017	529	179	16	25	**749**
2018	473	170	15	24	**682**
2019	511	188	18	30	**747**
Total	**1,513**	**537**	**49**	**79**	**2,178**

Source: CPSRMS.

Figure 1: Reported OHV-Related Fatalities by Vehicle Classification and Incident Year, 2017–2019.



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 (2017–2019) 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 Texas (113), California (107), West Virginia (106), Pennsylvania (98), and Kentucky (95). Together, these five states accounted for 519 fatalities from 508 incidents, or around 24 percent of the total 2,178 fatalities from 2,126 incidents. As of September 2022, no fatal incidents occurring between 2017 and 2019 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, 2017–2019.

State	Reported Fatal Incidents	Reported Deaths from Incidents	Percent of All Reported Deaths
Texas	113	113	5.2%
California	102	107	4.9%
West Virginia	105	106	4.9%
Pennsylvania	95	98	4.5%
Kentucky	93	95	4.4%
Florida	88	88	4.0%
New York	77	78	3.6%
Alabama	69	72	3.3%
Missouri	71	71	3.3%
North Carolina	69	70	3.2%
Georgia	64	66	3.0%
Minnesota	61	65	3.0%
Oklahoma	63	64	2.9%
Ohio	58	61	2.8%
Michigan	60	60	2.8%
Louisiana	57	58	2.7%
Tennessee	51	53	2.4%
Arizona	49	53	2.4%
Mississippi	47	50	2.3%
Indiana	49	49	2.2%
Wisconsin	47	48	2.2%
Idaho	44	47	2.2%
Colorado	46	46	2.1%
South Carolina	43	44	2.0%
Virginia	41	43	2.0%
Oregon	38	38	1.7%
Montana	36	36	1.7%
Iowa	34	34	1.6%
Illinois	33	33	1.5%
Alaska	30	32	1.5%
Kansas	28	28	1.3%
Nevada	26	27	1.2%
New Mexico	26	27	1.2%
Maine	24	24	1.1%
Nebraska	22	22	1.0%
Arkansas	19	20	0.9%
Wyoming	17	18	0.8%
South Dakota	17	18	0.8%
North Dakota	16	17	0.8%
Utah	15	15	0.7%
Washington	15	15	0.7%
Vermont	14	14	0.6%
New Jersey	13	13	0.6%
Massachusetts	12	12	0.6%
Maryland	10	10	0.5%
Connecticut	9	9	0.4%
New Hampshire	6	6	0.3%
Rhode Island	2	3	0.1%
Delaware	1	1	<0.1%
Hawaii	1	1	<0.1%

Source: CPSRMS.
States are listed in descending order of total reported deaths between 2017 and 2019 from OHV-related incidents. Percentages may not sum to 100% due to rounding.

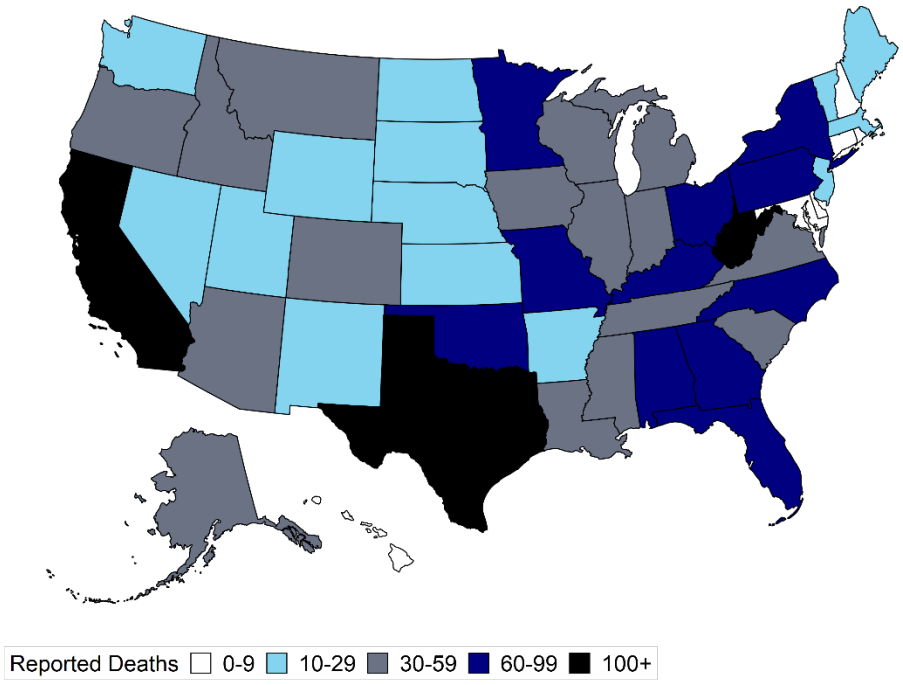
When reviewing state-level fatal incidents and death counts between 2017 and 2019, staff notes the following:

- 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.

Figure 2 provides a graphical overview of the total number of reported OHV-related deaths in each state between 2017 and 2019.

Figure 2: Reported OHV-Related Fatalities by Incident State, 2017–2019.



Source: CPSRMS.

Reported Deaths of Children Compared with All Ages

Review of fatalities from OHV-related incidents found that 283 (13%) of the 2,178 decedents between 2017 and 2019 were under the age of 16, and 134 (6%) were under the age of 12. Among the decedents younger than 16, 47 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.

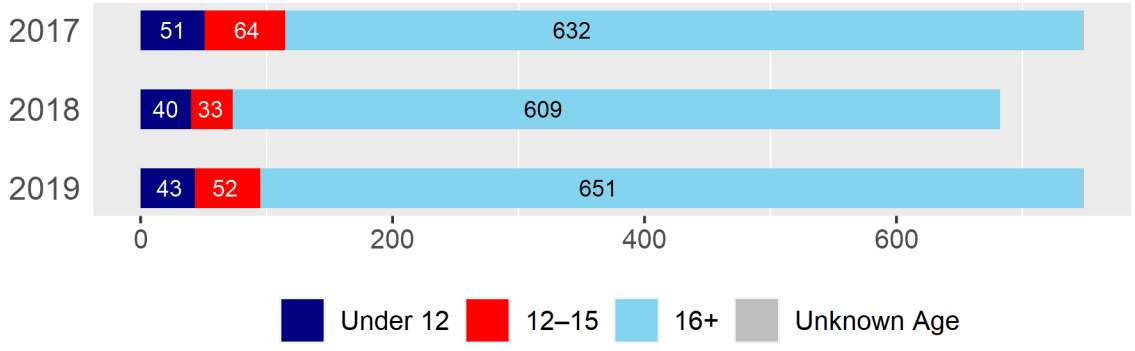
Table 5: Reported OHV-Related Fatalities for All Ages and Children's Age Groups, 2017–2019.

	All Ages	Under 16 Years of Age		Under 12 Years of Age		
Year	Deaths	Deaths	Percent of All Ages	Deaths	Percent of All Ages	Percent of Children under 16
2017	749	115	15%	51	7%	44%
2018	682	73	10%	40	6%	55%
2019	747	95	13%	43	6%	45%
Total	**2,178**	**283**	**13%**	**134**	**6%**	**47%**

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.

Figure 3: Reported OHV-Related Fatalities by Year & Children's Age Groups, 2017–2019.



Source: CPSRMS.

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 2019.

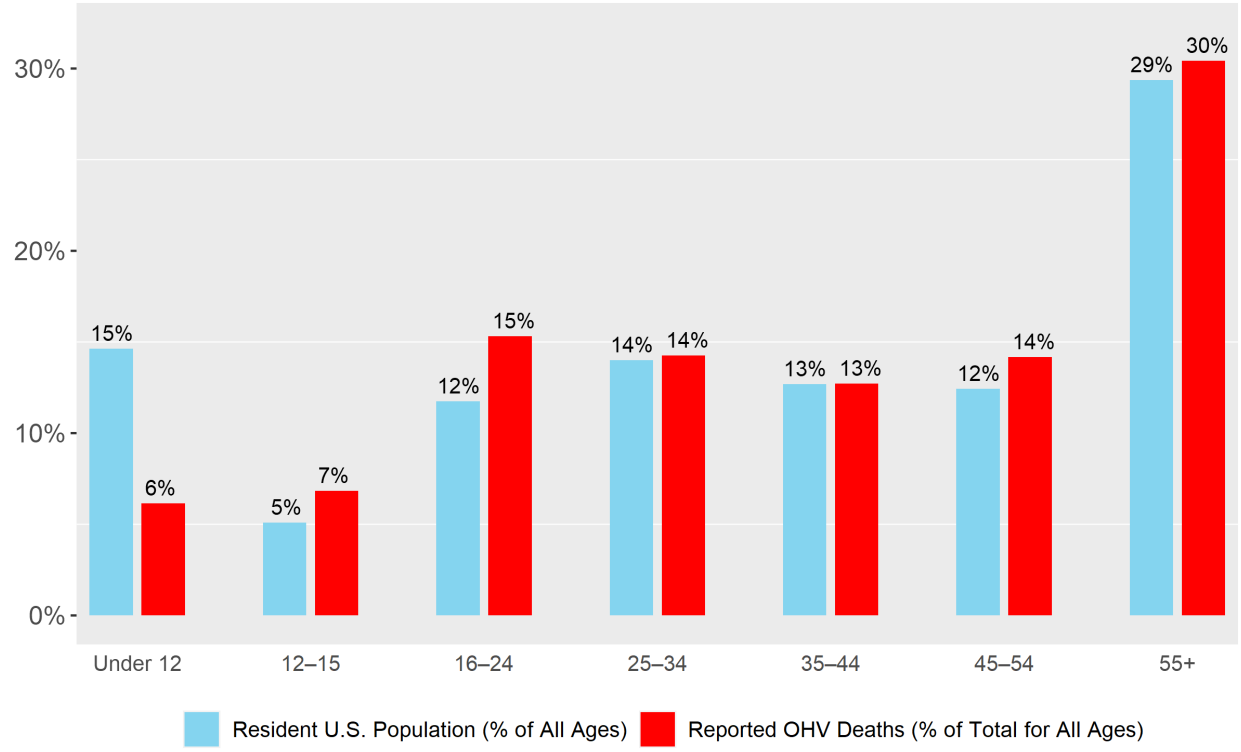
Comparing the age distributions for OHV-related fatalities and the U.S. population as a whole, the largest imbalances mostly appear in the younger age groups. Disproportionately fewer fatalities are reported among children under the age of 12, compared to their population representation. The opposite 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, 2017–2019.

	Age Group (in years)								
Year	**Under 12**	**12–15**	**16–24**	**25–34**	**35–44**	**45–54**	**55+**	**Unknown**	**Total**
2017	51	64	123	107	85	100	217	*2*	**749**
2018	40	33	98	103	98	102	208	*0*	**682**
2019	43	52	113	100	93	107	238	*1*	**747**
Total	**134**	**149**	**334**	**310**	**276**	**309**	**663**	***3***	**2,178**
Percent of Total	6%	7%	15%	14%	13%	14%	30%	<1%	

Source: CPSRMS.

Figure 4: Reported OHV-Related Fatalities Per Year by Age Group, 2017–2019.



Source: CPSRMS and U.S. Census Bureau.[7]

Summary of Reported Deaths by Gender, Race and Ethnicity

Males were disproportionately more likely to be represented in the reported OHV-related fatalities; between 2017 and 2019, around 83 percent of the 2,178 decedents were male, and about 17 percent were female. The proportion of male decedents ranged between 81 percent and 86 percent for the individual years, compared to 14 percent to 19 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.

[7] Resident U.S. Population percentages are based on U.S. population estimates published by the U.S. Census Bureau for July 1, 2019, accessible here.

Table 7: Reported OHV-Related Fatalities by Age Group and Gender, 2017–2019.

	Age Group (in years)							
Gender	**Overall**	**Under 12**	**12–15**	**16–24**	**25–34**	**35–44**	**45–54**	**55+**
Female	**17%**	30%	28%	26%	20%	13%	15%	10%
Male	**83%**	70%	72%	74%	80%	87%	85%	90%

Source: CPSRMS.
There were 3 fatalities where the victim age was not listed, and 1 fatality where the victim gender was not listed. These 4 fatalities were not considered for this table.

Race data are somewhat incomplete for OHV-related fatalities between 2017 and 2019, with around 18 percent of reported deaths denoting an unknown or unspecified race. For the 3-year period, among the 2,178 reported deaths, at least 73 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 77 percent of reported deaths denoting an unknown or unspecified ethnicity. Between 2017 and 2019, among the 2,178 reported deaths, at least 6 percent were Hispanic and at least 17 percent were non-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,[8] 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[9] 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

[8] CPSC staff analyses conducted in support of ROV Termination Package and Congressional Report, June 2020

[9] 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

For the 5-year period from January 1, 2017 through December 31, 2021, there were an estimated 517,700 emergency department-treated injuries (an annual average of 103,500 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 section of the 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.

Estimated Injuries by Product Code

Table 8 presents the distribution of injury estimates and corresponding NEISS sample sizes for the period 2017 through 2021, for each of the five product codes.

Table 8: Estimates of OHV-Related, Emergency Department-Treated Injuries by Product Codes, 2017–2021.

Product Code	Product Code Description	Sample Size	5-Year Total (2017–2021)	Annual Average	Percent
5044	Utility Vehicles (includes both ROVs and UTVs)	533	29,600	5,900	6%
3285	All-terrain vehicles (three-wheels only; exclusively off road)	107	5,500	1,100	1%
3286	All-terrain vehicles (four wheels, excluding dune buggies; exclusively off road)	6,768	329,500	65,900	64%
3287	All-terrain vehicles (number of wheels not specified; excluding dune buggies; exclusively off-road)	4,185	152,000	30,400	29%
3296	All-terrain vehicles (more than four wheels; exclusively off-road)	26	**	**	<1%
Combined	**Total (All of the above)**	**11,613***	**517,700**	**103,500**	**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 11,613 injury cases.
** Estimate fails to meet NEISS reporting criteria because the coefficient of variation (CV) exceeds 33 percent. The CVs for the estimates of the other four product codes (5044, 3285, 3286, 3287) range between 11 percent and 26 percent. More information about NEISS reporting criteria and calculation/ interpretation of CVs can be found in Appendix A.

CPSC staff is confident in characterizing OHV injuries by using *total* estimates derived from combining all vehicle types defined by these five product codes. However, estimates derived from each individual product code only represent 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. For example, only around 6 percent of the OHV injury cases were classified under product code 5044, which consists of UTVs and ROVs. Prior studies and other sources suggest that these vehicles may often be mistakenly classified as ATVs in injury narratives. Thus, it may be the case that the number of injuries associated with UTVs and ROVs is considerably greater than estimated here; as such, staff considers the actual distribution of injuries involving these vehicle types to be unknown. Without the benefit of a full-scale follow-up study, staff is at present limited to providing injury estimates by the individual product codes, or as an overall combined estimate of all five OHV product codes. Data collection for a special study began in January 2022, and the data will be available in 2023.

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 2017 and 2021, 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, 2017–2021.

	All Ages	Under 16 Years of Age		Under 12 Years of Age		
Year	Estimated Number of Injuries	Estimated Number of Injuries	Percent of All Ages	Estimated Number of Injuries	Percent of All Ages	Percent of Children under 16
2017	108,100	28,400	26%	13,400	12%	47%
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%
Total	**517,700**	**140,000**	**27%**	**68,200**	**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 11 percent to 19 percent. More information about calculation and interpretation of CVs can be found in Appendix A. Some estimates may differ slightly from those presented in the 2020 and 2021 annual reports, due to correction of rounding errors and removal of 5 duplicate injury cases between 2017 and 2020.

The 12 percent decrease between 2017 and 2018, from 108,100 to 95,000 injuries, is statistically significant (p-value = 0.02), as is the 17 percent increase between 2019 and 2020, from 96,000 to 112,300 injuries (p-value = 0.02). However, the net difference between the total estimates in the start year (2017) and end year (2021) of the examined time frame was not found to be statistically significant (p-value = 0.88). In addition, there was no significant statistical evidence of a linear trend in estimated injuries for the overall 5-year period (p-value = 0.97).

Between 2017 and 2021, 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 2017 and 2021.

Table 10: Annual Estimates of OHV-Related, Emergency Department-Treated Injuries by Age Group, 2017–2021.

	Age Group (in years)							
Year	**Under 12**	**12–15**	**16–24**	**25–34**	**35–44**	**45–54**	**55+**	**Total**
2017	13,400	15,000	24,700	21,800	13,000	10,000	10,200	**108,100**
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**
Total	**68,200**	**71,800**	**116,600**	**100,400**	**68,400**	**44,700**	**47,700**	**517,700**
Percent of Total	13%	14%	23%	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 11 percent to 20 percent. More information about calculation and interpretation of CVs can be found in Appendix A. Some estimates may differ slightly from those presented in the 2020 and 2021 annual reports, due to correction of rounding errors and removal of 5 duplicate injury cases between 2017 and 2020.

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

For the 12–15 age group:

- The 20% decrease between 2017 and 2018, from 15,000 to 11,900 (p-value = 0.03).

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 (2017) and end year (2021) 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.

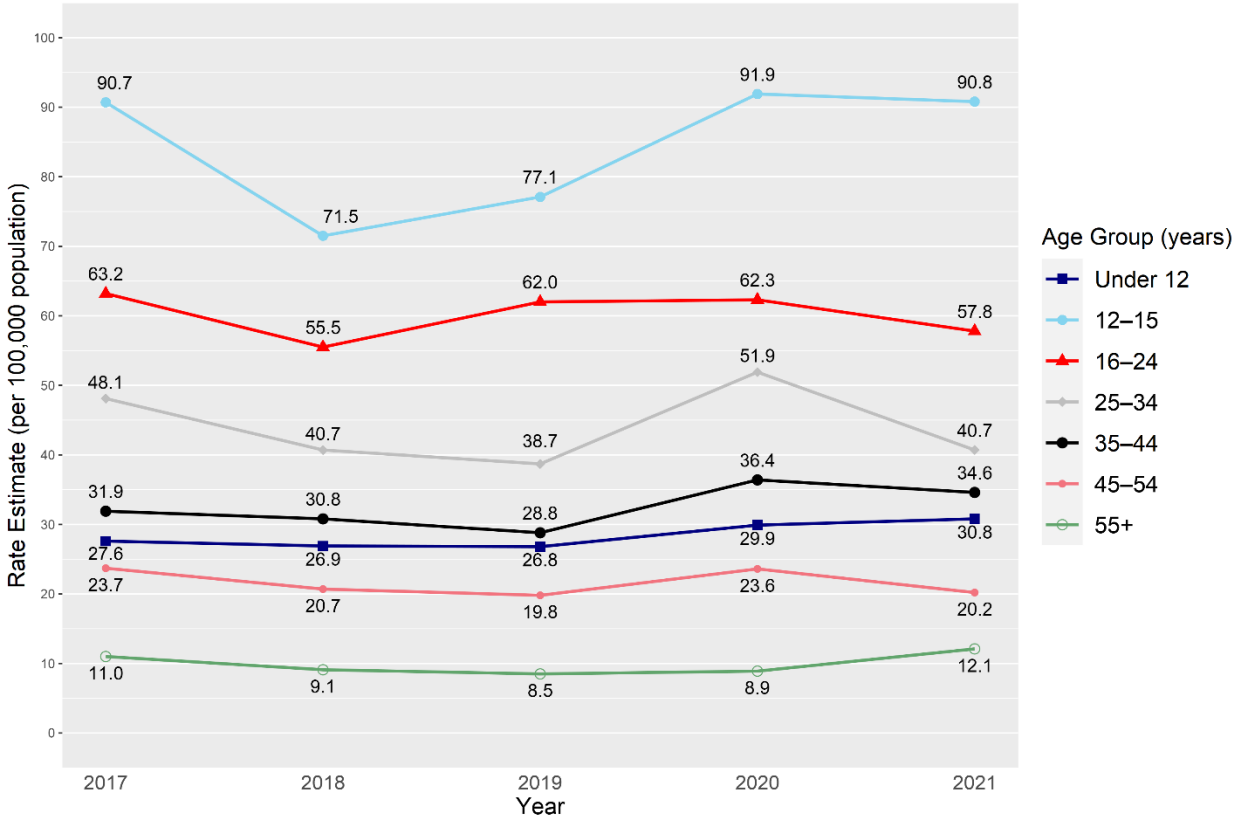
Changes in the age demographics of the U.S. population over time likely affect the estimated number of injuries for the age groups above. According to data by the U.S. Census Bureau, the number of persons aged 55 years or older in the United States increased from an estimated 92.6 million to 98.7 million between 2017 and 2021, and the number of persons between ages 35 and 44 increased from an estimated 40.8 million to 43.4 million between 2017 and 2021. 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.[10] 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.

The estimated rate of OHV-related, emergency department-treated injuries for the total U.S. population (for all ages), by individual year, are as follows: 33.3 in 2017, 29.1 in 2018, 29.2 in 2019, 33.2 in 2020, and 32.1 in 2021.

[10] Tables for population estimates published by the U.S. Census Bureau may be found here for 2017–2020, and here for 2021.

Figure 5: Annual OHV-Related Hospital Emergency Department-Treated Injury Rate Estimates by Age Group in Years, 2017–2021



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 Injuries by Gender

Table 11 provides the distribution of estimated OHV-related, emergency department-treated injuries by gender between 2017 and 2021. 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 2017 and 2021, males were roughly 49 percent of the estimated U.S. population, while females made up around 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, 2017–2021.

Year	Overall		Male			Female		
	Estimated Number of Injuries	Estimated Overall Injury Rate	Estimated Number of Injuries	Percent of All Injuries	Estimated Injury Rate	Estimated Number of Injuries	Percent of All Injuries	Estimated Injury Rate
2017	108,100	33.3	74,300	69%	46.4	33,800	31%	20.5
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%	46.2	36,400	32%	21.8
2021	106,600	32.1	72,200	68%	43.9	34,300	32%	20.5
Total	**517,700**		**354,000**	**68%**		**163,800**	**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 on July 1 of each year. There was 1 injury case of the 11,613 total from 2017–2021 where the victim's gender was unspecified. The coefficients of variation (CVs) for the injury estimates in this table range from 10 percent to 14 percent.

The 15 percent increase in estimated injuries for males between 2019 and 2020, from 65,900 to 75,800, was statistically significant (p-value = 0.03). The net differences between the estimates in the start year (2017) and end year (2021) of the examined time frame were not statistically significant for either males and 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 381,700 injuries from 2017 to 2021, with *known* race, Whites constitute around 85 percent of injuries, while making up 76 percent of the U.S. population. In contrast, Blacks/African-Americans constitute around 9 percent of injuries, while making up 13 percent of the population. Other races constitute the remaining 6 percent of injuries, while making up 11 percent of the population.[11] There was limited fluctuation year over year in the known racial distribution for OHV-related injuries.

[11] Based on annual July 1 U.S. population estimates by race, published by the U.S. Census Bureau. Estimates for 2017–2020 can be found here; estimates for 2021 can be found here.

Table 12: Annual Estimates of OHV-Related, Emergency Department-Treated Injuries by Race, 2017–2021.

	Race Information Available							
	Overall Known	White		Black		Other*	Race Information Missing	
Year	Estimated Number of Injuries	Estimated Number of Injuries	Percent of Injuries	Estimated Number of Injuries	Percent of Injuries	Percent of Injuries	Estimated Number of Injuries	Percent of Injuries
2017	79,300	67,300	85%	6,900	9%	6%	*28,800*	*27%*
2018	70,400	60,300	86%	5,400	8%	7%	*24,600*	*26%*
2019	70,100	62,000	88%	5,700	8%	3%	*25,900*	*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%*
Total	**381,700**	**323,100**	**85%**	**35,200**	**9%**	**6%**	***136,100***	***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 30 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, there is no ethnicity data available for 2017, the first year of this analysis, and ethnicity data is unknown or unspecified for around 91 percent of injuries in 2018, as well. For the remaining years, at least 25 percent of injuries were of unknown ethnicity. Overall, more than half (53%) of the estimated injuries between 2018 and 2021, were to victims of unknown ethnicity; as such, injury rates by ethnicity or race/ethnicity groups cannot be accurately computed. Between 2017 and 2021, 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 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 2021.[12]

[12] Based on published U.S. Census Bureau estimates for July 1, 2021, accessible here.

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,[13] by specifically comparing the respective injury distributions for the latest year of the analysis (2021) with the average of the previous 4 years (2017–2020). 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 517,700 emergency department-treated injuries, staff categorized the majority – approximately 81 percent of injuries between 2017 and 2020, and 77 percent in 2021 – as "treated and released." Hospitalizations[14] represented around 17 percent of estimated injuries between 2017 and 2020, and around 21 percent in 2021. In comparison with the earlier 3 years of the time frame (2017–2019), 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).

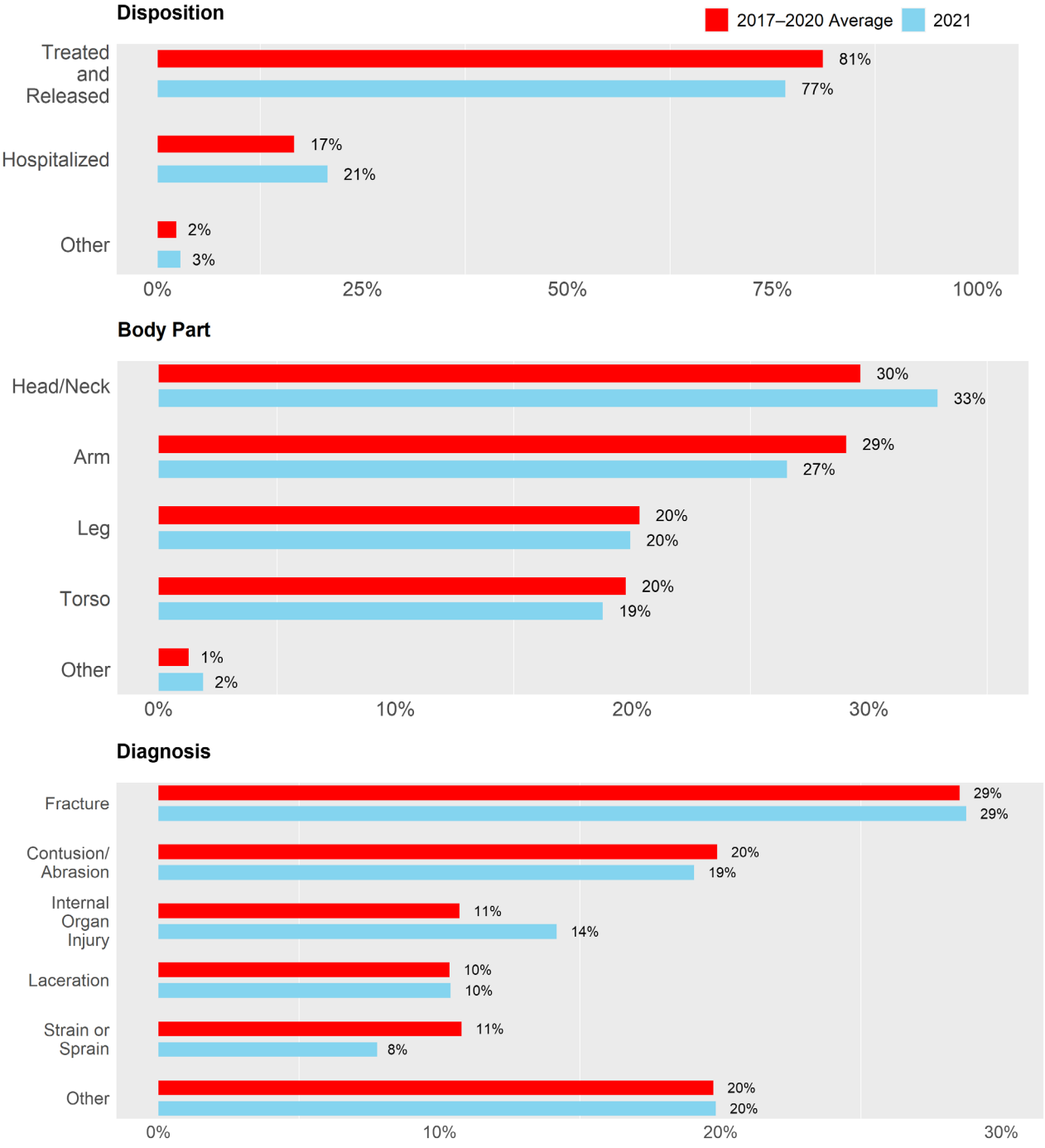
Staff categorized the various coded diagnoses into the following groups: fractures, contusions or abrasions, strains or sprains, internal organ injuries, lacerations or other injuries (including, but not limited to, concussions, dislocation, hematoma and general pain). In both periods, the most common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

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 (30% from 2017–2020, 33% in 2021) or arms (29% from 2017–2020, 27% in 2021).

[13] 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.

[14] 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 Distributions for 2017–2020 and 2021



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

Discussion

Substantial uncertainties exist regarding the classification of OHV-related injury cases in NEISS. Although staff could determine that about 30 percent of reported fatal OHV-related incidents occurring between 2017 and 2019 were not ATVs, all but 6 percent of the total 5-year injury estimate from 2017 to 2021, were classified as ATVs, and thus, coded under one of the four ATV product codes (3285, 3286, 3287, 3296). In-depth investigations (IDIs), which can provide clarity on the exact type of vehicle involved, are attempted for fatal incidents, but not for incidents involving nonfatal injuries; this may have contributed to the comparatively lower injury rates for ROVs and UTVs derived from NEISS data. Thus, the rate of emergency department-treated UTV and ROV injuries, in actuality, may be greater than 4 percent. However, it is also plausible that ATVs that expose riders to their surroundings may have a greater proportion of involvement among nonfatal injuries. It is not clear whether differences in exposure (as a function of riders and miles and time), or lack of follow-up investigations on NEISS cases, account for the difference. This observation can also be made for the OHV-related CPSRMS reports without an associated IDI, where the involved vehicle is almost always referred to as an "ATV."

After reaching a high of 812,000 in 2004, ATV sales declined steadily until 2018, to an estimated 205,000.[15] Only more recently have ATV sales increased by an estimated 1.8 percent between 2018 and 2019, the last years for which CPSC staff have data. Except between 2009 and 2010, during the financial crisis, combined ROV and UTV sales have increased steadily, from 164,000 in 2004, to 474,000 in 2019. Combined ROV and UTV sales first exceeded ATV sales in 2011, and they have done so every year since. However, the lifespan of these products is uncertain, and use of these products is even less clear. Accordingly, the effect of exposure 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 2017 through 2020 and 2021, 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 29 percent of the total OHV injury estimates from 2017 through 2021. 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), staff estimates that 2 percent of the cases may be imputed as involving

[15] Based on previous correspondence with staff from CPSC's Directorate for Economics.

vehicles having 3, 5, or 6 wheels, while the remaining 98 percent of cases may be imputed as having involved 4-wheeled vehicles. Based on historical knowledge, staff expects that some minority proportion of these cases correspond to misclassified ROVs and UTVs. 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 special study results 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.

Without the benefit of a more recent follow-up special study, staff cannot reliably produce an adjusted and corrected injury estimate specific to ROVs and/or UTVs. Until the current special study, for which data collection started in January 2022, is completed and results are available (expected next year), this annual report will continue to present ATV, ROV, and UTV injury estimates as combined OHV-related injury estimates.

Appendix A: 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.

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 emergency departments. OHV-related injuries that were not treated in 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 this year's annual report. These adjustment factors, used in older annual reports and discussed in Levenson (2003, 2005) and Garland (2011), 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.

References

ANSI/ROHVA 1 *American National Standard for Recreational Off-Highway Vehicles*.

Garland, S. (2011) *2010 ATV Injury Adjustment Factor, 2010 Adjustment Factor Standard Error, and 2010 Adjustment Factor Implementation in ATV-related Injury Analyses, memorandum*. June 16, 2011. U.S. Consumer Product Safety Commission.

Levenson, M. (2003) *ATV Injury Adjustment Factors for 1997 and 2001, memorandum*. September 12, 2003. U.S. Consumer Product Safety Commission.

Levenson, M. (2005) *Uncertainty Estimates of ATV Adjusted Injury Estimates, memorandum*. August 22, 2005. U.S. Consumer Product Safety Commission.

National Center for Health Statistics (NCHS) "About the International Classification of Diseases/Clinical Modification (ICD-10-CM)." August 2007. http://www.cdc.gov/nchs/icd.htm.

Schroeder, T. *Trend Analysis of NEISS Data*. February 2000. U.S. Consumer Product Safety Commission.

Schroeder, T. and Ault, K. (2001a) *The NEISS Sample (Design and Implementation) from 1979 to 1996*. June 2001. U.S. Consumer Product Safety Commission.

Schroeder, T. and Ault, K. (2001b) *The NEISS Sample (Design and Implementation) from 1997 to the Present*. June 2001. U.S. Consumer Product Safety Commission.

Topping, J. (February 2020) *2018 Annual Report of ATV Deaths and Injuries*. U.S. Consumer Product Safety Commission.

Topping, J. (December 2021) *2021 Report of Deaths and Injuries Involving Off-Highway Vehicles with More than Two Wheels*. U.S. Consumer Product Safety Commission.

U.S. Census Bureau. https://www.census.gov/.

U.S. Consumer Product Safety Commission. *Final Rule: Standard for All Terrain Vehicles*. Federal Register, Volume 73, Number 221, Pages 67385-67387. November 14, 2008.

World Health Organization (WHO), "International Classification of Diseases." http://www.who.int/classifications/icd/en/.