

E-scooter Related Presentations to an Urban Trauma Centre: A Two-Year Analysis of Patient Volume, Injury Patterns, and Healthcare Burden

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Abstract

Aims

E-scooters are increasingly popular, offering convenience and environmental benefits but also contributing a significant healthcare burden. We aimed to quantify the impact of e-scooter-related injuries on healthcare resources at the Mater Misericordiae University Hospital in Dublin, Ireland, over a two-year period.

Methods

A retrospective chart review was conducted for patients over the age 16 presenting with e-scooter-related trauma from 01/07/2021 to 30/06/2023. Data included demographics, mechanisms, investigations, interventions and outcomes. Descriptive statistics were applied.

Results

The study included 380 patients, 259 (68.2%) male and predominantly aged 20-39 years (59%), 351 (92.3%) were riders. A significant proportion 143 (37.6%) triaged as "Very Urgent". Cumulative Patient Experience Time in the Emergency Department totalled 2,813 hours, averaging 7.4 hours. Radiological investigations required, 831 x-rays (2.2 per patient) and 282 CT scans (0.7 per patient). Fifty-three (13.9%) patients required admission, 43 (11.3%) underwent surgery. These patients accounted for 294 inpatient days, including 39 days in critical care. A total of 168 (44.2%) patients required outpatient follow-up. We recorded one fatality.

Discussion

E-scooter-related injuries present a growing challenge to healthcare. The increasing trend of presentations and the resource utilisation underscore the need for regulation to manage e-scooter-related trauma effectively. Further research and policy development are essential to mitigate the healthcare burden and ensure safety.

Introduction

E-scooters are battery-powered versions of the traditional two-wheeled "push along" scooters¹. Their use has expanded rapidly in urban areas³, both as modes of private transportation as well as through rental services¹⁰. This mode of transport offers several advantages, including convenience, cost-effectiveness, reduced traffic congestion and parking requirements, and environmental benefits.² However, e-scooter use also poses significant risks to both the riders and pedestrians, with injuries predominantly affecting the head, face and extremities³⁻⁵.

Injuries related to e-scooters are often concentrated among young men, with alcohol and illicit substance use being a contributing factor⁴⁻⁵. One study reported a particularly low rate of protective equipment use among e-scooter riders, with helmet usage observed in only 2.5% of cases⁴. Previous studies have reported that injury patterns differ from those seen in cyclists,⁶ suggesting unique risks associated with e-scooter use. Regulatory efforts to address these risks are increasing worldwide with Paris being the first European capital to ban E-scooter rentals since September 1, 2023⁷.

In Ireland, although e-scooter use was previously illegal, the Road Traffic and Roads Act of 2023 will introduce regulations allowing their use under specific conditions⁸. The new legislation exempts Powered Personal Transporters (PPTs) from registration, insurance, and licensing requirements but imposes limits on their power, weight, and design⁹.

While several studies have investigated the mechanism and pattern of e-scooter-related injuries,¹⁰⁻¹² the primary aim of this study is to describe the overall healthcare burden in a single hospital, associated with e-scooter related injuries in the Irish context. This includes the use of ambulance services, ED patient experience times (PET), diagnostic resources, surgical interventions, and hospital admissions. To provide further context to the data, secondary outcomes will also describe ED triage categories and patterns of injuries.

Methods

This study is a retrospective cross-sectional chart review conducted at the Mater Misericordiae University Hospital (MMUH), a Model 4 state-funded teaching hospital and an urban trauma centre. The ED serves an urban population with approximately 96000

presentations per year. Ethics was approved by the MMUH Institutional Review Board reference: 1/378/2379.

Patients over the age of 16 who presented to the MMUH ED with injuries directly or indirectly related to the use of e-scooters between July 1, 2021, and June 30, 2023 were included in the study. This included both e-scooter riders and pedestrians struck by e-scooter users. Accidents involving non-motorised scooters were excluded.

Cases were identified through a free-text search for the term "scooter" in patient electronic health records (EHR) from the hospital's ED. Each case was reviewed to confirm the involvement of an e-scooter. Data collected included patient demographics, mode of transport to the hospital, ED triage category (the ED utilises the Manchester Triage System),¹³ presenting complaint, injury details, admission status and length of stay (including ED PET/ICU/HDU admissions), surgical interventions and post-discharge follow-up

Data was collected utilising a Microsoft Excel Spreadsheet, and descriptive statistics were used to analyse and present the findings. Results are reported as frequencies and proportions for categorical variables and means and absolute range for continuous variables. For data analysis, we used Statistical Package for Social Sciences (SPSS, IBM, USA).

Results

Over the 2-year period a total of 420 patients were identified utilizing the search strategy of which 380 patients met the inclusion criteria and 40 were excluded as being unrelated to e-scooter (non-motorised or mobility scooters). There was no incomplete data.

Table 1 - Patient Demographics and Incident Characteristics (Data recorded in order Mean (Interquartile range) Total)

Measurements:		Frequency	Proportion
Total patients		380	
Age		34 (19)	
Male		259	68.2%
Transport to hospital	Ambulance	127	33.4%
	Private transport	253	66.6%

Triage category	Category 1: Immediate	2	0.5%
	Category 2: Very Urgent	143	37.6%
	Category 3: Urgent	217	57.1%
	Category 4: Standard	18	4.7%
	Category 5: Non-Urgent	0	0.0%
Cause of injury	Rider	351	92.3%
	Pedestrian	29	7.7%

The majority of the patients were male (68%) and 59% were aged between the ages of 20 and 39 years old (Figure 1). Only 8% (n=29) of the presentations were associated with being a pedestrian struck by an E-scooter. Thirty-three percent (n=127) of the patients required transportation to the hospital by Ambulance. One hundred and forty-five (38%) of the patients were triaged as immediate and very urgent on presentation to the ED, representing over a third of the cohort.

Figure 1- Age related e-scooter presentations

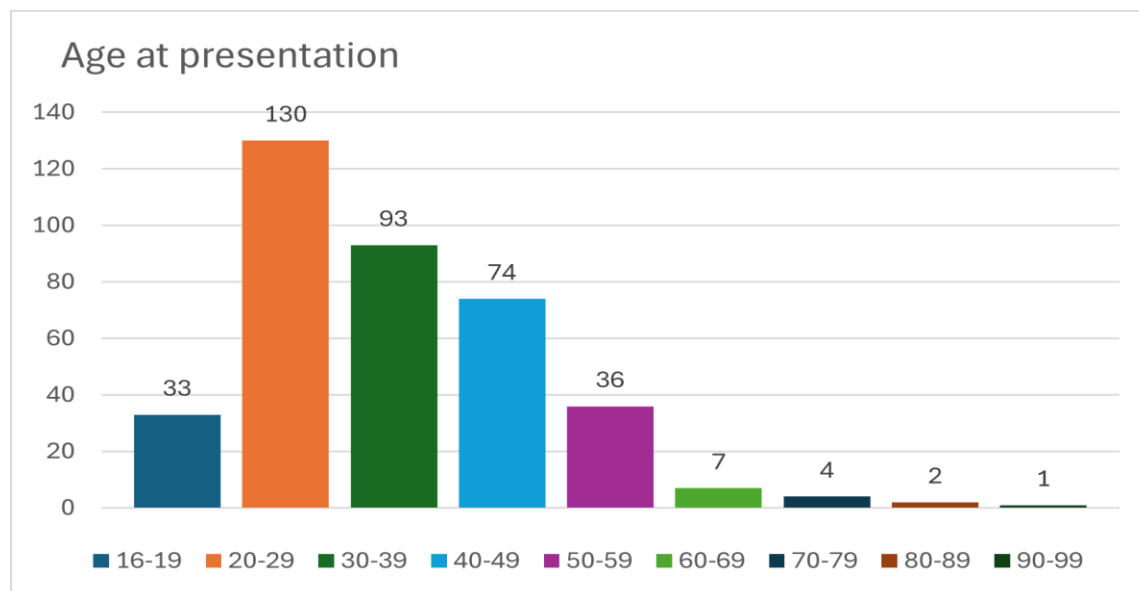
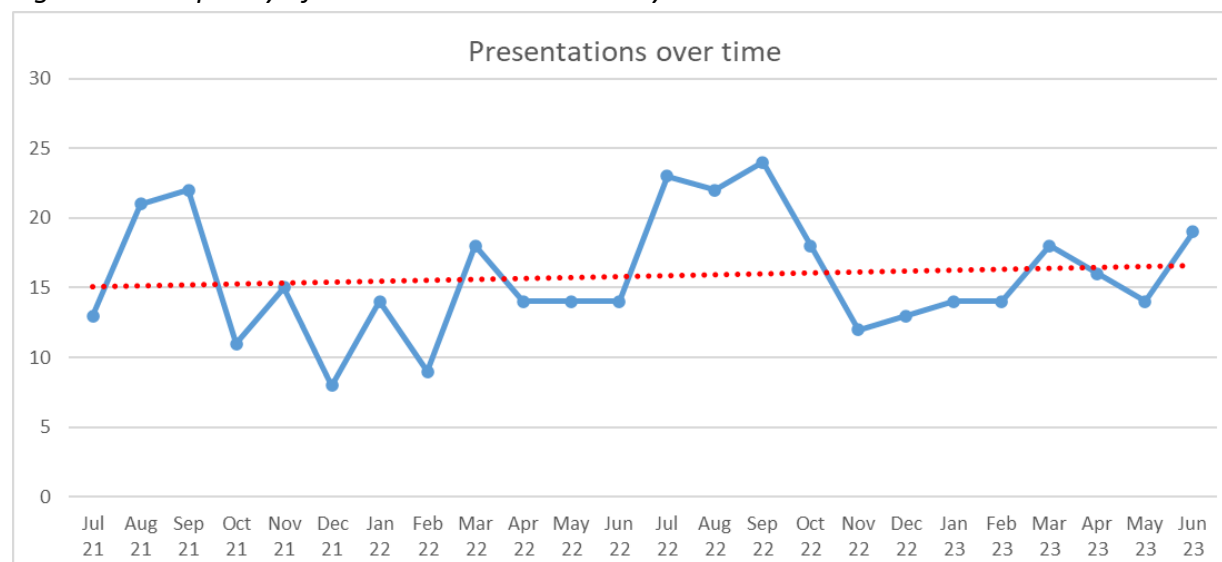


Figure 2 outlines the total number of presentations month on month for the study duration. From 1 July 2021 to 30 June 2022 there were 173 presentations and in the following year from 1 July 2022 to 30 June 2023 there were 207 presentations. There was an increase in

presentations during the months of July, August and September coinciding with the Summer in Ireland.

Figure 2 – Frequency of e-Scooter Presentations by Month.



ED PET accumulated to 2813 hours for all patients with an average ED PET time of 7.4 (IQR 6.05) hours per patient. In managing these patients, 70% required a total of 831 plain radiographs, with an average of 2.2 radiographs per patient (IQR 3). Additionally, 38% of the patients required a total of 282 CT scans, with an average of 0.7 scans per patient (IQR 1). Fifty-three (13.9%) patients required admission and 43 of the admitted patients required surgery. Eighty-six percent (327) of patients were discharged home from the ED with 44% requiring follow up either with a specialised clinic or their local GP.

The admitted patients required a total of 294 days of admission to hospital with an average length of stay (LOS) of 5.54 (IQR 5) days. Ten patients required admission to a critical care ward including 7 patients to HDU requiring 22 total bed days with an average LOS of 4.4 (IQR 2) days and 3 patients to ICU requiring 17 total bed days with an average LOS of 5.7 (IQR 5) days. A total of 4 patients required transfer to other hospitals due to pre-existing alternative pathways of care (Maxillo-facial/Neurosurgery). There was tragically one reported fatality of a pedestrian with a traumatic brain injury after being struck by an e-Scooter.

Table 2 summarizes the distribution of injuries and subsequent surgical interventions including the operations performed. Fifty-two percent (n=197) of patients suffered extremity trauma, 31% (120) patients had either a head or spinal injury and 10% (n=39) experienced injuries to multiple regions. There were 11 (10.2%) patients with intra-cranial hemorrhages of which 2 required transfer to Beaumont Hospital for emergent operative management.

Most patients required management of their injuries either in ED (n=327) or via ward-based observation (n=7). Twelve percent (n=45) of patients underwent operative management, of which a considerable proportion (83%, n=35) was for extremity injuries and a smaller proportion underwent either spinal or craniofacial surgery (21%, n=9). Forty-four percent (n=168) of the patients required follow up in surgical outpatient departments.

Table 2 - Distribution of Injuries and Surgical Procedures Performed by Body Region (ORIF – Open Reduction/Internal Fixation; CRPP - Closed reduction percutaneous pinning; IMN - Intermedullary Nailing

	Frequency	Proportion
Distribution of injuries	380	
Upper Limb	123	32.4%
Head	107	28.2%
Lower limb	74	19.5%
Polytrauma	39	10.3%
Thorax	18	4.7%
Spine	13	3.4%
Abdomen	4	1.1%
Pelvis	1	0.2%
Vascular	1	0.2%
Distribution of Surgeries		
Upper limb	22	48.9%
ORIF Hand	6	
ORIF Distal Radius	5	
ORIF Olecranon	5	
Soft Tissue Repair Hand	4	
CRPP Distal Radius	1	
ORIF Distal Humerus	1	
Lower limb	13	28.9%
ORIF Ankle	6	

ORIF Olecranon	5	
ORIF Tibial Plateau	5	
IMN Tibia	1	
ORIF Distal Femur	1	
Cranio-facial	6	13.3%
Repair Facial Wound	3	
ORIF Facial Bone	2	
Closed Reduction of Nasal bone	1	
Spinal surgery	3	6.7%
Posterior Spinal Fusion	1	
Halo application/removal	2	
Interventional radiology	1	2.2%

Discussion

This study highlights the wide-ranging impact of e-scooter related injuries on a single healthcare service over a 2-year period. The results describe the increased burden of these injuries on the healthcare system.

The exposed nature of e-scooter riders often categorises these incidents as high-velocity injuries, leading to a significant proportion of patients being triaged as Category 2 or 3 in the ED. This may contribute to the long ED PET times and large numbers of radiological imaging investigations, which was also reported by Shichman et al¹⁴. Despite large numbers being transported by ambulance to hospital and the high triage status, most patients were discharged without follow-up, suggesting that while the mechanism of injury often appeared severe, many injuries were ultimately less critical.

E-scooter injuries more frequently involve the head and upper extremities, and this is consistent with previous studies¹⁰⁻¹². The injury patterns lead to higher rates of injuries requiring admission and surgery, compared with those seen in bicycle-related trauma, as demonstrated by a nationwide study in England and Wales⁶.

A clear seasonal trend was observed, with increased presentations during the summer months. This seasonal variation likely reflects changes in transportation habits, with more individuals opting for e-scooters during favourable weather conditions. The study also noted

a year-on-year increase in e-scooter-related presentations, emphasising the growing popularity and associated risks of this mode of transport.

The healthcare burden extended beyond the ED, with e-scooter incidents necessitating a broad range of healthcare resources, including emergency medical services, diagnostic imaging, inpatient bed days, and operating theatre time. Notably, 44% of patients required follow-up care, highlighting the sustained impact on outpatient services as well. Orthopaedic services bore a substantial burden, with 83% of surgical interventions related to orthopaedic injuries, comparable to international data.^{12,14-16} Extremity injuries, which comprised 51.9% of all cases, often required specialised Orthopaedic interventions, including ORIF, IMN, and soft tissue repairs. The high volumes of these procedures' places significant pressure on operating theatre schedules, inpatient ward capacity, and rehabilitation services. Additionally, the requirement for follow-up care in Orthopaedic outpatient clinics further extends the demand on Orthopaedic resources.

A comparison with a recent study from another area of Dublin¹⁵ revealed similar demographics and injury patterns, particularly in admission rates (13.9% vs. 13.3%) and the need for surgical intervention (11.3% vs. 9.3%). A noticeable disparity was observed in the number of patients discharged home without follow-up, with only 44% of MMUH patients requiring follow-up, compared to 68.5% in the other study. Our study also identified a higher incidence of pedestrian injuries, likely reflecting increased foot traffic in the city centre. The consistency across studies enhances the generalisability of our findings across other urban settings.

The study identified a small subset of patients with life-threatening injuries, including one tragic fatality involving a pedestrian who sustained severe head trauma. Although the overall mortality rate was low, consistent with findings from other studies, this case underscores the significant risks faced by vulnerable road users, particularly pedestrians. No fatalities were reported among e-scooter riders themselves.

The risk associated with e-scooter use cannot be overstated and careful thought and regulation about rider safety must be prioritised beyond current minimal provisions. Further, proposals for unregulated e-scooter rental availability present a very serious public health risk when late-night use is considered.

While our study provides valuable insights into the impact of e-scooter-related trauma, it is limited by its retrospective design and single-centre scope and may not be generalisable to the population of Dublin or Ireland. MMUH only serves patients over the age of 16 and therefore the study excluded paediatric patients. Data collection relied on documentation from clinicians limiting ability to calculate formal scoring systems and including detail around the circumstances of the accident and personal safety equipment utilised. Further research should focus on larger, multicentre studies to assess regional variations and the effectiveness

of emerging regulatory measures. E-Scooter injuries should be included in the national trauma audit. Additionally, prospective studies examining interventions such as helmet mandates and speed restrictions would provide valuable data for policymakers.

E-scooter-related injuries represent a significant and growing burden on trauma and emergency care systems. Our findings align with international trends demonstrating high rates of fractures, surgical intervention, and extended hospital stays. The increasing number of e-scooter-related presentations underscores the need for improved safety measures, including public awareness campaigns, helmet mandates, and infrastructure improvements to reduce injury severity. Future studies should focus on evaluating regulatory interventions to mitigate the impact of e-scooter trauma on healthcare resources.

Declarations of Conflicts of Interest:

None declared.

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