



Micromobility Products-Related Deaths, Injuries, and Hazard Patterns: 2017–2019

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This analysis was prepared by the CPSC staff and it has not been reviewed or approved by, and may not necessarily reflect the views of, the commission.

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Executive Summary

In this report, U.S. Consumer Product Safety Commission (CPSC) staff presents the latest available statistics on injury estimates, fatalities, and hazard patterns associated with three micromobility products: e-scooters (including dockless/rental e-scooters), hoverboards, and e-bikes. The timeframe covered is 2017 through 2019. For micromobility-related fatalities, staff notes that due to delays in death certificate reporting, the number of reported fatalities may change in the future.

Emergency Department (ED) - Treated Injury Estimates:

- All Micromobility Products
 - Estimated total of 132,800 ED visits from 2017 through 2019;
 - The corresponding annual estimated ED visits for 2017, 2018, and 2019, were 34,000, 44,000, and 54,800, respectively.

- E-Scooters
 - Estimated total of 50,000 ED visits from 2017 through 2019;
 - Annual estimated ED visits were 7,700, 14,500, and 27,700 in 2017, 2018, and 2019, respectively;
 - Year-over-year increases were statistically significant for e-scooters from 2017 through 2018, as well as from 2018 through 2019;
 - Estimates for dockless/rental e-scooters did not meet the reporting criteria for NEISS.* The NEISS estimates accounted for 13 percent of ED visits for e-scooters. However, this may be an underestimate because not all dockless/rental e-scooters may have been identified in the NEISS data by the hospital staff.

- Hoverboards
 - Estimated total of 71,100 ED visits from 2017 through 2019;
 - Annual estimated ED visits were 22,800, 26,300, and 22,100 in 2017, 2018, and 2019, respectively;
 - Year-over-year decrease was statistically significant from 2018 through 2019.

- E-Bikes
 - Accounted for 9 percent of the overall micromobility injury estimate for 2017 through 2019.
 - Estimates did not meet the reporting criteria for NEISS.*

Reported Fatalities:

- All Micromobility Products
 - CPSC staff is aware of 41 fatalities from 2017 through 2019;

* These estimates did not meet the reporting criteria for NEISS, which requires that the estimated number of injuries be 1,200 or higher, the sample size be 20 or larger, and the coefficient of variation be less than 33 percent.

- Number of fatalities were 5, 10, and 26 in 2017, 2018, and 2019, respectively.
- E-Scooters (Dockless/rental in parenthesis)
 - CPSC staff is aware of 27 (9) fatalities from 2017 through 2019;
 - Number of fatalities were 1 (none),¹ 5 (2), and 21 (7) in 2017, 2018, and 2019, respectively.
- Hoverboards
 - CPSC staff is aware of 4 fatalities from 2017 through 2019;
 - All 4 reported fatalities occurred in 2017.
- E-Bikes
 - CPSC staff is aware of 10 fatalities from 2017 through 2019;
 - No fatalities were reported in 2017. There were 5 fatalities in 2018 and 5 fatalities in 2019.

Associated Hazard Patterns:

CPSC Field staff completed 140 follow-up in-depth investigations related to all micromobility products, based on reports of incidents in CPSC’s Consumer Product Safety Risk Management System (CPSRMS) that occurred from 2017 through 2019. Of the 140 completed investigations, 37 involved an e-scooter, 102 involved a hoverboard, and 1 involved an e-bike.

- E-Scooters
 - Thirty-seven of the investigated incidents involved an e-scooter (32 of the 37 were dockless/rental e-scooters);
 - Brake problems were associated with more of the reported incidents (16 out of 37) than any other category.
- Hoverboards
 - Field staff investigated 102 incidents associated with hoverboards;
 - Fire hazards were the most common problem reported, accounting for 93 of the 102 incidents.
- E-Bikes
 - CPSC staff had only one completed investigation report to review. The incident indicated that the brake problems were the issue. The e-bike was owned by the consumer; she needed to “tighten” the brakes repeatedly until, on the day of the incident, the brakes failed completely.

¹ Fatality reports associated with dockless e-scooters began to appear in the surveillance data maintained by the CPSC in 2018.

Introduction

The use of micromobility products, including e-scooters, hoverboards, and e-bikes, has increased in recent years with advancements in battery technology and the growing popularity of commercial ride-sharing services. Consumers may rent commercial dockless e-scooters and e-bikes or purchase their own micromobility products. These products are popular with consumers because they are perceived as eco-friendly, given they have no tailpipe emissions, and they are a convenient, cost-effective mode of transportation for short-distance travel.²

This report summarizes the injuries, hazards, and deaths associated with the use of micromobility products, based on incident data collected from 2017 through 2019, by the CPSC. The micromobility products covered in this report are:

- electric scooters (e-scooters: electric-powered, motorized standing scooters), including ride-sharing dockless/rental e-scooters;
- hoverboards (also referred to as self-balancing e-scooters that are electric-powered, two-wheeled standing scooters with no handlebars); and
- electric bicycles (e-bikes: motorized bicycles powered by battery to assist riders' pedal-power, with a maximum speed of 15-20 mph).

No motor vehicle license is required to operate these products. Three-wheeled e-scooters, non-electric kick scooters, gas-powered scooters, or mobility scooters, mopeds, motorized carts, and other seated motorized scooters are not in scope for this report.

The report begins with national estimates of injuries that were treated in emergency departments throughout the United States. This is followed by a section on the fatalities reported to CPSC. Following the fatalities is a section on hazard patterns, as identified from the completed in-depth investigation reports. The individual injury estimates for dockless/rental e-scooters and e-bikes were not presented in this report, due to small sample sizes and limitations in NEISS data possibly leading to undercounts because of the unavailability of sufficient information to identify the product as a dockless/rental. On the other hand, the fatality data have sufficient information to identify dockless/rental e-scooters, and they are shown in parentheses following the statistics for all e-scooters.

The first section of this report presents the national injury estimates for the micromobility products in the following order: overall micromobility, e-scooters, and hoverboards. For the sections on Fatality and Hazard Patterns, the analysis is presented for overall micromobility, then e-scooters (dockless/rental e-scooter statistics in parenthesis), hoverboards, and finally for e-bikes. Lastly, Appendix A describes staff's methodology, including process for data extraction, scope determination, and association of multiple reports to the same source incident, if necessary. Appendix B presents additional details about the injury estimates. Appendix C presents a list of the fatality records used in this analysis.

² See <https://www.cpsc.gov/s3fs-public/safety-concerns-associated-with-micromobility-products>.

Staff's national estimates of injuries are based on injury data collected by CPSC's NEISS,³ which is a nationally representative stratified probability sample of hospitals in the United States and its territories. Each injury report contains a product code that identifies the type of product involved; in addition, information on the injured victim's sex, age, diagnosis, disposition, body part injured, and a brief narrative description of the injury is available. Each injury in the sample represents an estimated number of injuries that staff projects nationally.

The fatality statistics, as well as the hazard pattern review staff presents in this report, are based on incidents reported to CPSC through the CPSRMS. See Appendix A for the code and keywords used in the database searches. Reports in CPSRMS come from various sources, including consumer complaints, news clips, state/local authorities, medical examiners, national death certificates, manufacturers and retailers, among others. Staff considers the data in CPSRMS to be anecdotal and not nationally representative. Moreover, data collection is ongoing, and staff considers the latest 3 years' worth of data incomplete. Specifically for death statistics, which rely on death certificates reported by the states, staff observes a lag of up to 2 years from the time of the death certificate to the time of reporting to the CPSC. As such, the data included in this report (from 2017 through 2019) are likely incomplete. In annual reports for coming years, CPSC staff will update the statistics on an as-needed basis. Each incident report contains a product code that identifies the type of product involved, as well as information about the location of the incident (state and city) and the individual(s) involved or injured (age and sex), and a narrative description.

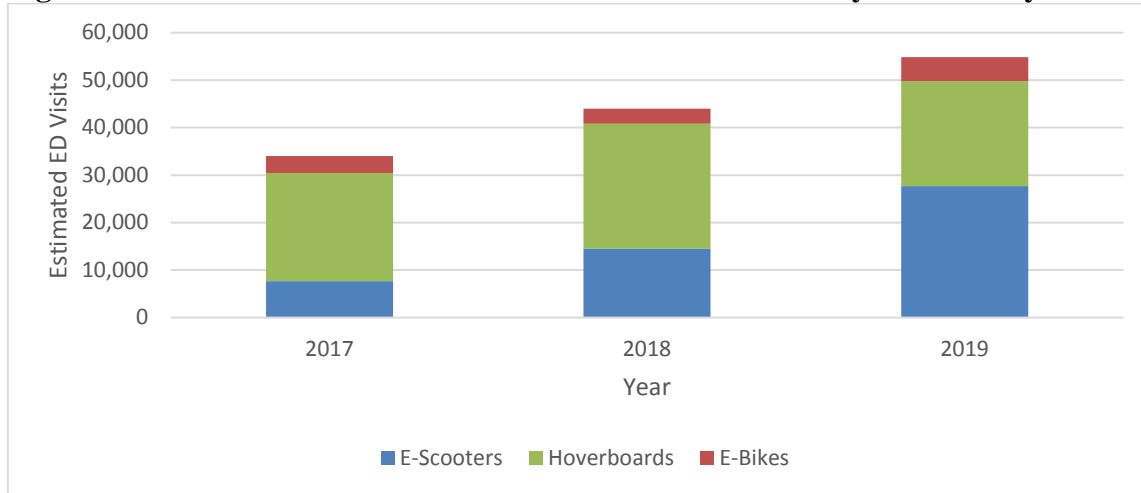
I. National Injury Estimates

Staff estimates 132,800 injuries (sample size=3,645, coefficient of variation=0.11) related to all micromobility products were treated in U.S. EDs over the 3-year period 2017 through 2019. The annual estimated ED visits were 34,000, 44,000, and 54,800 in 2017, 2018, and 2019, respectively. The annual estimates for 2020 are not available until NEISS data for 2020 are finalized in spring 2021. Figure 1.1 shows the national annual estimates of ED-treated micromobility injuries from 2017 through 2019. The ED-treated injury estimates for the overall micromobility products reflect a statistically significant increase from 2017 to 2018 (p-value: 0.01), as well as from 2018 to 2019 (p-value: 0.05). See Appendix B for additional details.

³ See <https://www.cpsc.gov/Research--Statistics/NEISS-Injury-Data>.

Products

Figure 1.1: Estimated ED Visits Associated with Micromobility Products by Year



Source: NEISS, U.S. Consumer Product Safety Commission, 2017-2019.

During 2017 through 2019, annual estimated ED visits were 7,700, 14,500, and 27,700 for e-scooters; and 22,800, 26,300, and 22,100 for hoverboards. Staff's 2019 ED-treated injury estimate of 27,700 represents a statistically significant increase (p-value:<0.01) from the 2018 estimate. In 2018, staff's estimated ED-treated injury increase was also statistically significant (p-value: 0.05). Staff did not identify any dockless/rental scooters in the 2017 NEISS data; for 2018 through 2019, the annual estimated ED visits, where the NEISS narrative provided enough information to determine that the product was a dockless/rental e-scooter, did not meet minimum requirement for NEISS.* Moreover, it is likely that NEISS estimates on dockless/rental e-scooters is an underestimate, due to insufficient information present to identify the product as a dockless/rental .

Similarly, staff determined that the annual estimated ED visits for e-bikes did not meet the reporting criteria for 2017 through 2019. Refer to Appendix B for details. E-bikes' share of annual estimates of ED-treated injuries for all micromobility products in 2017, 2018, and 2019 were 10, 7, and 9 percent, respectively.

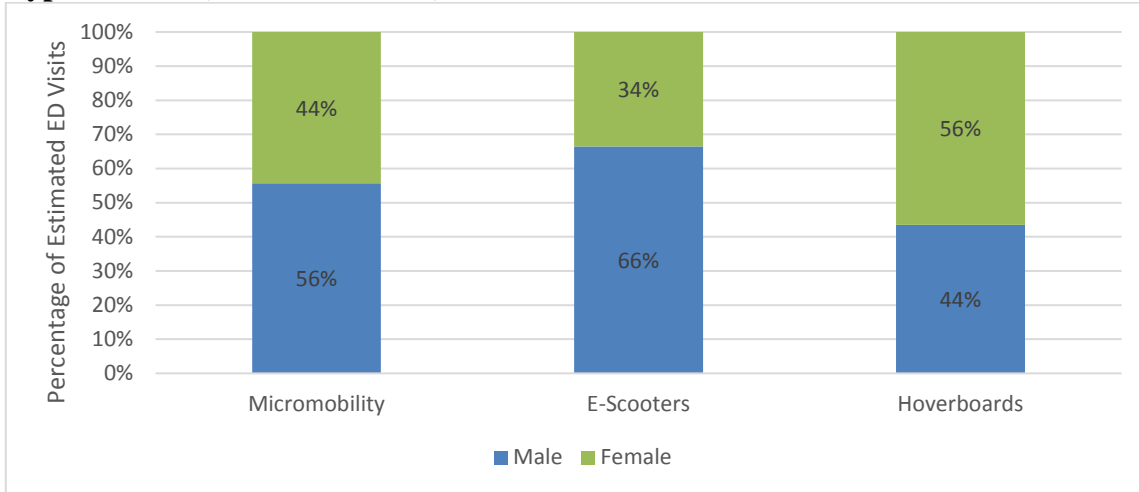
The 2019 ED-treated injury estimate of 22,100 for hoverboards reflects a decrease of 16 percent from the 2018 estimate, which is statistically significant (p-value: 0.03). Additionally for hoverboards, staff observed a year-over-year increase of 15 percent in 2018 (from 22,800 in 2017 to 26,300 in 2018), but the increase was not statistically significant (p-value: 0.06).

* These estimates did not meet the reporting criteria for NEISS, which requires that the estimated number of injuries be 1,200 or higher, the sample size be 20 or larger, and the coefficient of variation be less than 33 percent.

Gender

Figure 1.2 shows the distributions of estimated micromobility-related injuries by product type and sex. Males experienced a higher percentage (at 66 percent) of micromobility-related, ED-treated injuries in e-scooters during the 3-year period. In contrast, females had a higher percentage (56 percent) of hoverboard-related, ED-treated injuries.

Figure 1.2 Distribution of Estimated ED Visits Associated with Micromobility by Product Type and Sex (2017–2019 Total)



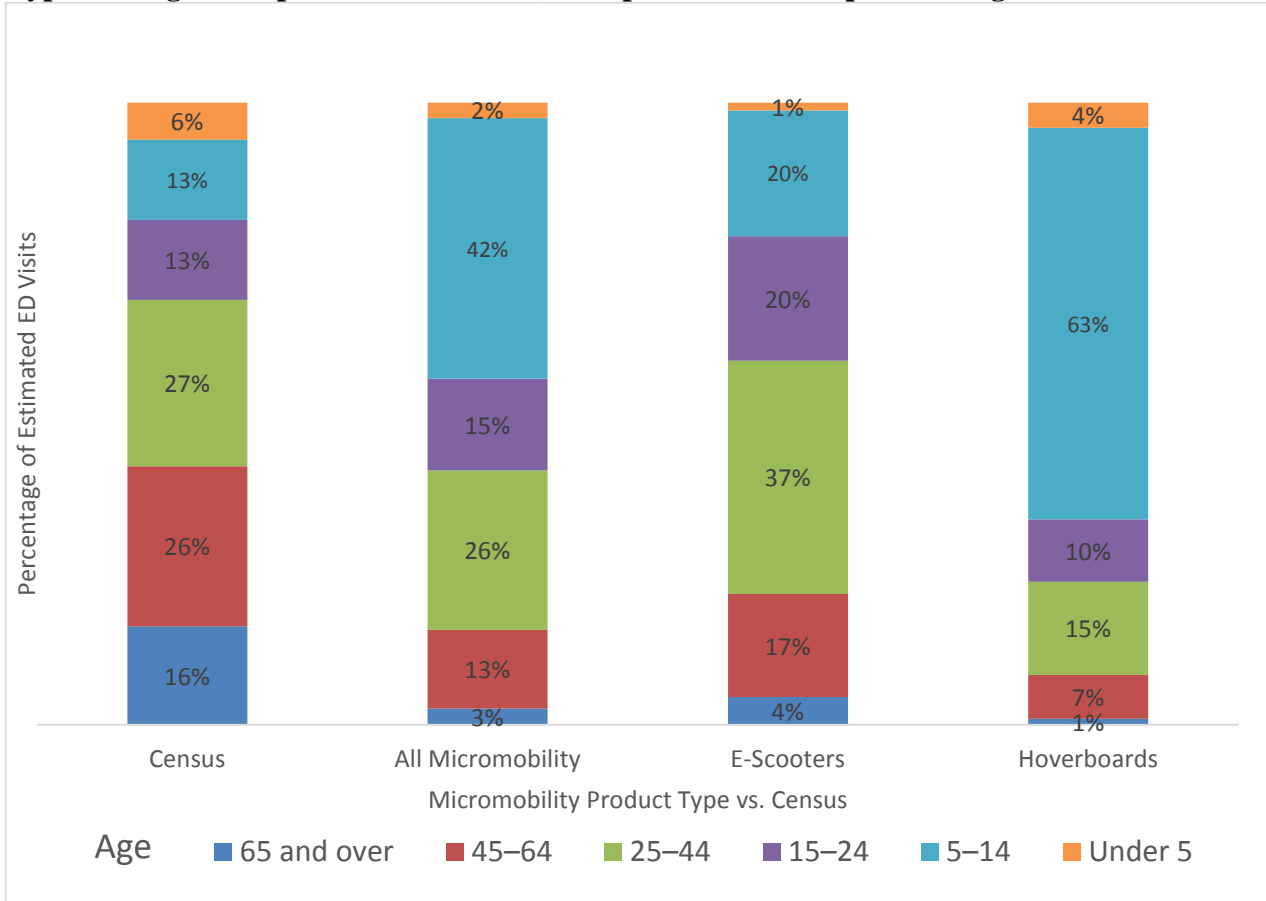
Source: NEISS, U.S. Consumer Product Safety Commission, 2017-2019.

Age Groups

Figure 1.3 shows the distribution of estimated micromobility-related injuries by age from 2017 through 2019, versus the general U.S. population distribution. Staff obtained the population by age data from the U.S. Census Bureau,⁴ corresponding to the average of 3 years. The distributions of estimated injuries sustained by the 15-to-24 and 25-to-44 age groups were 20 percent and 37 percent, respectively, for e-scooters. These distributions were disproportionately high compared to their proportions in the general U.S. population (13 percent and 27 percent, respectively). Similarly, the percentage of estimated hoverboard-related injuries for the 5-to-14 age group (63 percent) was disproportionately high, compared to its proportion in the general U.S. population (13 percent).

⁴ See <https://www.census.gov/data/datasets/time-series/demo/popest/2010s-national-detail.html>.

Figure 1.3: Distribution of Estimated ED Visits Associated with Micromobility by Product Type and Age Group (2017–2019 Total) Compared to U.S. Population Age Distribution

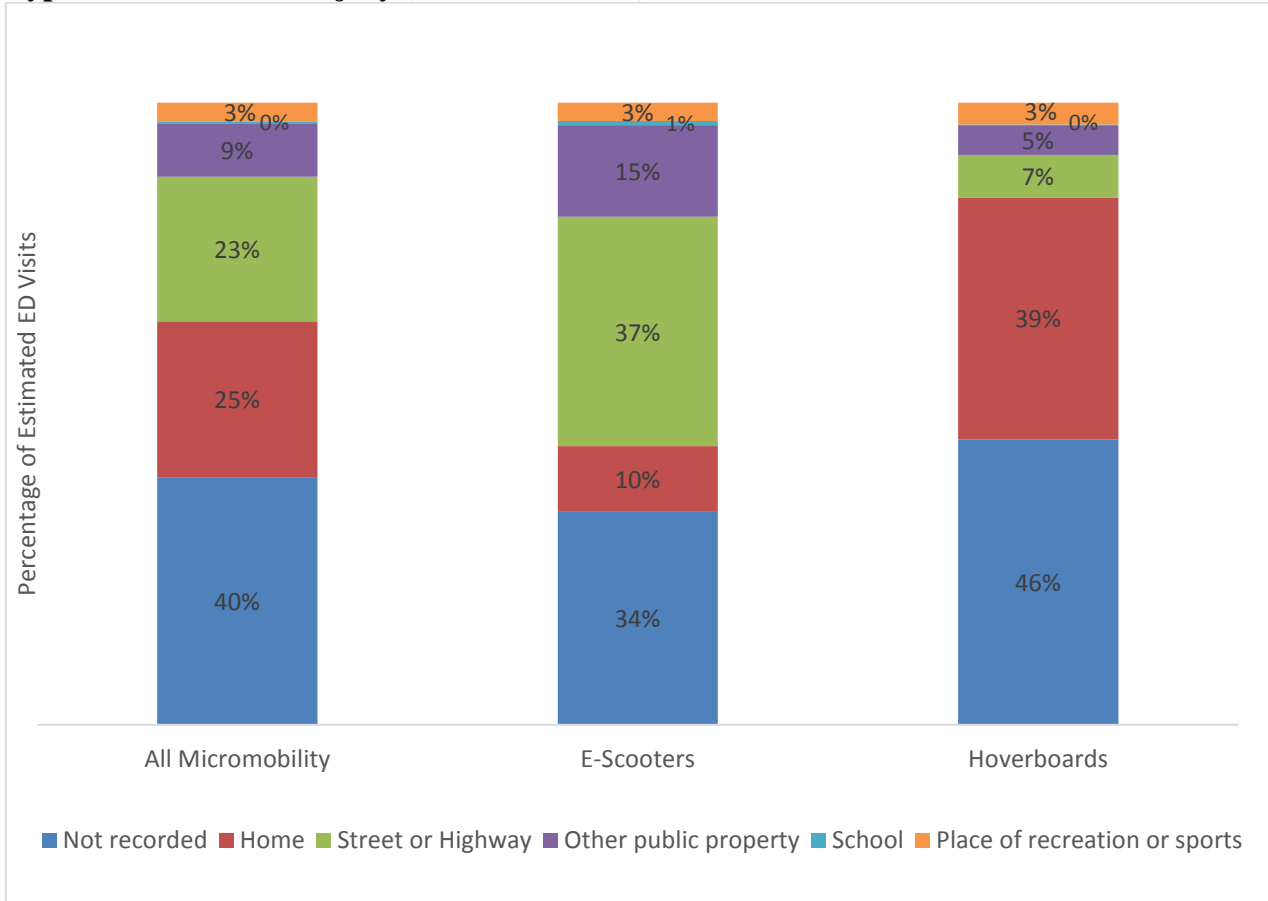


Source: NEISS, U.S. Consumer Product Safety Commission, 2017-2019.

Location of Injury

Figure 1.4 presents the proportions of injuries associated with micromobility by product type and location of injury. A large proportion (34 percent for e-scooters, 46 percent for hoverboards, and 40 percent overall) of estimated injuries occurred at unknown locations. For the known locations, the injuries associated with e-scooters occurred most frequently on streets or highways (37 percent); whereas, the hoverboard-related injuries occurred most frequently at home (39 percent).

Figure 1.4: Distribution of Estimated ED Visits Associated with Micromobility by Product Type and Location of Injury (2017–2019 Total)



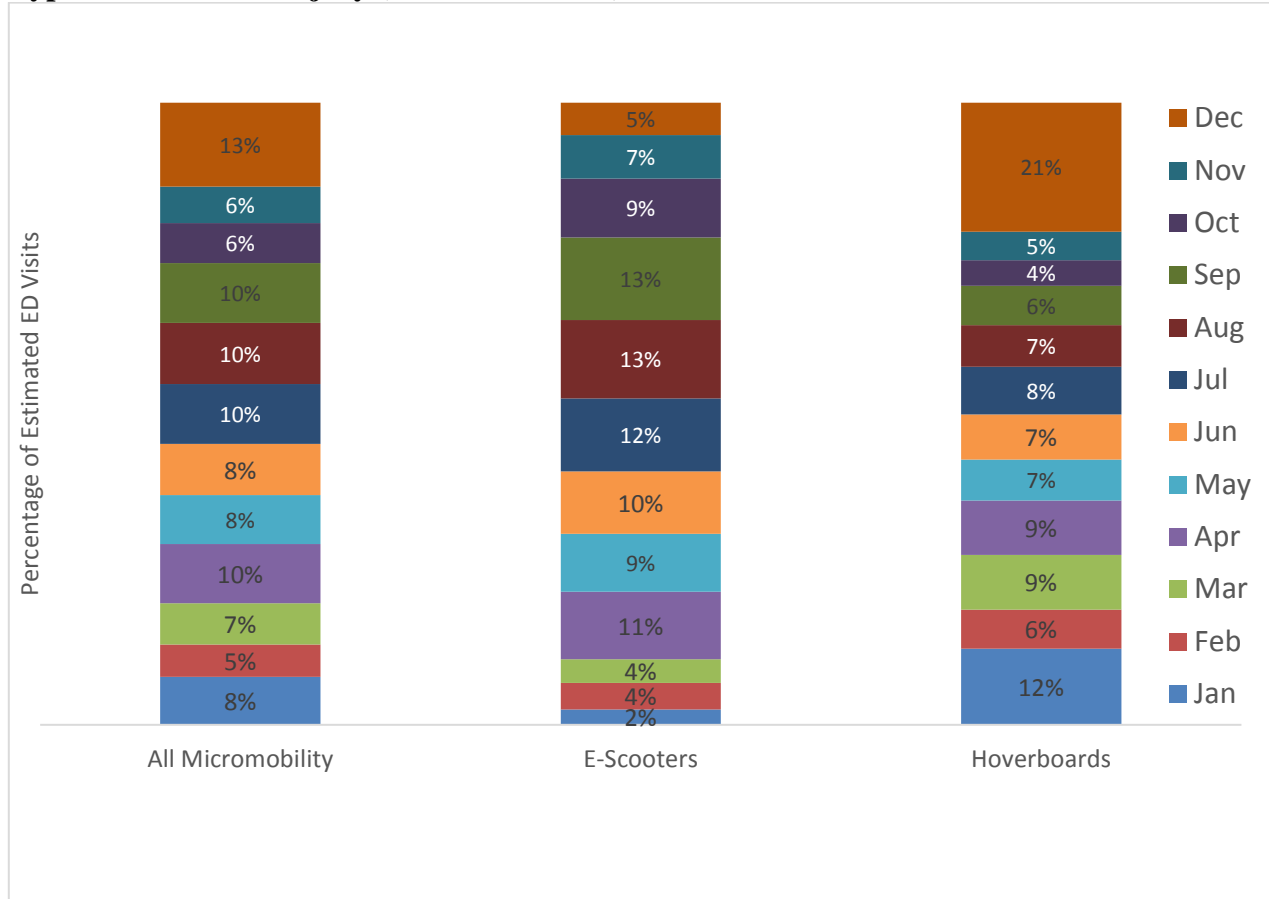
Source: NEISS, U.S. Consumer Product Safety Commission, 2017-2019.

Time of the Year

Figure 1.5 illustrates the monthly percentage distribution of the estimated emergency visits by micromobility product type. If the distribution of ED visits were to follow the discrete uniform distribution,⁵ the expected monthly ED visits is around 8 percent. Staff observes that monthly distribution of the estimated ED visits for hoverboards behave differently than the rest of the micromobility products. The months of April through October had the largest percentages for e-scooters ED visits; whereas December and January had the largest percentages for hoverboard-related ED visits.

⁵ The discrete uniform distribution is a symmetric probability distribution, where all 365 days are equally likely to be observed, then every month has a probability between 7.7 percent and 8.5 percent.

Figure 1.5: Distribution of Estimated ED Visits Associated with Micromobility by Product Type and Month of Injury (2017–2019 Total)



Source: NEISS, U.S. Consumer Product Safety Commission, 2017-2019.

Other Characteristics

The remaining characteristics, which do not vary much by product type, are as follows:

- Fractures, followed by contusions/abrasions, are the two most common diagnoses;
- The most frequently injured body parts⁶ are the upper and lower limbs, as well as the head and the neck;
- Most of the injuries are attributed to unspecified falls. Loss of user control, collisions with other motor vehicles, and pavement issues are other notable hazards leading to the injuries;
- More than 90 percent of the injured are treated and released from the EDs. About 7 percent are treated and admitted or transferred to another hospital. Disposition of the remaining 3

⁶ Body parts were grouped. For example, all body parts that would generally be considered a part of the lower limb (e.g., toe, foot, ankle, knee, and leg) were grouped as “lower limb.”

percent of injuries included: “left without being seen,” “held for observation,” as well as fatalities.⁷

II. Reported Fatalities Associated with Micromobility Products

CPSC staff is aware of 41 fatalities related to micromobility products that occurred in the United States during a 3-year timeframe, 2017 through 2019. Some of the characteristics of these reported fatalities are summarized in the tables below. Appendix C contains a full listing of the fatalities. Due to delays in death certificate reporting, staff expects the number of reported fatalities to change in future reports.

Table 2.1 shows the fatality data for micromobility products by year of death from 2017 to 2019. While data reporting is ongoing, staff observes an increase in the overall number of fatalities involving the micromobility products. E-scooter-related fatalities represent 27 (9 were dockless e-scooter-related) out of 41, or 66 percent, of total fatalities, increasing substantially from 2017 to 2019. E-bikes account for 10 fatalities, about 24 percent of the total fatalities, mostly reported in the latter part of the 3-year time frame 2017-2019. All four fatalities involving hoverboards occurred in 2017; as of the time of writing this report, staff is unaware of any hoverboard-related fatalities in 2018 or 2019.

Table 2.1: Number of Reported Fatalities Associated with Micromobility by Product Type and Year

Year	All Micromobility	E-Scooter (Dockless/rental)	Hoverboard	E-Bike
2017	5	1 (0)	4	0
2018	10	5 (2)	0	5
2019	26	21 (7)	0	5
Total	41	27 (9)	4	10

Note: Reporting for 2017-2019 is ongoing. Counts may change in future reports.

Source: CPSRMS, NEISS, U.S. Consumer Product Safety Commission, 2017-2019.

Of the 41 micromobility-related fatalities, 33 were male decedents, 7 were female decedents, and the gender was unknown for the remaining one. Decedents in the majority of the fatalities related to e-scooters (24, including all 9 dockless e-scooter fatalities), and e-bikes (9 out of 10) were males; whereas, decedents in all 4 hoverboard-related fatalities were females. (Table 2.2)

⁷ Less than 0.1 percent of the estimated injuries were fatal. All fatal injuries from NEISS have been included in the fatality discussion of this report.

Table 2.2: Number of Reported Fatalities Associated with Micromobility by Product Type and Gender (2017–2019 Total)

Gender	All Micromobility	E-Scooter (Dockless/rental)	Hoverboard	E-Bike
Male	33	24 (9)	0	9
Female	7	2 (0)	4	1
Unknown	1	1 (0)	0	0
Total	41	27 (9)	4	10

Note: Reporting for 2017-2019 is ongoing. Counts may change in future reports.
Source: CPRSMS, NEISS, U.S. Consumer Product Safety Commission.

Table 2.3 presents the fatality data for micromobility by product type and age group of the deceased from 2017 to 2019. Thirty-four out of 45 total reported micromobility fatalities provided age information. The fatalities were divided into three age groups: children (younger than 18 years of age); adults (ages 18 to 59 years); and seniors (60 years of age or older). Of the 41 fatalities, 21 (51 percent) were adults, 8 (20 percent) seniors, 5 (12 percent) were children, and the remaining 7 (17 percent) among unspecified ages. The majority of the 21 adult fatalities involved e-scooters (18, including 6 dockless/rental). The remaining 3 adult fatalities involved e-bikes. Of the 5 child fatalities, 3 involved hoverboards, and 2 (1 dockless/rental) involved e-scooters. The majority the 8 senior fatalities involved e-bikes (7).

Table 2.3: Reported Fatalities Associated with Micromobility by Product Type and Age Group (2017–2019 Total)

Age Group	All Micromobility	E-Scooter (Dockless/rental)	Hoverboard	E-Bike
Under 18	5	2 (1)	3	0
18–59	21	18 (6)	0	3
60 and over	8	0	1	7
Unknown	7	7 (2)	0	0
Total	41	27 (9)	4	10

Note: Reporting for 2017-2019 is ongoing. Counts may change in future reports.
Source: CPRSMS, NEISS, U.S. Consumer Product Safety Commission, 2017-2019.

Table 2.4 shows the data for micromobility-related fatalities by product and hazard types. Motor vehicle accidents were the leading cause of death associated with the 41 fatalities reported to CPSC staff. Out of the 41 fatalities, 26 deaths involved motor vehicle accidents, such as directly colliding with cars, SUVs, and trucks. E-scooters accounted for 20 (7 were dockless/rental e-scooters) of these 26 deaths, while e-bikes accounted for the other 6 of these deaths involving motor vehicle accidents.

Seven e-scooter fatalities (including 2 on dockless/rental e-scooters) were due to user-control issues. User-control issues led to crashing into trees, colliding with other riders, striking road curbs, and/or getting thrown into oncoming traffic.

Three fatalities were associated with hoverboard-related fires. In one incident, two children died when a hoverboard that was charging caught fire. In another incident, one person died during a house fire that started in an area where two hoverboards were located, and at least one hoverboard was being charged at the time.

One e-bike fatality incident was related to a pedestrian collision. The e-bike rider crashed into a pedestrian in a crosswalk. The e-bike rider fell on the road, suffered head injuries, and died.

The remaining three fatality incidents (one involving a hoverboard and 2 involving e-bikes) were associated with falls resulting in deaths, but staff does not have sufficient scenario-specific information to determine the associated hazard.

Table 2.4: Reported Fatalities Associated with Micromobility by Product Type and Associated Hazards (2017–2019 Total)

Hazard Pattern	All Micromobility	E-Scooter (Dockless/rental)	Hoverboard	E-bike
Motor vehicle accident	26	20 (7)	0	6
User control	7	7 (2)	0	0
Fire hazards	3	0	3	0
Pavement	1	0	0	1
Pedestrian accident	1	0	0	1
Unspecified	3	0	1	2
Total	41	27 (9)	4	10

Note: Reporting for 2017-2019 is ongoing. Counts may change in future reports.
Source: CPSRMS, NEISS, U.S. Consumer Product Safety Commission, 2017-2019.

III. Hazard Patterns Based on In-Depth Investigation Review

Because the narratives available in NEISS focus on the injury sustained, rather than on the circumstances leading to the injury, and the death reports only cover the fatalities reported, CPSC staff evaluated the available in-depth investigations for a more comprehensive look at how incidents happened. Based on reports of incidents in CPSRMS that occurred between 2017 and 2019, CPSC Field staff completed 140 follow-up in-depth investigations related to all micromobility products. Of the 140 completed investigations, 37 involved an e-scooter (32 of the 37 were dockless/rental e-scooters); 102 involved a hoverboard; and one involved an e-bike. This does not necessarily reflect the current prevalence of incidents related to micromobility products in the CPSRMS database. Staff initiated many more in-depth investigations that could not be completed due to product unavailability or unwillingness of consumer(s) to cooperate and provide product and injury information. Data collection is ongoing for 2017 through 2019, and staff expects the numbers to change in future reports. Below staff discusses the types of products and the reported hazards associated with each.

E-Scooters (Including Dockless/Rental E-Scooters)

Of the 37 e-scooter-related incidents that were investigated, 32 were dockless e-scooters. Staff's review of the 37 in-depth investigations shows the following hazards:

- **Brake problems** were associated with more of the reported incidents (16 out of 37) than any other category. The investigations show that brakes not engaging at all, sporadically engaging, or engaging excessively following a delay resulted in 13 of the 16 reported incidents. In one other case, the complainant reported that the brake cable was not properly attached to the adjustment bracket on the handlebar grip. The remaining 2 incidents happened to the same consumer; other than an email message indicating mechanical brake failures, the consumer did not share any additional scenario-specific detail.
- **Unexpected power loss** caused the rider(s) to tip over or get thrown off in 5 of the 37 reported incidents. In one of the 5 incidents, the rider was going downhill and the e-scooter lost power when it went over a curb.
- **Fire hazards** were reported in 4 of the 37 incidents; all occurred while charging the e-scooter.
- **Multiple product-related issues**, such as brakes malfunctioning, throttles getting stuck, control panels catching fire, and wobbliness were reported in 4 of the 37 incidents. In one of these 4 incidents, the rider went over a bump, which seemed to mark the onset of throttle and brake problems.
- **Miscellaneous product-related problems**, such as footboard or handlebar breaking/detaching or e-scooter not powering up, were reported in 3 of the 37 incidents.
- **Human factors, environmental factors, and unknown factors** played a major role in the remaining 5 (out of 37) incidents. The users lost control of the e-scooters in 3 cases after hitting a pothole, coming off of a curb, or while being chased by an aggressive dog, respectively. Staff has insufficient information to determine why the users in the remaining 2 incidents went through an intersection against a red light, causing a collision with other motor vehicles that had the right-of-way.

Hoverboards

A review of the 102 in-depth investigations showed the following hazards:

- **Fire hazards** were the most common problem, accounting for 93 of the 102 reports. The reports describe fire (sometimes after an explosion), smoke, or sparks, emanating from the product; some reports describe the product overheating or melting. Sixty of the 93 incidents occurred when the board was being charged or had just completed charging; 16 of the 93 reported that the incidents occurred during use or immediately after use; 10 of the 93 boards caught fire spontaneously. Two additional incidents reported that the board would not shut-off and eventually started to smoke. In a different incident, the board caught fire after a consumer had reset the battery, which was not charging. Another hoverboard emitted sparks when the consumer attempted to remove the battery per the manufacturer's recommendation because the board was not charging. Staff had no scenario-specific information for the 3 remaining incidents.

- **Other electrical hazards** were identified in 6 of the 102 investigated incidents. These included unexpected loss of power, resulting in the rider losing balance (3 incidents); board operating (spinning) on one side only (2 incidents); and board failing to shut off and throwing off the rider (1 incident).
- **Other/unknown issues** resulted in 3 of the 102 investigated incidents. In each case, the board vibrated excessively, throwing off the rider. While uneven weight distribution may have contributed, at least for 2 of these incidents, some other unknown factor was at play.

E-Bikes

CPSC staff reviewed one completed investigation report.

- **Brake problem:** The e-bike was owned by the consumer; she needed to “tighten” the brakes repeatedly until, on the day of the incident, the brakes failed completely.

Table 3.1 summarizes the hazards associated with the use of the various micromobility products.

Table 3.1: Distribution of Investigated Incidents by Product Type and Associated Hazard (2017–2019 Total)

	All Micromobility	E-Scooter (Dockless/rental)	Hoverboard	E-Bike
Fire	97	4 (1)	93	0
Brakes	17	16 (16)	0	1
Power Loss	5	5 (5)	0	0
Other Electrical	6	0	6	0
Misc. Product-Related	5	3 (2)	0	0
User/Environmental Factors	5	3 (3)	0	0
Multiple Product-Related	4	4 (3)	0	0
Unknown	1	2 (2)	3	0
Total	140	37 (32)	102	1

Source: CPSC In-Depth Investigation File from CPSRMS, 2017-2019.

References

Lee, Douglas, “Safety Concerns Associated with Micromobility Products” U.S. Consumer Product Safety Commission, March 2020. Online at https://www.cpsc.gov/s3fs-public/Report-on-Micromobility-Products_FINAL-to-Commission.pdf?THHlorYXAZ.KiZnobh1o7.7.1N9nNCLo

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NEISS sample design: <https://www.cpsc.gov/Research--Statistics/NEISS-Injury-Data>

U.S. Census Bureau <https://www.census.gov/>
The Monthly Postcensal Resident Population counts can be found at:
<https://www.census.gov/data/datasets/time-series/demo/popest/2010s-national-detail.html>

Appendix A: Methodology

CPSC staff queried epidemiology data from the National Electronic Injury Surveillance System (NEISS) and Consumer Product Safety Commission Risk Management System (CPSRMS). Staff reviewed query results to include only the incidents related to micromobility products.

Date of Queries: 04/02/2020

Incident Dates or Treatment Dates: 1/1/17-12/31/19

Product codes and narrative descriptions

E-scooter (italics indicate dockless/rental e-scooter):

- Product code: 5042
- Narrative/Text contains any of the following: “electric scooter”, “e-scooter”, “stand up scooter”, “standup scooter”, “motorized scooter”, “power scooter”, “*dockless scooter*”, “*rental scooter*”, “*scooter sharing*”, *any brand known to be dockless/rental e-scooters* and other variant spellings
- For CPSRMS data, searched brand, manufacturer fields when their information were available to identify in-scope products

Hoverboard:

- Product code: 5042
- Narrative/Text contains any of the following: “self-balancing scooter”, “hoverboard” and other variant spellings
- For CPSRMS data, searched brand, manufacturer fields when their information were available to identify in-scope products

E-bike:

- Product code: 3215
- Narrative/Text contains any of the following: “electric bike”, “e-bike”, “electric bicycle”, “e-bicycle”, “power (assisted) bike”, “power (assisted) bicycle”, “motorized bike”, “motorized bicycle”, and other variant spellings
- For CPSRMS data, searched brand, manufacturer fields when their information were available to identify in-scope products

For this report, an incident was deemed out of scope if any of the following criteria was satisfied:

- not electric or battery-powered
- not two-wheeled
- seated scooters
- mopeds, motorcycle
- mobility scooter/wheelchair
- Any brand names that are known to be not of interest.

For CPSRMS data, CPSC staff consolidated multiple reports that pertain to a single incident as one incident prior to analysis.

Appendix B: Summary of Annual Injury Estimates and Trend Analysis

Annual Injury Estimates, Corresponding Sample Sizes, and Coefficients of Variation by Product Type, 2017-2019

Year	All Micromobility			E-Scooter			Dockless/Rental E-Scooter			Hoverboard			E-Bike		
	N	Est. ED Visits	C.V.	N	Est. ED Visits	C.V.	N	Est. ED Visits+	C.V.	N	Est. ED Visits	C.V.	N	Est. ED Visits+	C.V.
2017	935	34,000	0.113	185	7,700	0.182				120	22,800	0.113	21	3,500	0.321
2018	1,149	44,000	0.118	369	14,500	0.252	15	1,800	0.797	128	26,300	0.126	20	3,200	0.478
2019	1,561	54,800	0.153	761	27,700	0.266	51	4,900	0.586	101	22,100	0.155	47	5,000	0.360
Total	3,645	132,800	0.114	1,315	49,900	0.220	66	6,700	0.626	349	71,100	0.122	88	11,800	0.364

Source: NEISS, U.S. Consumer Product Safety Commission, 2017-2019.

Grey shaded cells in the table do not meet the NEISS reportability criteria. Reporting criteria for NEISS require that the estimated number of injuries be 1,200 or higher, the sample size be 20 or larger, and the coefficient of variation be less than 33 percent.

Trend Analysis

Staff observed significant increases for all micromobility product related injuries from 2017 to 2018 as well as from 2018 to 2019. However, even after running trend analyses using different statistical models (results for one of the models shown below), no significant trend was observed. This is counter-intuitive; however, staff opines a lack of data point is the reason for absence of significance. It is likely that additional years of data would produce significant results.

Trend Analysis Results Based on Unstructured Variance/Covariance Matrix

Effect	Parameter Estimate	Standard Error	Degrees of Freedom	t-value	p-value
Intercept	-20,610,000	7,336,718	1	-2.81	0.22
Year	10,236	3,637	1	2.81	0.22

Source: NEISS, U.S. Consumer Product Safety Commission, 2017-2019.

Appendix C: List of Fatalities from 2017 to 2019

Fatality Number	Incident Date	Incident Description	State	Age	Gender
E-Scooters					
1	Dec-2017	An 11-year-old boy was riding an electronic scooter on the street when he was hit by a vehicle. He was taken to a local area hospital with major injuries and died of injuries.	CA	11	M
2	Aug-2018	21 YOF rode an electric motorized scooter and was hit by a vehicle. She was taken to a hospital where she died.	CA	21	F
3	Sep-2018	A 24 year old male was riding an electric rental scooter. He lost control of the scooter and went off of a curb. He sustained a fatal head injury as a result of this incident and died a short time later at an area hospital.	TX	24	M
4	Sep-2018	A 20 YOM was riding an electric scooter was killed after being struck by an SUV.	DC	20	M
5	Nov-2018	38 YOM, riding scooter when he hit a tree. He was transported to the hospital where he was pronounced dead.	Unk.	38	M
6	Dec-2018	A man riding an electronic scooter was killed when he was struck by a car. The driver of the car struck the scooter from behind.	CA	Unk.	M
7	Feb-2019	21 YOM was riding an electric scooter on a street in the wrong direction when he was struck by a vehicle. He was taken to the hospital where he died the next day.	TX	21	M
8	Mar-2019	A 53 YOM and a friend were riding an electric scooter on the sidewalk. The decedent approached and intersection and attempted to make a left hand turn when he struck a fixed object.	CA	53	M
9	Apr-2019	41 YOM decedent was riding on a scooter when he collided with a truck. He was transported to the hospital where he was pronounced dead.	FL	41	M
10	Apr-2019	The driver of a car struck and killed 27 YOM who was riding a shareable dockless electric scooter.	FL	27	M
11	Apr-2019	A truck hit the 31 YOM on the scooter, back up and roll him over before speeding off. The scooter's rider died in a hit-and-run incident.	CA	31	M
12	May-2019	A man was riding an electric scooter in the road when he was hit by a vehicle. The man on the scooter died as a result of his injuries.	GA	Unk.	M
13	May-2019	30 YOM Decedent was the operator of a scooter who lost control, veered into the sidewalk, and striking the curb. He was airlifted to trauma center. His health deteriorated & was pronounced.	FL	30	M
14	May-2019	20 YOM was riding an electric scooter, in the street. He was struck by a vehicle. Authorities responded to the scene. 20 YOM died due to his injuries.	GA	20	M
15	Jun-2019	33 YOM was riding an electric scooter when he collided with a truck. He was taken to a hospital and died of injuries later on.	FL	33	M
16	Jun-2019	The decedent was a 47-year-old male who resided in Arizona. The decedent and a friend were riding scooters together when they collided and fell to the concrete walkway.	CA	47	M
17	Jun-2019	A man and a female companion were riding scooters when they collided and fell to the ground. He complained of chest pains and he was transported to the hospital where he died of blunt force trauma to the torso.	CA	Unk.	M
19	Jul-2019	18 YOM was killed and a 15 YOM was critically injured after the scooter they were riding on was struck by a car. The 18 YO victim was pronounced dead at the hospital. The 15 YO is in critical condition.	CT	18	M
20	Jul-2019	34 YOF was riding an electric scooter with her spouse and was hit by a vehicle. She suffered a seizure and her health declined. She was in comatose state and was pronounced later on.	GA	34	F
21	Aug-2019	A 26 YOM victim has died after he collided with a car while riding an electric scooter. Victim rode into oncoming traffic.	CO	26	M
22	Aug-2019	A man on an e scooter ran a red light and struck an oil truck. He was killed.	GA	Unk.	M
23	Oct-2019	A man on an electric scooter was struck and killed by an SUV that fled the scene. The victim died on the scene.	WA	Unk.	M
24	Oct-2019	A scooter rider was hit by car driver. The person was taken to a hospital and pronounced dead. The driver stayed at the scene and cooperated with investigators.	WA	Unk.	U
25	Oct-2019	A male teen riding scooter hit, killed by vehicle. It happened near an intersection.	AZ	Unk.	M

Appendix C: List of Fatalities from 2017 to 2019 (continued)

26	Oct-2019	A 16-year-old boy died and another boy was seriously injured when the e-scooter that they were riding on was hit by a truck. The boys entered an intersection on a red light when they were struck.	ID	16	M
27	Nov-2019	Man riding an electric scooter dies following crash A 35-year-old man riding an electric scooter died after a crash at an intersection. Reportedly, he lost control of the scooter while in the bike path and fell into oncoming traffic.	KY	35	M
Hoverboards					
28	Jan-2017	The 10-years-old female decedent had fallen off of a hoverboard striking her head. Cause of death: intracranial hemorrhage with midline shift.	FL	10	F
29-30	Mar-2017	A hoverboard was being charged when it erupted into flames igniting a chair and curtains. Six people were hospitalized and 2 (2 year old female & 10 year old female) of the six died as a result of their injuries.	PA	2, 10	F, F
31	Oct-2017	One person died and two other family members were injured during a house fire that started in an area where two hoverboards were located and with at least one hoverboard being charged at the time via a power strip.	PA	88	F
E-Bikes					
32	Jan-2018	73 YOM died after crashing his electric bicycle. He was riding his bike when he hit a speed bump. He went airborne, then landed and crashed. He was taken to MC where he was pronounced dead later that afternoon.	CA	73	M
33	Aug-2018	62 YOM is believed to have fallen off his electric bicycle. He was riding in the city. Cause of death: multiple blunt impact injuries.	PA	62	M
34	Sep-2018	67 YOM rode his electric bicycle along the edge of the road, into the path of an SUV. The bicyclist was killed in the crash.	CA	67	M
35	Oct-2018	79 YOM decedent was operator of electric bicycle involved in collision with SUV. Cause of death: multiple blunt force traumatic injuries.	CA	79	M
36	Oct-2018	69 YOM was riding electric bike when he was struck by a truck on the street, causing life-threatening injuries. Took him to medical center where he later died from injuries.	AZ	69	M
37	Jan-2019	26 YOM bicyclist died after he struck an open taxi door and was tossed into oncoming traffic. He was unconscious in the roadway with head and body injuries after a car hit him. He was on an electric bike when he collided with the open door of a parked taxi.	NY	26	M
38	May-2019	72 YOM decedent was operator of motorized bicycle who fell. Cause of death: Hypercapnic respiratory failure, multiple traumatic injuries, traumatic fall from motorized bicycle.	CA	72	M
39	Aug-2019	43 YOM e-biker critically hurt after crashing into a pedestrian in a crosswalk near a road. Suffered head injuries in the crash and died.	NY	43	M
40	Sep-2019	62 YOM decedent was a cyclist riding an e-bike when struck by a truck. Cause of death: Complications of blunt head trauma.	NY	62	M
41	Sep-2019	29 YOF was riding a power-assisted bicycle and hit a vehicle. She was taken to a hospital and pronounced later on.	PA	29	F

Note the two fatalities involving hoverboards for the March-2017 incident.