Characterisation of e-scooter, e-bike and bicycle injuries by motor vehicle involvement: USA (2020–2024)

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ABSTRACT

Background Micromobility use and injuries in the USA have increased in recent years along with injuries from electric micromobility in particular. We examined USA emergency department (ED) visits between 2020 and 2024 involving e-scooters, e-bikes and bicycles overall and by motor vehicle (MV) involvement.

Methods Using National Electronic Injury Surveillance System (NEISS) data, we estimated annual weighted ED visit counts and percentages with 95% CIs for each micromobility category and by MV involvement. We also examined percentages by patient age group, sex, race and disposition.

Results An estimated 2 532 882 ED visits involving e-scooters, e-bikes and bicycles occurred in the USA during 2020–2024, with 20.5% involving an MV. Individuals aged 18–39 years, males and Black individuals comprised a greater percentage of visits involving MVs than those not involving MVs. Hospital admission was consistently greater among MV-involved visits than those not involving an MV (eg, bicycle: 17.7% vs 9.5%). From 2020 to 2024, annual visit counts increased by 306% for e-scooters, 389% for e-bikes and 6.4% for bicycles.

Discussion This study found that e-bike injuries had more MV involvement than those from e-scooters and bikes and that demographics varied by MV involvement. Our findings related to hospital admission and race align with prior literature.

Conclusions The growing use of micromobility vehicles, and our findings that MV involvement is associated with increased hospital admission, emphasises the need for evidence-based strategies such as helmet use and separated roadways to reduce injuries and improve safety.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ In recent years, micromobility ridership, as well as injuries sustained from electric micromobility, has increased in the USA. Understanding the prevalence of and recent trends in micromobility injury by motor vehicle involvement can inform prevention strategies.

WHAT THIS STUDY ADDS

⇒ The number of e-scooter and e-bike-involved ED visits increased from 2020 to 2024. Micromobility-involved visits with motor vehicle involvement were more likely to result in hospitalisation than those not involving motor vehicles.

HOW MIGHT THIS STUDY AFFECT RESEARCH, PRACTICE, OR POLICY

⇒ Implementing evidence-based strategies that improve safety for micromobility road users can reduce risks of injuries and injury severity as ridership and associated ED visit counts increase in the USA.

BACKGROUND

Micromobility, defined as use of small electric and non-electric vehicles such as bicycles and scooters,[1] offers transportation options not dependent on a motor vehicle (MV). Injury related to electric micromobility has recently increased. One analysis showed that the number of US emergency department (ED) visits for e-bike and e-scooter injuries sharply increased 2017–2022, while the number of bicycle and scooter-related visits stayed the same.[2] Different analyses showed similar results for 2019 through 2022.[3–6]

Injury severity may vary between micromobility category and MV involvement.[4] For example, electric micromobility allows riders to travel at higher speeds than non-electric micromobility, which might result in more severe injury if a crash occurs. Factors like helmet use, shared roadways, and crash circumstances can also impact risk of injury and injury severity.[7 8] A micromobility rider in an MV-involved crash might sustain a more severe injury than a rider in a crash not involving an MV. One study showed that among e-scooter-related ED visits during 2015–2019, visits with MV involvement were more likely to result in hospitalisation (14.6% of the time) compared with visits without MV involvement (8.8% of the time);[9] this is similar to subsequent study findings of 2021–2022 data.[5] Understanding the prevalence of micromobility-related injury and MV involvement continues to be important to inform prevention strategies, especially as use of these transportation modes has increased.

This project uses 2020–2024 data from the National Electronic Injury Surveillance System (NEISS) to estimate the number of ED visits in the USA involving e-scooters, e-bikes and bicycles overall, annually, and by MV involvement. The proportion of visits resulting in hospitalisation are reported as well as the proportions by patient age,

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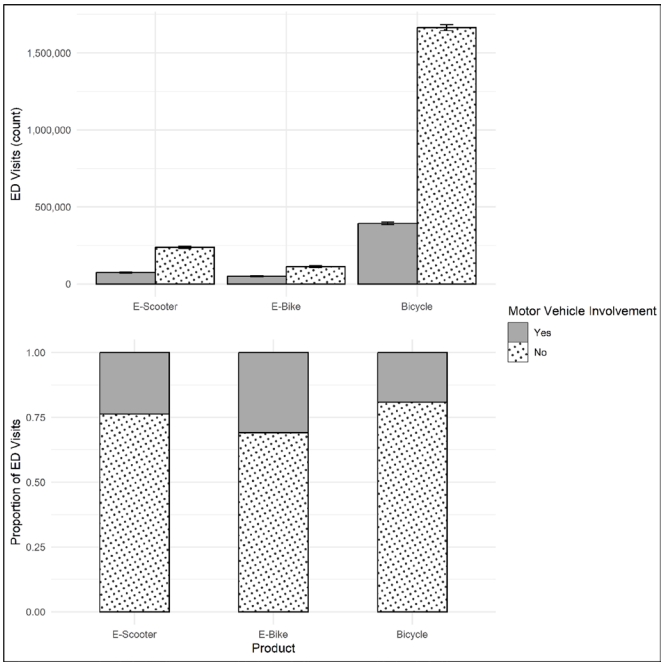

Figure 1 Number and proportion of emergency department (ED) visits involving e-scooters, e-bikes and bicycles by motor vehicle involvement: USA (2020–2024).

sex and race. To our knowledge, our study is the first to examine these outcomes in the USA through 2024.

METHODS

Data source

ED visits involving micromobility-related injuries during 2020–2024 were obtained from NEISS, an injury surveillance system maintained by the US Consumer Product Safety Commission (CPSC). NEISS generates nationally representative estimates of product-involved ED visits via a stratified probability sample of approximately 100 US hospitals with 24-hour EDs and at least six inpatient beds.[9 10] Estimates are produced using sampling weights equal to the inverse probability of a participating hospital being included in the overall sampling frame. Demographic and injury-related information for product-involved injuries, including a narrative field describing the injury, are abstracted by CPSC-trained coders via medical chart review.

Measures

ED visits involving injuries related to e-scooters, e-bikes and bicycles were identified using NEISS product codes and narrative field text searches (online supplemental table S1). We included visits where the patient was injured by an e-scooter, e-bike or bicycle as either a rider or as a bystander (eg, tripped over an e-bike on the sidewalk or hit by an e-scooter while walking). Mopeds were not counted as e-scooters or e-bikes. MV involvement was determined using narrative field text searches (online supplemental table S1). Initial search terms for MV involvement were based on previous literature[4 9] and further refined through an iterative review process conducted by three authors. Discrepancies were resolved by consensus, and the newly refined search terms for MV involvement were used when identifying the study sample of ED visits involving micromobility-related injuries. To further improve sample quality (eg, reclassify mopeds as MVs), several additional manual reviews (online supplemental table S2) were conducted within the selected study sample by two authors; discrepancies were again resolved by consensus. Injury severity was measured using the patient's disposition at the conclusion of the ED visit: admitted to the hospital, fatality and not admitted/not fatality (eg, treated and released).

Analysis

All statistical analyses were conducted in R V.4.4.1 and adjusted for NEISS' complex survey design via the R package 'survey'.[11 12] We estimated national ED visit counts and percentages with 95% CIs stratified by micromobility category and MV involvement. We then calculated the change in ED visit counts in 2024 compared with 2020. Weighted column percentages with 95% CIs for each micromobility category and MV involvement were also examined by age group, sex, race, and disposition.

RESULTS

The final NEISS 2020–2024 study sample contained 67 985 records (weighted n=2 532 882) of ED visits for injuries involving e-scooters (weighted n=315 211), e-bikes (weighted n=162 558) and bicycles (weighted n=2 059 886) occurring nationally. About 1 in 5 of these visits involved an MV (20.5%). E-bike visits were more likely to involve an MV (30.2%) compared with e-scooter (22.9%) and bicycle (18.2%) visits (figure 1). The percentage of visits resulting in hospital admission or fatality was greater among visits with MV involvement compared with those without for all three micromobility categories. For example, the percentage of patients admitted to the hospital was higher among bicycle visits involving an MV (17.7%) than among bicycle visits not involving an MV (9.5%). Nationally, the number of ED visits from 2020 to 2024 increased 389% for e-bike visits, 306% for e-scooter visits and 6.4% for bicycle visits (figure 2) with the largest increases occurring between 2023 and 2024.

Almost 90% of micromobility-involved visits occurring nationally were among individuals aged ≤64 years (88.3%), 73.9% were among males, and 52.8% were among White individuals (online supplemental table S3). Across all three categories, the distribution of age, sex and race differed by MV involvement. Groups more represented among visits involving MVs than visits not involving MVs were patients aged 18–39 years, males and Black/African American patients. Groups more represented among visits not involving MVs than visits involving MVs were patients aged <18 or ≥65 years, females and White patients. For example, Black/African American patients were more represented among e-scooter visits involving an MV (32.8% of visits) than among e-scooter visits not involving an MV (19.1%); the opposite was true for White patients (38.1% vs 54.7% of visits). There were a few differences by micromobility category; females represented a greater percentage of e-scooter visits than e-bike and bicycle visits.

DISCUSSION

This study expands knowledge of the role of MV involvement and highlights recent trends in e-scooter, e-bike, and bicycle-involved ED visits. Between 2020 and 2024, there were over 2.5 million micromobility-related ED visits, with 20.5% involving an MV. E-bike visits were more likely to involve an MV than e-scooters or bikes and patient demographics varied by MV involvement. MV involvement for all three micromobility categories was associated with increased hospital admission, similar to prior findings on e-scooter injuries.[9] Males, those aged 18–39 and Black/African American micromobility users appeared to be at disproportionate risk of MV involvement compared with other groups,

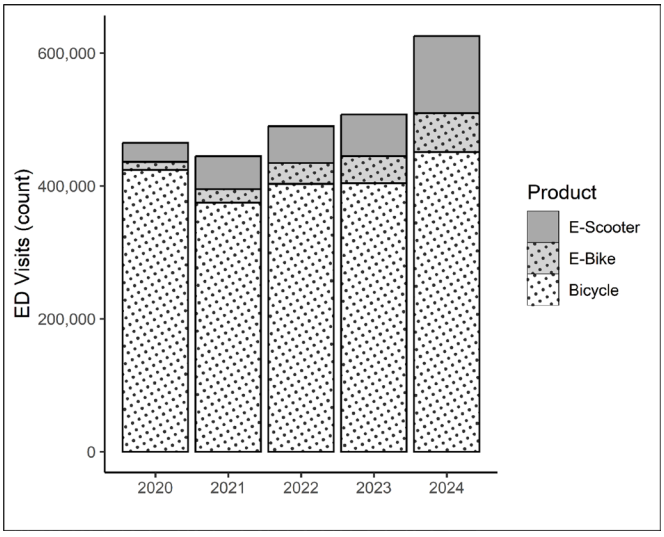

Figure 2 Annual number of emergency department (ED) visits involving e-scooters, e-bikes, and bicycles: USA (2020–2024).

putting them at increased risk of severe injury. Differences by race are consistent with literature showing a higher fatality rate for Black people than White people while cycling.[13] Finally, we observed increasing annual counts of ED visits for each micromobility category, with e-scooters comprising an increasingly larger proportion of visits each year. Our findings align with prior findings of trends in e-scooter, e-bike and bicycle-related ED visits from 2020 to 2022,[2–4] but with our study examining this outcome through 2024.

This study had several limitations. First, NEISS data are limited to injuries presenting to participating US EDs and are not representative of injuries treated elsewhere, such as urgent care settings, or injuries with fatal outcomes. Second, there is the potential for misclassification of micromobility category or MV involvement because of incomplete data from the medical record, incorrect NEISS coding, or terms not caught by our iterative reviews. For example, some e-bike visits may be incorrectly classified as bicycle visits if the medical record did not distinguish bicycle type. Similarly, increases in e-scooter and e-bike visits during more recent years may likely be because of increasing electronic micromobility use, as well as improved recognition and reporting of injuries. Third, urbanicity information is unavailable in NEISS. Finally, this study includes children under 18 years in a single age group. Future research using data sources with urbanicity information and/or examining more granular age groups could further illuminate patterns in micromobility injury.

Micromobility vehicles, including e-scooters, e-bikes and bicycles, offer increased accessibility for alternate, non-MV transportation. Shareable platform micromobility has increased from 65 million trips in 2020 to 133 million in 2023.[14] Individual micromobility ownership has also increased, with an over threefold increase in US e-bike sales between 2018 and 2021 and supported by a rise in e-bike incentive programmes.[15] Further, individuals using personally-owned micromobility may do so for commuting or longer travel and therefore be at greater risk of injury due to increased exposure.[16] This increased micromobility use, along with our observed increase in annual ED visits for micromobility injuries, emphasises the importance of implementing evidence-based injury prevention strategies. These include promoting helmet use, increasing separation between vulnerable road users and MVs, and appropriate speed limits for all road users.[17 18]

CONCLUSIONS

In the USA, micromobility use has grown recently, along with injuries sustained by riders. This work identified differences in ED visits by micromobility category (two electric and one non-electric) and MV involvement, and examined changes in ED visit frequency over time. There is a need to further implement existing evidence-based strategies designed for preventing injuries among micromobility road users and develop new strategies, especially if US micromobility ridership continues to increase.

Contributors BS and EWL conceived of the study. All authors designed the study. EWL performed the statistical analysis. All authors carried out data review and validation. BS and EWL wrote the manuscript. VB and ACS critically revised the manuscript. BS and EWL are the guarantors for this work.

Disclaimer The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of the Centers for Disease Control and Prevention/the Agency for Toxic Substances and Disease Registry.

Competing interests None declared.

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