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Review of the Literature on the Safety of Micromobility

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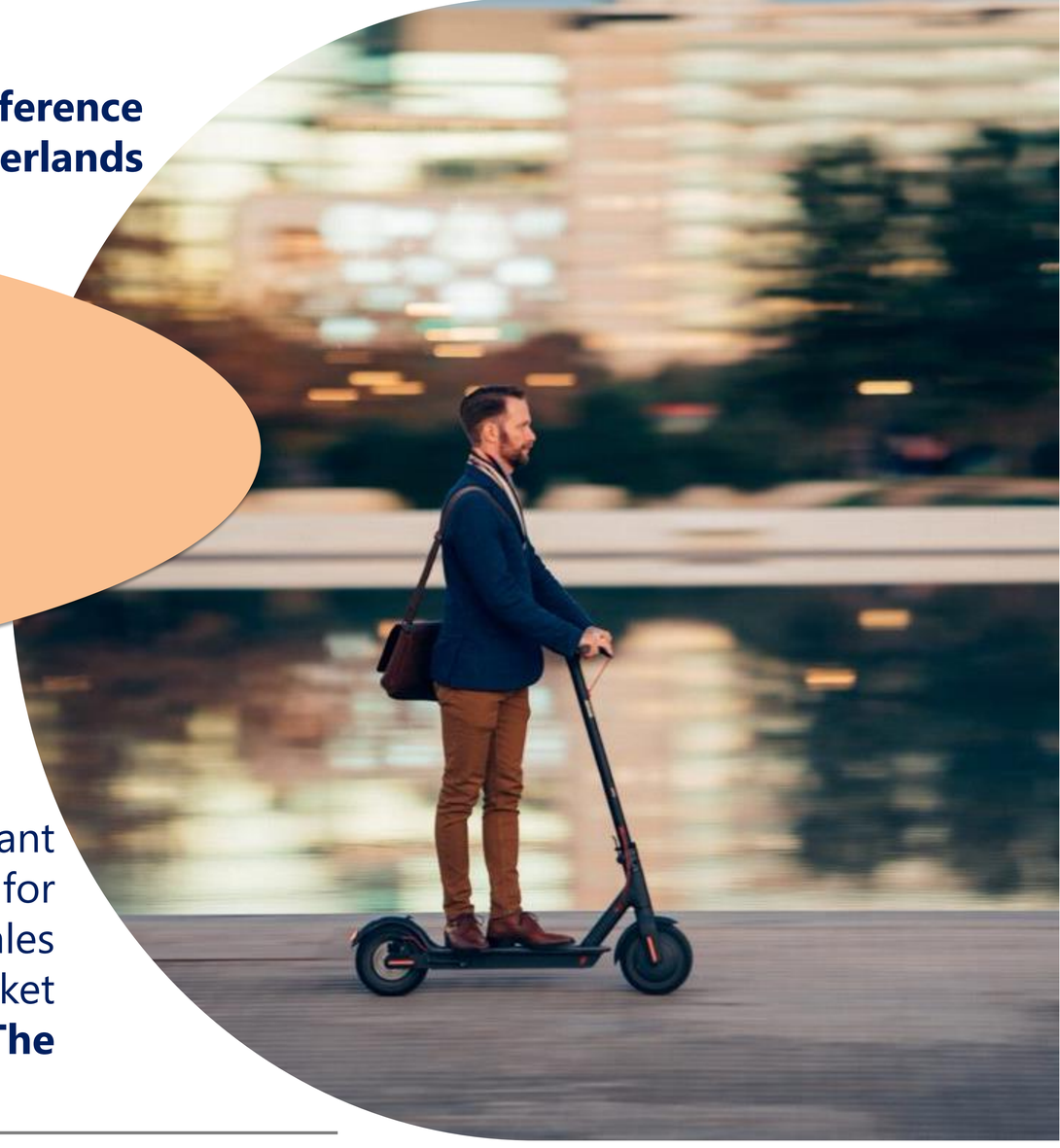


Introduction

The introduction of Micromobility (MM) services is leading to significant changes in urban transportation, bringing new challenges for policymakers. In 2019, 3.7 mil. e-bikes were sold and, by 2030 e-bike sales are expected to reach 17 mil. annually in the EU28 while e-scooter market is anticipated to be driven by increasing e-scooter sharing services. **The rise of MM share highlights the necessity of examining its safety.**

Objective

The analysis of the **most recent safety trends of e-scooters and e-bikes** based on the existing literature focusing on the traffic safety impact of both shared and owned e-scooters and e-bikes.

Methodology

An **extensive review** of the scientific and "grey" literature was conducted; 81 relevant studies were considered appropriate for this review. The e-scooter studies were published from 2018 to 2023, primarily utilizing data from 2018-2020. In contrast, e-bike research spans 2007-2022, employing data from the same timeframe.

Micromobility Crash & Injury

The traffic safety of e-scooters and e-bike operations were investigated based on **58 studies and analyses**.

E-scooters

- **Crashes** often cause injuries mainly to upper body and head.
- **Helmet use** is low; 0-3% of all injured wore a helmet.
- **Fatalities** correspond up to 1% of reported injuries.
- **Falls** account for most incidents (80%) and injuries (64-85%).
- **Single-user crashes** are common, mostly involve the rider.
- 1-10% of **pedestrian injuries** are due to shared spaces with e-scooters.
- Most e-scooterist fatalities (85%) are due to **motor vehicle crashes**.
- Alcohol, night-time riding, poor road infrastructure, & speeding are **main injury factors**.

VS

E-bikes

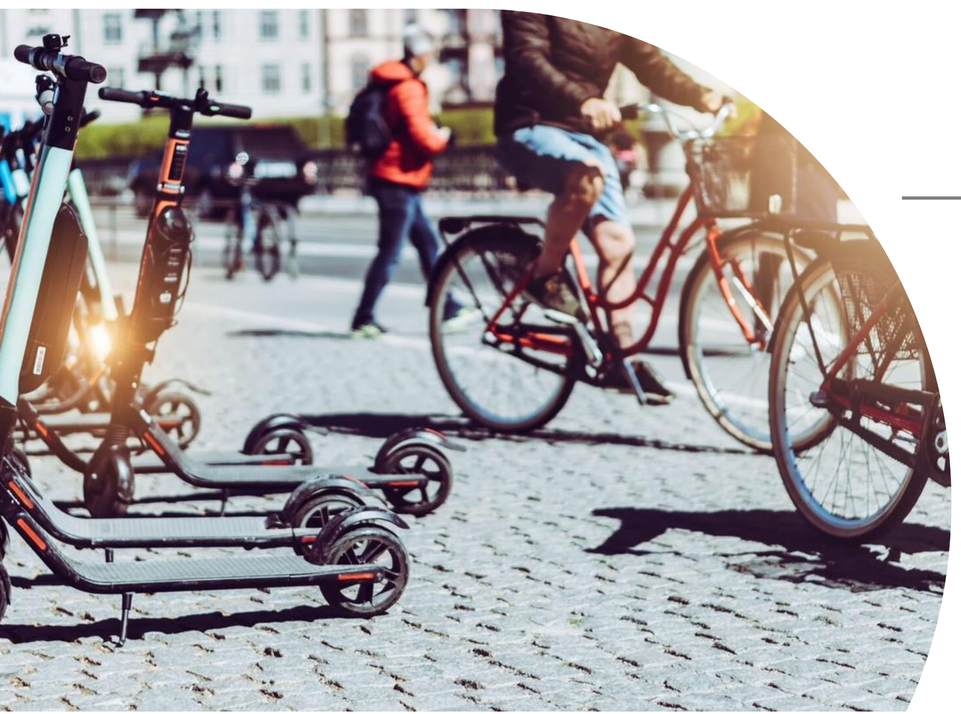
- **Crash and injury data** as well as exposure data for bikes are much more abundant and reliable compared to e-scooter data.
- **E-bike crashes** most of the times result in a minor injury (70%).

- **E-bike fatalities** correspond to 11% of reported injuries.
- E-bike crashes are in general **equally severe** as conventional bike crashes.

Surrogate Safety

With limited available crash MM data, **surrogate safety studies offer valuable insights**.

- E-scooters exhibit higher speeds compared to c-bikes on dedicated bike lanes.
- E-scooters attain higher speeds on low-traffic streets compared to sidewalks.
- E-scooters require longer braking distances.



Safety Implications of Modal Shift

Europe: e-scooters replace walking and Public Transport (PT), with higher substitution rates, and e-bikes replace cars, PT, and conventional bikes.

US: shared e-scooter users replace 46% of car trips, while e-bike users replace 57%.

China: e-bike usage significantly replaces PT (54%).

➢ A shift from car/taxi to MM **can improve road safety** as exposure to motor vehicles decreases.

Conclusion

MM safety results are not black and white; they depend on infrastructure, traffic volumes, speed, and safety culture. Future efforts should focus on renewing the findings from the literature and on extracting real-world datasets and conducting analyses to capture as early as possible the current safety trends, modal split and shift. Overall, addressing e-scooter and e-bikes safety issues requires a combination of measures, including improving infrastructure, promoting responsible behavior, and implementing regulations.