



# An Investigation of Personal Electric Mobility Device Related Injuries and Fatalities



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## Introduction

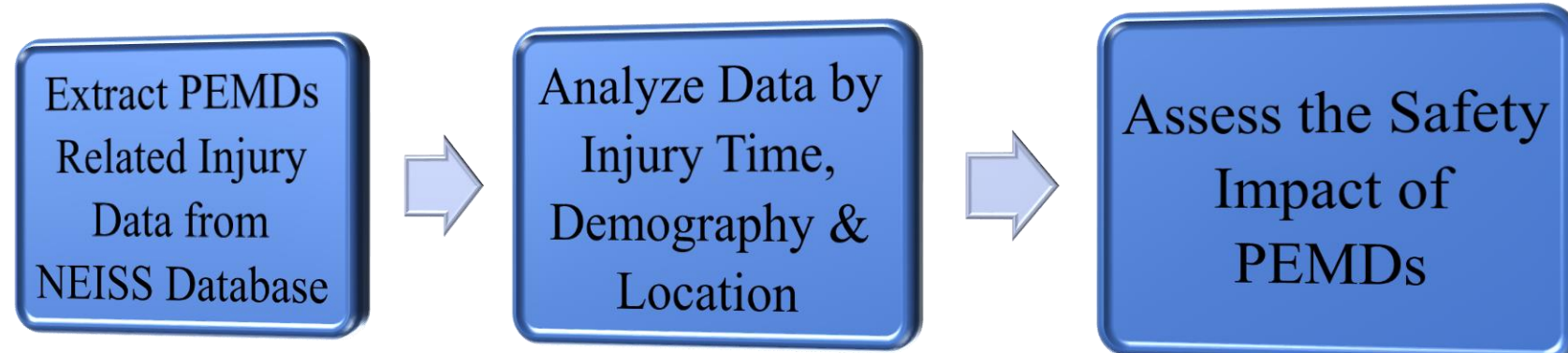
Personal Electric Mobility Device (PEMD) is becoming an accessible transportation mode among the people who used to walk, bike, or even drive a car. These modern PEMDs have advanced technology and the potential to increase transportation accessibility, mobility, and reduce traffic density and congestion on the roadways, which is why they are becoming a popular mode of transport for people. Some popular PEMDs are shown below:



Figure 1 PEMDs – From left electric unicycle, hoverboard, electric scooter, electric bicycle, electric tricycle, and electric mobility cart.  
(Source: pngkey.com, imgbin.com & iotatrax.com).

Although PEMDs has plenty of features, their safety, and operational features while running on a walkway or roadway are less known. Due to their faster speed for a footpath and slower speed for the road, PEMDs may need particular infrastructure and policy.

## Research Approach



## NEISS Database

- National Electronic Injury Surveillance System (NEISS), maintained by U.S. Consumer Product Safety Commission (CPSC)
- Classified hospitals as child, small, medium, large, and exceptionally large
- Raw data is coded in hospitals then decoded and stored in database by CPSC.
- Estimated injury for each vehicle/product,

$$E = \sum_i^n w_i x_i$$

Where,  $w_i$  = Weight of recorded data of hospital  $i$ , and  
 $x_i$  = No. of incidences for a specified product type reported by hospital  $i$

## Data Collection

☐ Data collected for 12 years (2006-2017) for the following NEISS products/devices:

Product Code	Product Title	Notation in Analysis
1744	Three or more wheels electric mobility cart	Electric Cart
3215	Mopeds or electric power-assisted scooters	Mopeds
5042	Electric-powered skateboards or hoverboards	Hoverboard

## Result and Discussion

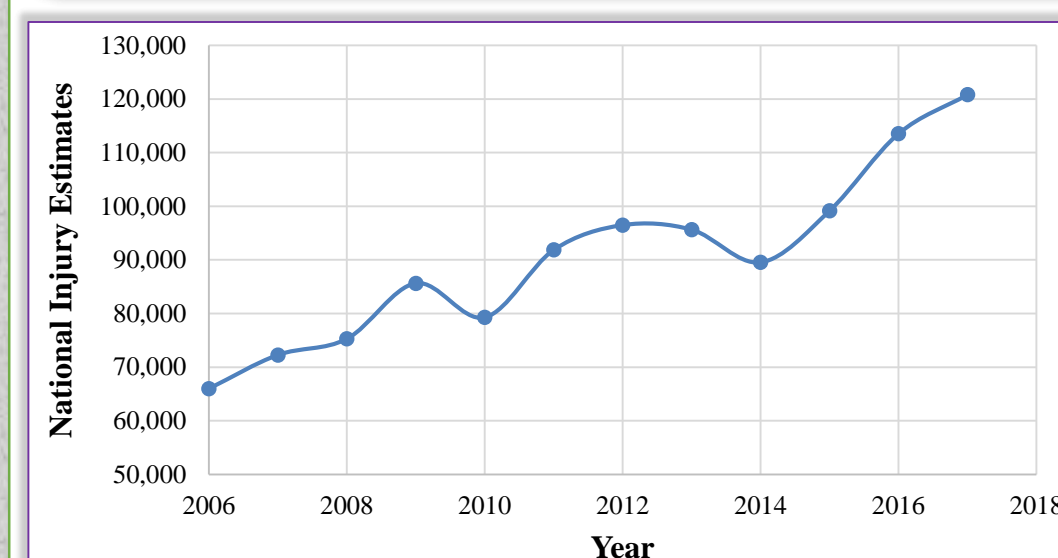


Figure 2 Injury Estimates of all Products by Year

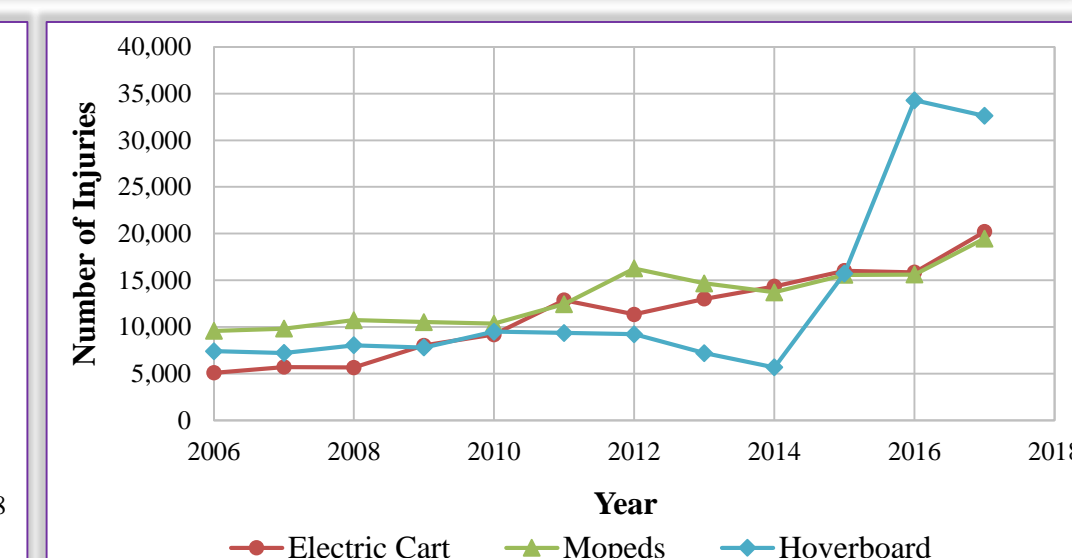


Figure 3 Injury by Specific Products by Year

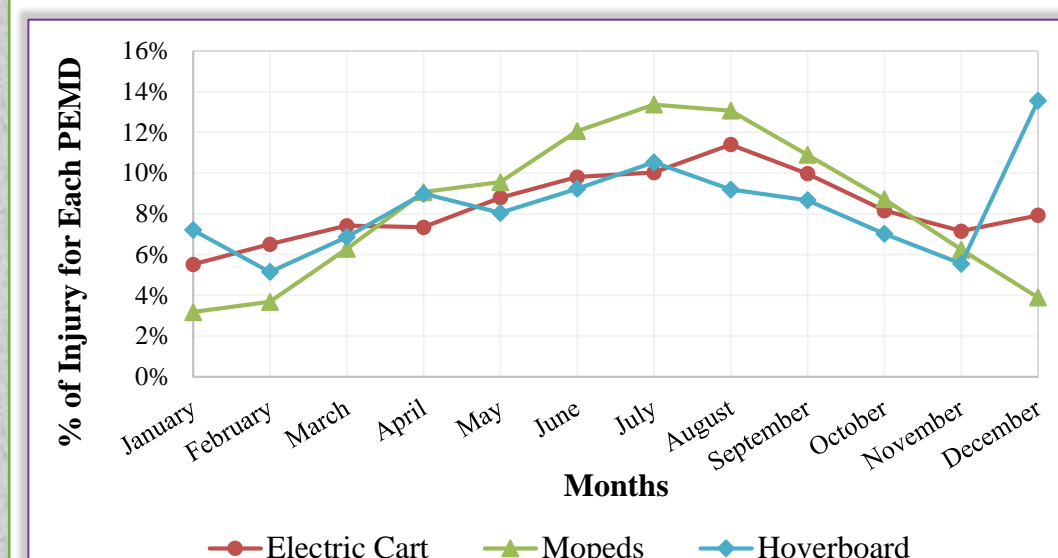


Figure 4 Injury by Specific Products by Month

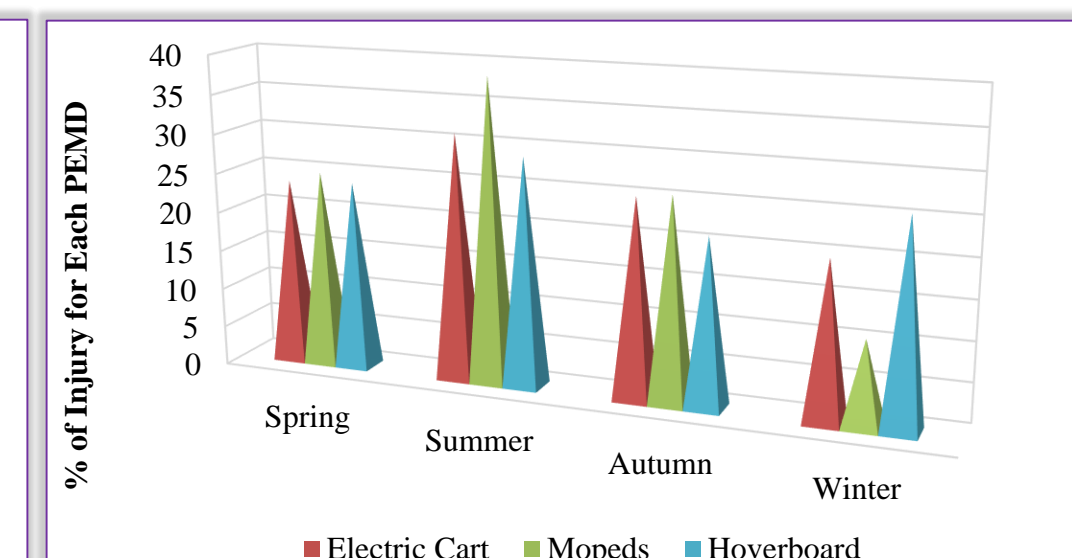


Figure 5 Injury by Specific Products by Season

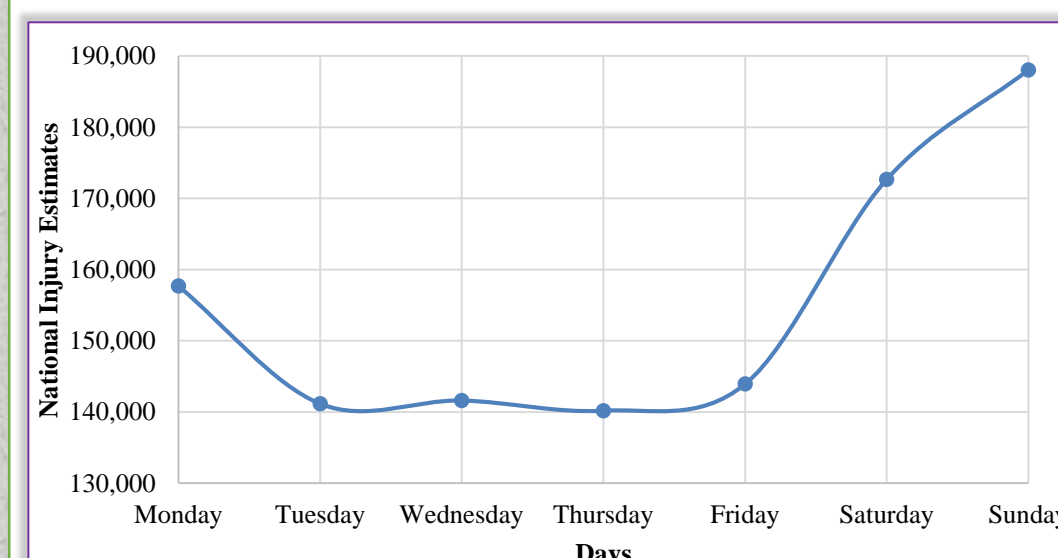


Figure 6 Injury Estimates of all Products by Day

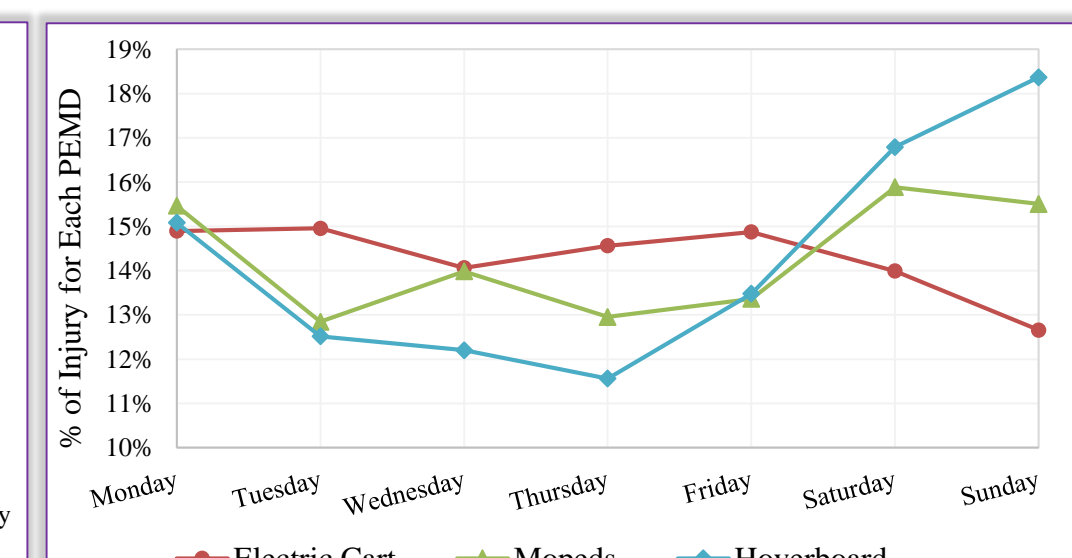


Figure 7 Injury by Specific Products by Day

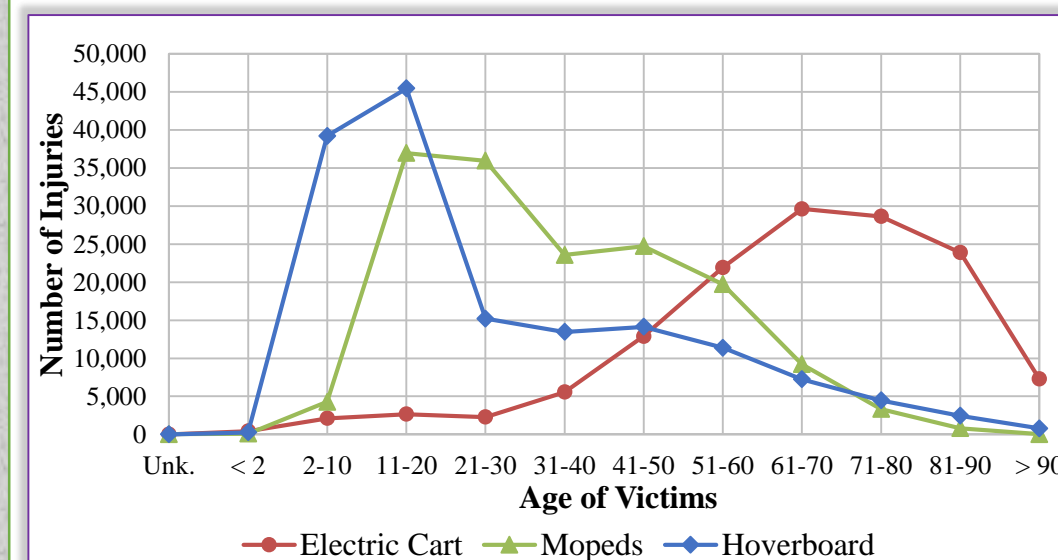


Figure 8 Age Distribution of Victims

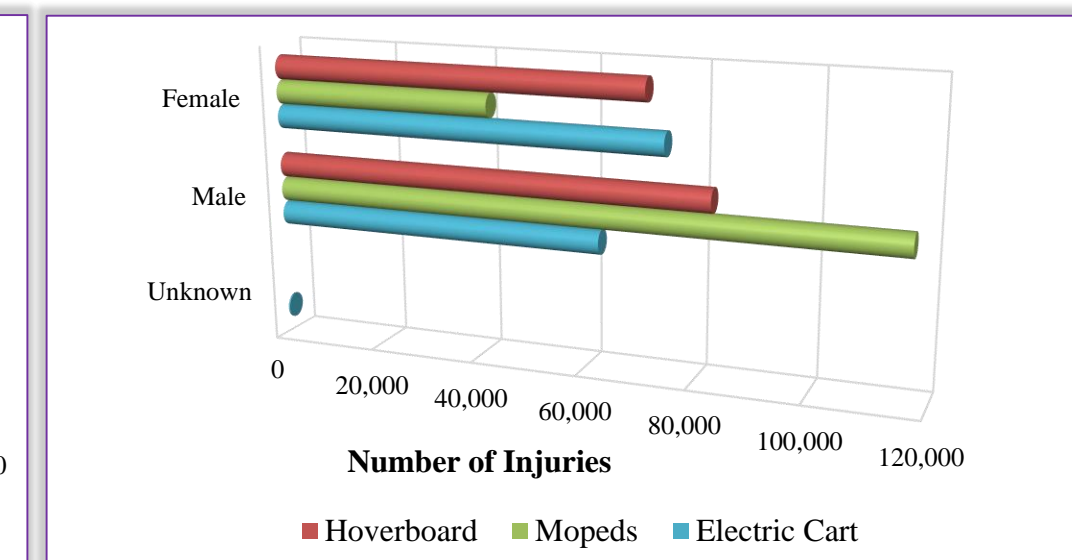


Figure 9 Injury by Specific Products by Gender

## Result and Discussion, cont.

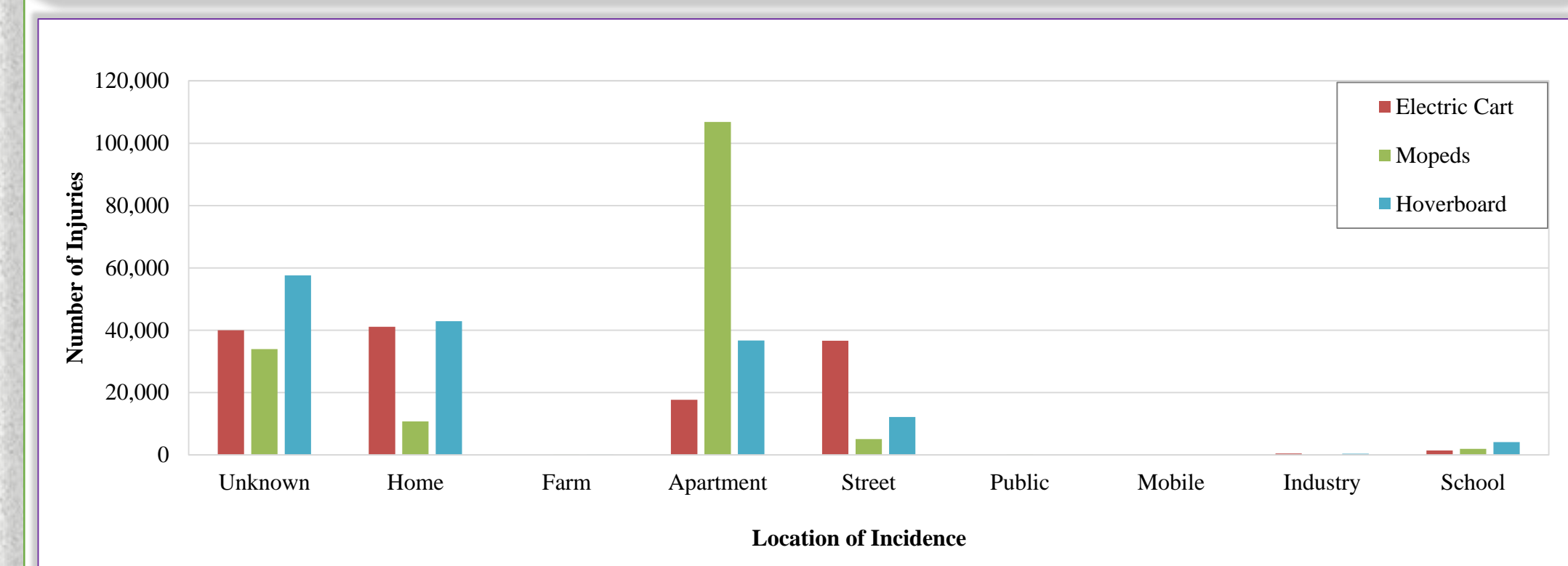


Figure 10 Location of the Incidences of the PEMDs Related Injuries

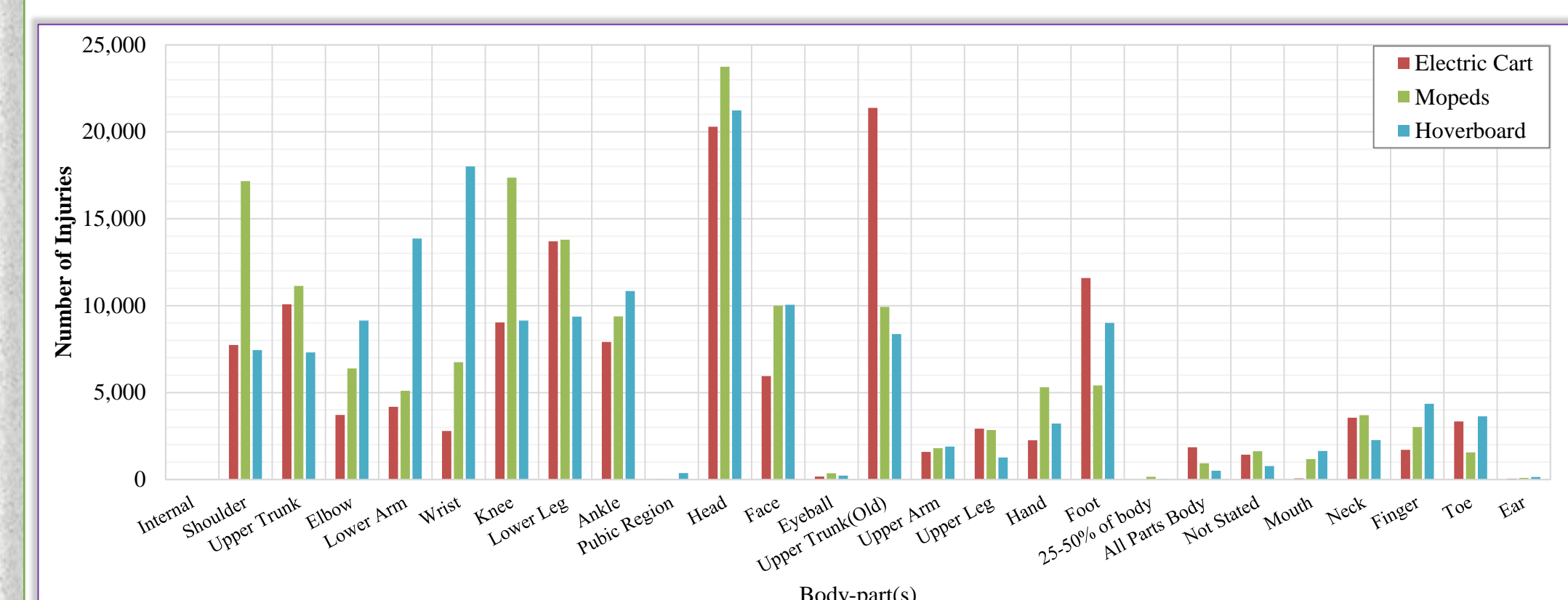


Figure 11 Affected Body-part(s) of the Victims of PEMDs Related Injuries.

## Conclusion and Recommendation

- NEISS database analysis, most PEMDs injuries: children age 2-10; Location: homes or apartments; Season: Summer; Month: August; Day: Sunday.
- Elder people (61-70 years) were involved in electric cart-related collisions, and teen-ager (11-20 years) old were in moped and hoverboard.
- Head is the most frequent injured body part in PEMD-related collisions. Upper-trunk (15.57%) is more vulnerable than the head for hoverboard.
- PEMDs users must have proper training. Helmet and safety gear for neck, knee, arm and wrist should be imposed as mandatory requirement.
- Separate lane can be constructed, or usage of PEMDs can be limited.

## Acknowledgment

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