E-SCOOTER COLLISION AND INJURY ANALYSIS

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Vision Zero SF Injury Prevention Research Collaborative
A Collaboration between the
San Francisco Department of Public Health's Program on Health, Equity and Sustainability
and the Zuckerberg San Francisco General Hospital and Trauma Center

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About the Vision Zero SF Injury Prevention Research (VZIPR) Collaborative

The ***VZIPR Collaborative*** is composed of epidemiologists, physicians, and key staff from the San Francisco Department of Public Health (SFDPH) and Zuckerberg San Francisco General Hospital and Trauma Center (ZSFG). As the city's only Level I Trauma Center, ZSFG treats nearly all patients who sustain traumatic injuries in San Francisco, California. The VZIPR Collaborative thus has a unique opportunity to analyze the full spectrum of severe traffic injuries occurring in our city. VZIPR has been working since 2014 to develop, institutionalize, and utilize comprehensive injury data in support of strategic research and analyses for Vision Zero SF, San Francisco's policy and commitment to eliminate traffic deaths on city streets.

The following current and former VZIPR Collaborative members, listed alphabetically by last name, contributed to the methodology and this report:

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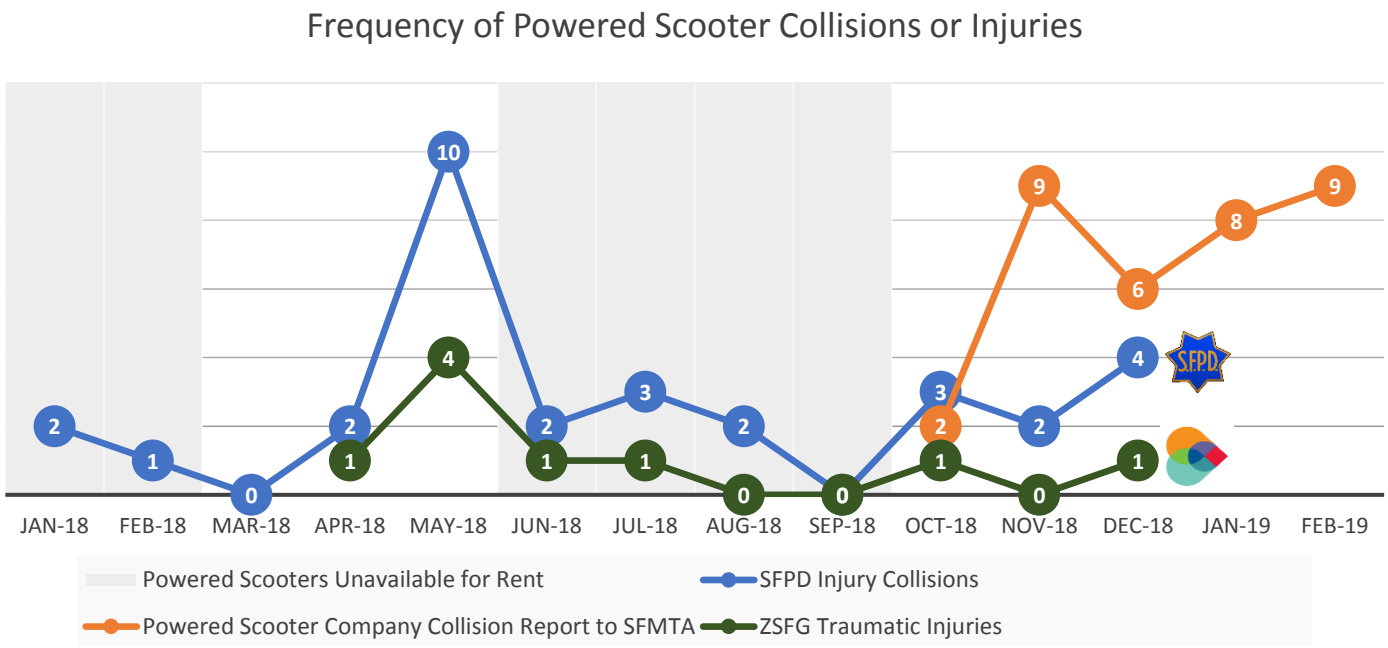
Collision and Injury Analysis

This analysis combines data from several City and County of San Francisco sources to provide available information on the injury impacts of powered scooters in the city. The chart below displays monthly counts of e-scooter injuries treated at Zuckerberg San Francisco General Hospital and Trauma Center (ZSFG, green) and tracked in the trauma registry, alongside counts of San Francisco Police Department (SFPD) reports of collisions involving an e-scooter (blue), and counts of collisions reported by riders and the public to Powered Scooter Pilot Program Companies in orange (which are ultimately provided to the San Francisco Municipal Transportation Agency, SFMTA). Note that ZSFG traumatic injuries represent a subset of injuries treated at the hospital - the more serious ones - and that powered scooter company collision reports did not all involve injuries.



Key Findings

Reports of e-scooter related injury collisions peaked in May 2018 according to both SFPD and ZSFG data sources. As detailed below, May was the month estimated to have seen maximum saturation of e-scooters in San Francisco, with approximately 2,000-3,000 on the streets. After being temporarily prohibited starting in June 2018, two agencies re-initiated powered scooter rental on San Francisco streets under new regulations and a pilot program in October 2018, with a cap of 1,250 total devices for the first six months. While SFPD and ZSFG data are not presently available for 2019, injuries from October 15 through December 31, 2018 indicate that injuries related to e-scooter use continue to occur in San Francisco.

Those reporting collisions and sustaining injuries related to powered scooters are predominantly male, adult, and White or Asian according to both SFPD and ZSFG data sources. Of nine people with traumatic injuries treated at ZSFG in 2018, 44% were injured in crashes with motor vehicles, 22% reported wearing a helmet, and one person was struck and injured by an e-scooter while walking. Of 32 e-scooter related injuries reported to SFPD in 2018, 19% were severe, 7% involved wearing a helmet[7], and 13% were injuries to people walking. Across all data sources, reported or documented rider helmet use is low.

[7] This statistic describes 2 out of 28 non-pedestrian injured parties.

History of Deployment and Injury Monitoring in San Francisco

A summary of the timeline of e-scooter availability in San Francisco is helpful to interpret trends. For context, in March 2018 several companies placed hundreds of dockless powered scooters for rent through proprietary apps on San Francisco streets. In April 2018, San Francisco's City Attorney issued cease and desist letters to three dockless electric scooter companies citing endangerment of public health and safety, and the Board of Supervisors passed a new city law which required e-scooter companies to obtain permits to operate in San Francisco beginning in June 2018. May 2018 likely reflected peak e-scooter saturation in San Francisco, and was the final month of unregulated e-scooter sharing services in the City. SFMTA released a pilot permit application in fall 2018, and selected two companies, Skip and Scoot, for permits. Those companies were permitted to deploy up to 625 devices apiece beginning October 15, 2018.

Given the unregulated history of e-scooters prior to October 2018, reliable counts of how many e-scooters were deployed or ridden on San Francisco streets by month are not available. In the chart above, a notable increase in collisions reported to police, as well as injuries requiring trauma team activation at ZSFG is evident in May 2018. At this time, an SFMTA-estimated 2,000-3,000[8] powered scooters were located on San Francisco streets, while one scooter company reckoned that "tens of thousands of San Franciscans" had ridden their devices[9].

During the period of unregulated deployment, the public voiced concern regarding injuries to people riding scooters as well as to people walking and using assistive devices. In response, the Vision Zero Injury Prevention Research Collaborative (VZIPR) comprised of epidemiologists, physicians, and key staff from the San Francisco Department of Public Health (SFDPH) and ZSFG developed and implemented a methodology to track powered scooter and other injuries via the ZSFG trauma registry[10]. The VZIPR Collaborative worked closely with SFMTA and SFPD to ensure definitions in the methods were as consistent as possible with injury tracking by SFPD and SFMTA recommendations to scooter companies, and that outreach regarding the methods to hospital and emergency medical services staff were aligned with direction given to SFPD officers.

Injury Reporting from Zuckerberg San Francisco General Hospital and Trauma Center

Zuckerberg San Francisco General Hospital and Trauma Center (ZSFG) tracks traumatic injuries associated with various non-traditional vehicle types – including e-scooters. As the only Trauma Center in the City and County of San Francisco, ZSFG treats nearly all patients who sustain traumatic injuries in the city.

In 2018, ZSFG treated ten patients with injuries requiring trauma team activation, sustained from a powered scooter (referred to as "e-scooters" in hospital reporting)[11]. One of these patients sustained injuries in Alameda County. The group of nine patients who sustained e-scooter related injuries in San Francisco had the following characteristics:

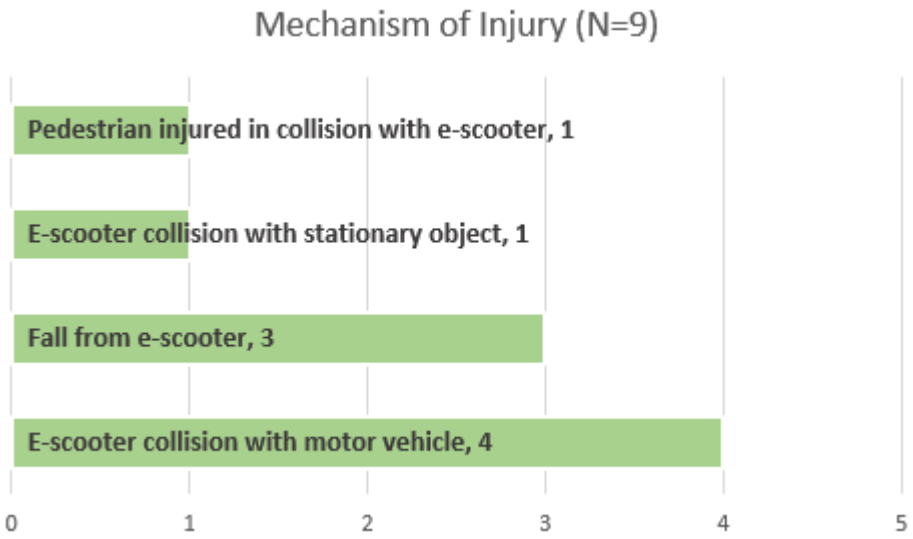
- 100% male (N=9)
- Average age 39 years, including three children (aged 17 and younger) injured and one senior (aged 65 and older) who was critically injured[12]
- 33% Asian (n=3), 67% White (n=6)
- 66% admitted to hospital (n=6) and 22% critically injured[11] (n=2), including one pedestrian struck by an e-scooter
- Peak month of injury was May, with four injuries occurring in that month

[8] This is a conservative estimate per SFMTA.
[9] https://www.cnet.com/news/san-francisco-scooter-law-means-goodbye-to-electric-scooters-for-now/
[10] Methodology available:
https://www.sfdph.org/dph/files/EHSdocs/PHES/VisionZero/Emerging_Mobility_Injury_Monitoring_Methodology.pdf
[11] Note that these numbers are preliminary, as abstraction efforts for 2018 are ongoing.
[12] Critical injury is a subset of traumatic injury reflecting the most severe injuries. This categorization relies upon assessment of an Injury Severity Score by trained medical professionals.

- Causes of e-scooter related injury were e-scooter vs. motor vehicle collision (n=4); rider falling from an e-scooter (n=3); collision with a stationary object (n=1); one pedestrian injured by collision with an e-scooter (n=1)
- Six injuries (67%) included involved injury to the head. Injury to the lower body was also prevalent, particularly to knees (n=4, 44%)
- 22% of those injured wore helmets (n=2)

While data available do not fully capture whether e-scooters involved in injuries are privately owned or accessed through membership with a powered scooter company, they do provide a valuable snapshot of traumatic e-scooter associated injury in San Francisco.

E-scooter vs. motor vehicle collision was the leading cause of e-scooter injury sustained in San Francisco treated at ZSFG, representing 44% of all cases. This mirrors reporting from powered scooter companies, discussed later. The next most frequently seen mechanism of injury was a rider falling from an e-scooter (33%). This category and another— collision with a stationary object (11%)— both fall under the umbrella of injuries not involving a second party. ZSFG data additionally include one critical injury to a pedestrian injured by collision with an e-scooter (11%).



ZSFG's e-scooter associated injury data reflect injuries sustained in 2018. While the methodology improving injury tracking for e-scooters and other formerly uncommon vehicle types was formalized in October 2018, medical charts were reviewed for all of 2018 with the new approach to data abstraction. Notably, data presented here do not include patients with less acute injuries (e.g. those of a person riding or hit by an e-scooter who presented to the ZSFG emergency department but did not require trauma team activation or hospitalization).

San Francisco data reveal a high proportion of e-scooter vs. motor vehicle collisions (44%) in comparison to preliminary injury data from other cities with similarly rapid emergence of shared e-scooters, such as Austin, TX[13]; Portland, OR[14]; and Los Angeles, CA[15]. This is likely in part because the ZSFG data in this report reflect traumatic injuries treated at the trauma center, while the other cities' use of emergency department records tracks patients treated for an e-scooter-related injury

[13] https://www.theverge.com/2019/3/8/18256197/scooter-injury-study-cdc-austin
[14] https://www.portlandoregon.gov/transportation/article/709719
[15] Trivedi TK, Liu C, Antonio ALM, et al. Injuries Associated With Standing Electric Scooter Use. *JAMA Netw Open.* 2019;2(1):e187381. doi:10.1001/jamanetworkopen.2018.7381

irrespective of injury severity. Portland, for example, found that the vast majority (83%, N=176) of e-scooter related Emergency Room (ER) visits followed a fall or other non-collision event.

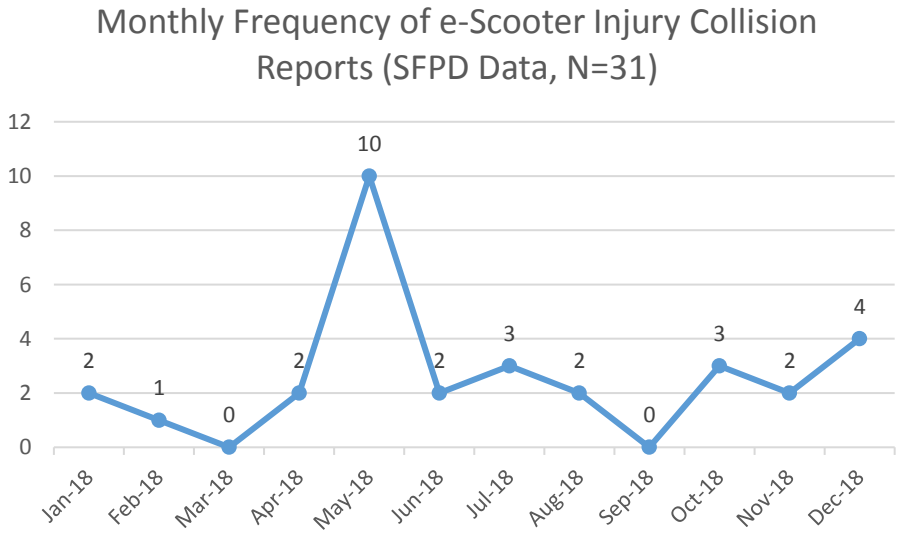
There are limitations to injury reporting data available from ZSFG. First, these injuries reflect only those requiring a trauma team response, and do not represent the full spectrum of injury associated with e-scooter use in San Francisco. This is one contributing factor to the differences in raw injury numbers reported in different jurisdictions – in addition to other differences in e-scooter deployment and ridership. For example, a recent study of two Los Angeles hospitals reviewing one year of ER records found 249 e-scooter related injuries, with 94% discharged home from the ER. Just 6% (n=14) were admitted or transferred to another hospital for further care – indicating severe injury[7]. To address this gap, VZIPR plans to undertake chart review in order to assess the prevalence of the less severe e-scooter associated injuries not represented in trauma registry data.

Second, efforts to train and educate emergency medical services and hospital staff on this data collection effort are ongoing; as this is a rapidly emerging issue, these data potentially underreport e-scooter injury involvement. E-scooters are an unfamiliar device to many, and injury data rely on accurate reporting in medical charts. Additionally, a person who has sustained a traumatic injury may not be in a position to communicate the circumstances or mode of their injury to their medical team.

Collision Reporting from San Francisco Police Department

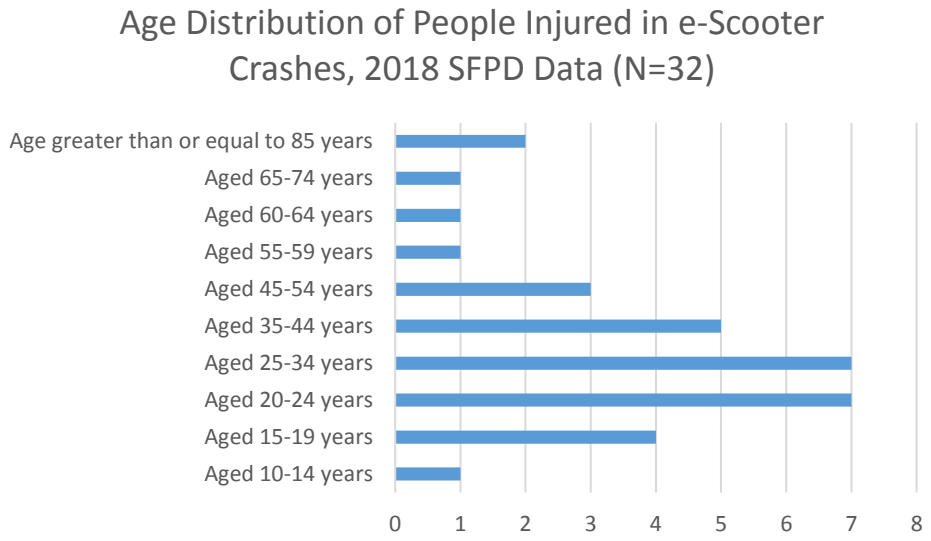
Another important source of e-scooter data is SFPD's collision reports. Collision reporting uses vehicle type categories developed by the California Highway Patrol, which include the classification of "Go-ped, ZIP Electric scooter, Motorboard." This code is employed by SFPD to reflect powered scooter vehicles in collision reports. For this summary, we also included reports with "Electrically Motorized Board" or "Low Speed Vehicle" vehicle type categories that also identified e-scooter involvement in the narrative.

Thirty-two injured parties were reported in 31 collision reports referencing e-scooters in 2018. As discussed elsewhere, reports of collisions were highest in May 2018, the month corresponding to peak e-scooter concentration in San Francisco. While collision reports dropped after May 2018, there has been a rise in the number of e-scooter related collision reports since the Powered Scooter Pilot Program commenced in mid-October 2018 (compared to the 4.5 months immediately prior).

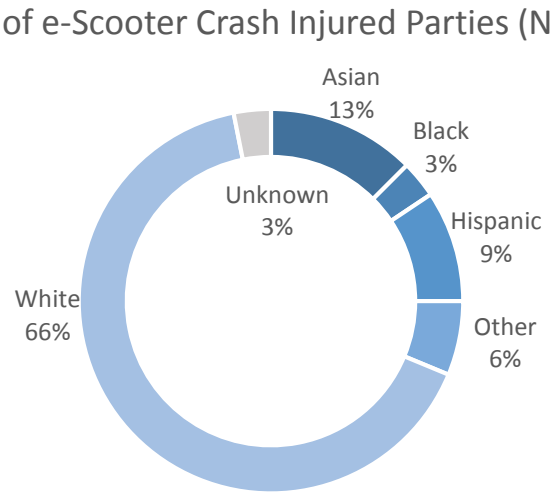


Looking at individuals with injuries referenced in collision reports (N=32), the data show the following:

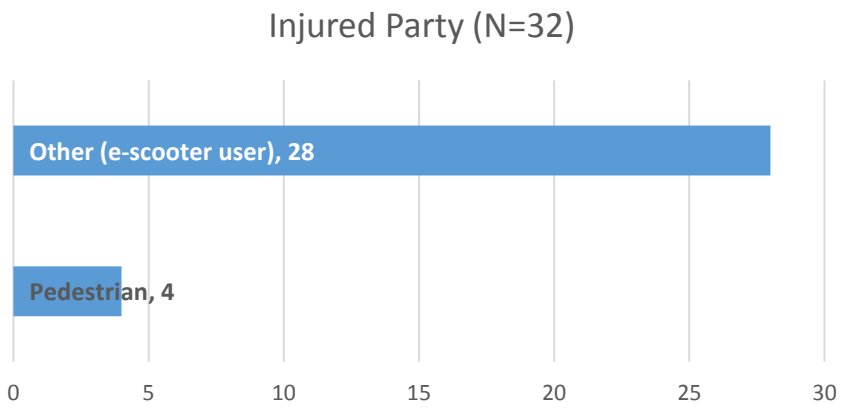
- **Gender:** of 32 injured people in 2018 reporting, 22% were female and 78% were male.
- **Age:** range from 12-86; 4 children (age 17 and under); 3 seniors (age 65 and up).



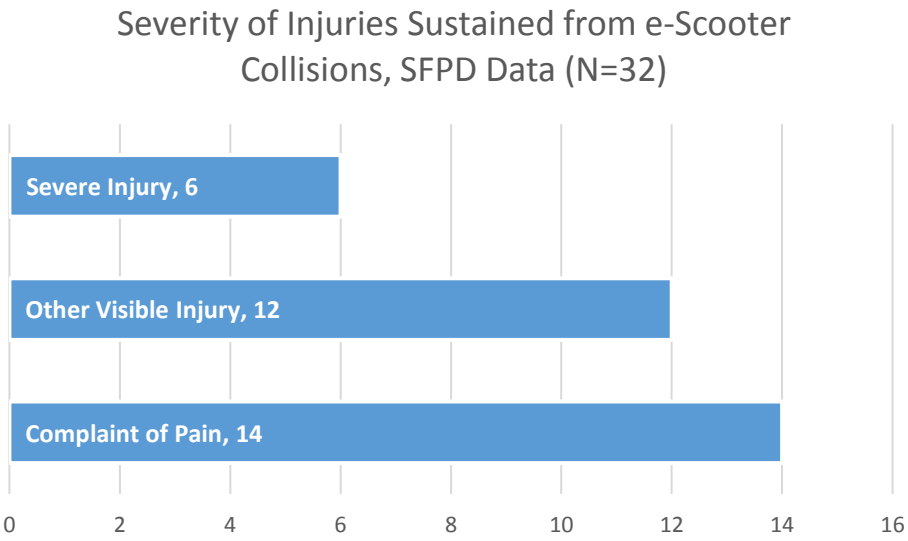
- **Race/ethnicity:** People injured in e-scooter related collisions were predominantly White (66%), and much less frequently Asian (13%), Hispanic (9%) or Black (3%). Nine percent of injured parties' race/ethnicities were either unknown or in another category.



- **Injured parties and Helmet Use:** 4 pedestrians, 28 e-scooter users. Injured pedestrians were older adults (age range 64-86), White or Asian (50% each), and 75% female. A quarter of injuries to pedestrians were described as severe, and 75% as other visible injury. Of injured e-scooter users, two people (7%) reported wearing a helmet.



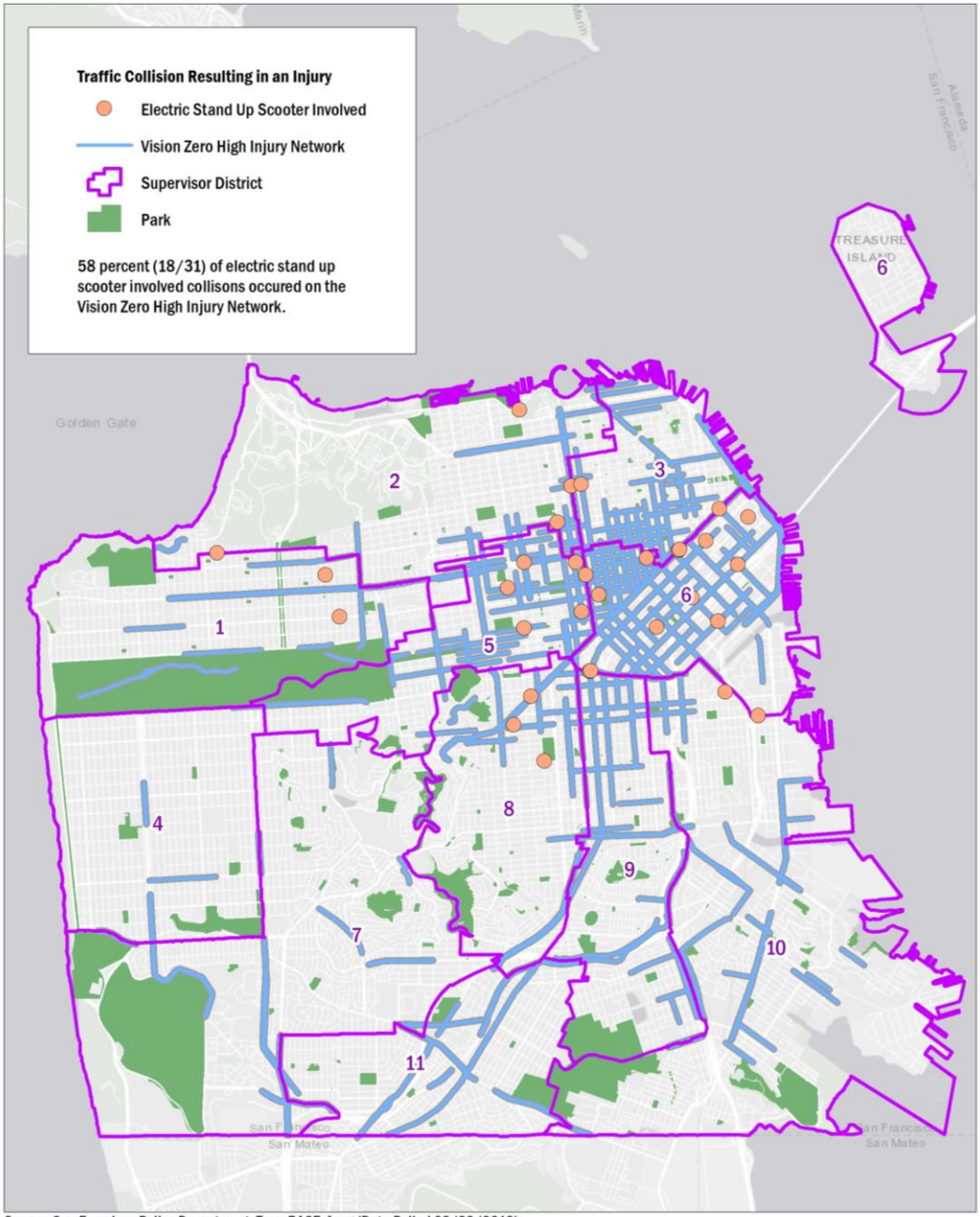
- **Severity:** Nineteen percent of injuries reported to police were severe, and 37% were described as other visible injury. Under half (44%) of reported injuries from e-scooter crashes were complaints of pain.



- **Location of collisions:** Powered scooter collisions reported to SFPD clustered in the northeastern quadrant of the city, particularly in the South of Market, Hayes Valley, and Western Addition neighborhoods. These locations may also reflect higher availability of powered scooter devices. Districts with highest numbers of reported collisions were Districts 5 and 6. A majority (58%) of collisions took place on San Francisco's High Injury Network[16] – the 13% of city streets where 75% of severe and fatal injuries occur.

SFPD Reported Traffic Injury Collisions Involving an Electric Stand Up Scooter

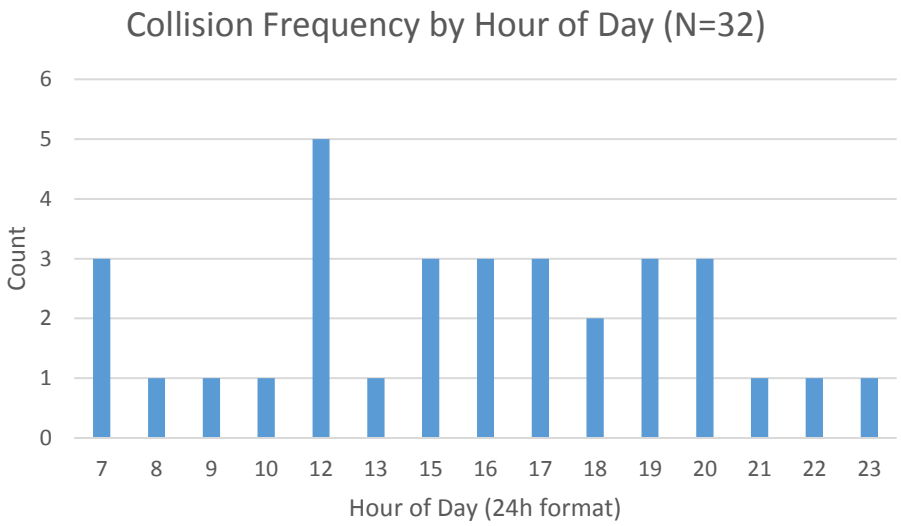
San Francisco, CA (1/1/2018 to 12/31/2018)



Source: San Francisco Police Department, TransBASEsf.org (Data Pulled 03/29/2019)
Created by: San Francisco Department of Public Health on 03/29/2019

[16] More information at: https://sfgov.maps.arcgis.com/apps/webappviewer/index.html?id=fa37f1274b4446f1bdddd7bdf9e708ff

- **Collision time of day:** While collisions took place in a wide distribution of times, the noon hour and early afternoon through early evening (3p-8p) appear to be particularly common times for e-scooter collision. No collisions were reported to have occurred in the nighttime and early morning hours between midnight and 7a.



Collision Reporting from Pilot Program Companies

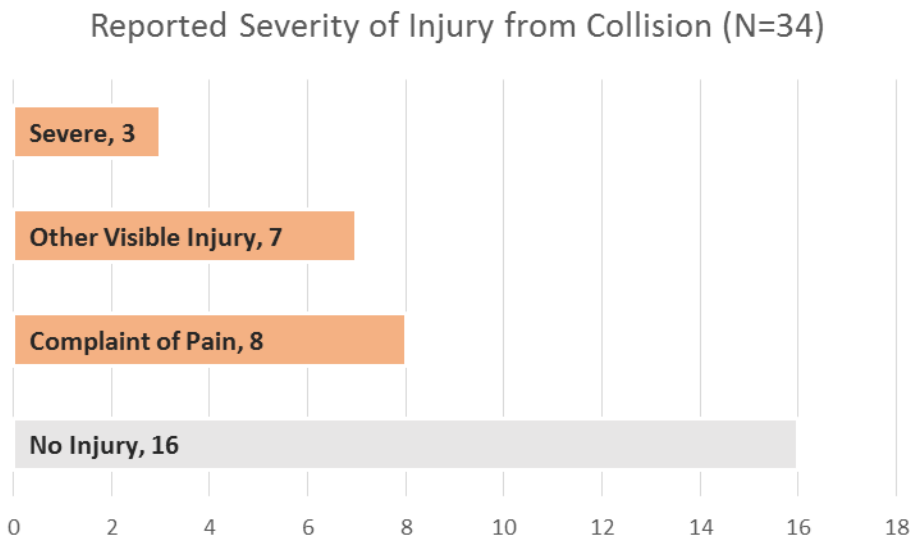
Powered Scooter Share Permit and Pilot Program companies Skip and Scoot submit monthly tracking data to SFMTA, including information on collisions reported by their users.

Scoot has reported zero collisions to date at the time of this report.

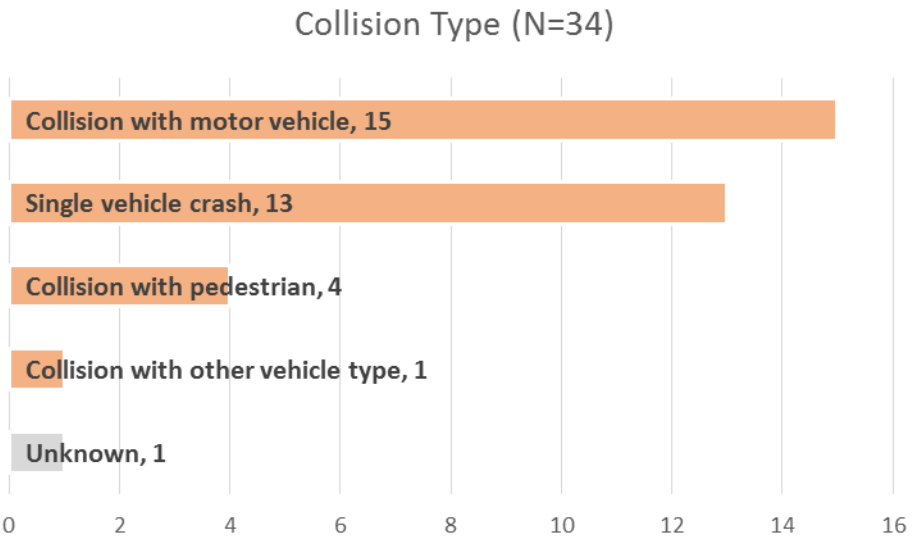
Skip reported 34 collisions over a five month period between mid-October 2018 and mid-February 2019, and the following summary reflects those data.

- **Gender:** of collision-involved users disclosing their gender, 80% were male and 20% were female.
- **Severity:** While a large minority of reported collisions resulted in no injury to the person reporting (47%), more often collisions sustained while riding e-scooters resulted in complaint of pain (23%), severe injury[17] (9%), or other visible injury (21%). These reporting categories are self-reported by the injured person (who may or may not be a powered scooter user) and mirror those employed in state-wide collision reporting by the California Highway Patrol and local police departments, including the San Francisco Police Department.

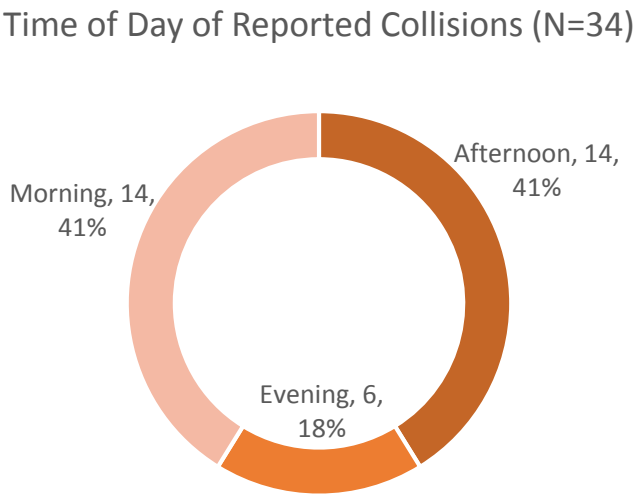
[17]The SFPD classification of severe injury includes broken or fractured bones, dislocated limbs, severe lacerations and unconsciousness, among other injuries.



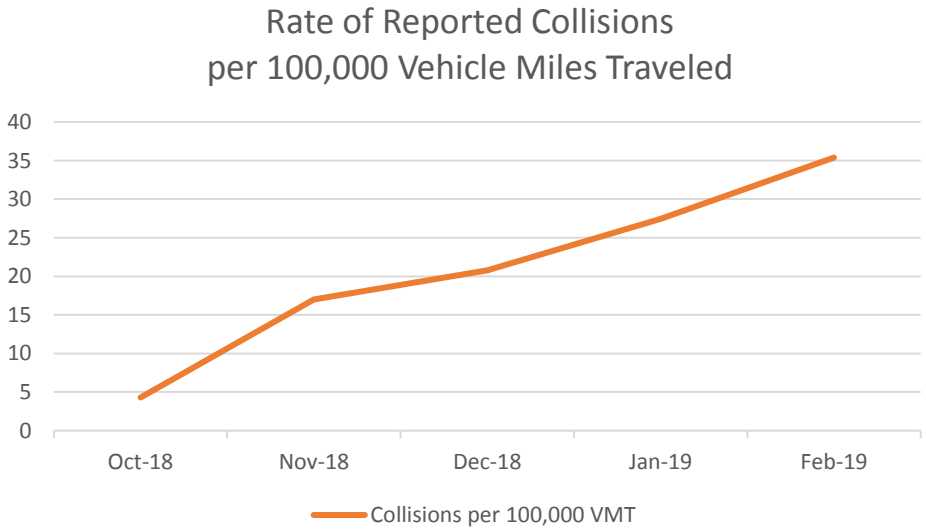
- **Police reports and hospital visits:** Just under 12% of collisions reported to powered scooter companies were made by users who filed or intended to file a police report. Similarly, users indicated they either made or planned to make a hospital visit following 9% of collisions reported to powered scooter companies.
- **Location:** Among reported locations, the most common collision location was the roadway (83%), followed by the sidewalk (10%) and bike lane (7%). Per California law, operation of e-scooters on sidewalks is prohibited. While e-scooter collisions on sidewalks may place pedestrians at particular risk, the level of injury of parties besides the collision reporter is not assessable from these data.
- **Helmet use:** Overall, 12% of users reporting collisions also reported helmet use. Data on helmet use were largely incomplete, with only 21% of reported collision events including this information.
- **Collision type:** The leading collision type reported was motor vehicle vs. powered scooter (44%), followed by powered scooter collisions without a second party (38%) and powered scooter vs. pedestrian collisions (12%).



- **Collision time of day:** Reported collisions were equally likely to take place in morning or afternoon (41% each), while relatively uncommon in evening hours (18%).



- **Collision rate:** The number of vehicles available for rental on San Francisco streets, as well as the actual miles ridden by users fluctuate month to month. Therefore, standardizing the monthly count of reported collisions by powered scooter vehicle miles traveled (VMT) helps compare like values across time. Standardizing reported collisions per 100,000 VMT **reveals a consistently rising trend of collisions**, with more than eight times as many collisions per vehicle mile traveled in February as in October. (Please note: Scoot and private vehicle mile data are not included in this calculation. Vehicle miles traveled include only revenue miles traveled by Skip devices, and not those traveled by gasoline powered trucks or vans or e-vehicles to reposition rental devices).



Collision Reporting via SF311

A total of two e-scooter collisions were reported via SF311, the publicly accessible portal for complaints and concerns citywide. One of these referenced a crash with a privately-owned scooter, while the other was a March 2019 report of a powered scooter company contractor who sustained an injury while riding a device. This injury is not currently reflected in company injury reporting, which has not yet been submitted beyond February.

Recommendations

Based on collision and injury data available, several issues deserve further attention. From an injury prevention perspective we offer the following recommendations:

- **Provide additional information on where it is legal to ride:** operation of e-scooters on sidewalks places pedestrian non-users of e-scooters at risk of injury and violates California vehicle code[18]. Promoting awareness of regulations to e-scooter users is necessary to prevent injury. A SFMTA campaign highlights Do's and Don'ts of powered scooter ridership[19] in brief, easy to read format and is a resource for user education.
- **Increase access to helmets:** Low rates of helmet use across data sources combined with the high prevalence of e-scooter associated head injuries in ZSFG data highlight a prevention opportunity. Recent e-scooter guidance from the American College of Emergency Physicians[20] names helmet use as the "easiest and smartest thing you can do to avoid serious head injury."
- **Monitor youth users of e-scooters:** ZSFG and SFPD injury data indicate that youth age 17 and younger are a population vulnerable to e-scooter injuries. Ongoing enforcement of pilot program companies' age restrictions is important to ensure that these injuries to youth do not arise on rented devices.
- **Conduct additional analysis with more data to assess opportunities for infrastructure improvements:** including on the Vision Zero High Injury Network.

Given the relatively recent popularity of e-scooters as a transportation mode, VZIPR also offers one recommendation from a data perspective:

- **Improve tracking of e-scooter associated injury**: presently, there is a lack of consensus on which International Classifications of Disease, 10th revision (ICD-10) codes should reflect e-scooter collision events in medical records. VZIPR will engage in the national dialog on selecting codes to reliably capture e-scooter related modes of injury. Standardizing ICD-10 code use will improve tracking of both critical and less severe injuries, and allow for better comparisons between hospitals and across the country.

[18] California Vehicle Code Sec. 21235(g)

[19] https://www.sfmta.com/blog/powered-scooters-are-here%C2%A0

[20] http://newsroom.acep.org/2019-02-27-Scoot-Safe-New-Public-Service-Announcement-Shares-Emergency-Physicians-Tips-for-Electronic-Scooter-Riders