Public Health Medicine Environment & Health Group (PHMEHG) Position on e-Scooters

Introduction

Advances in technology have brought about rapid changes in the way people travel, particularly in cities. Electric scooters (e-scooters) have quickly become a popular option for short distance transportation; first widely introduced in the US in 2017, by 2018 the number of e-scooter trips was estimated at over 38 million (1). These changes have implications for urban road safety and coincide with the beginning of the World Health Organization (WHO) Decade of Road Safety (2).

This report aims to identify the potential benefits but also highlight challenges associated with the emergence of electric scooters or 'e-scooters' as micro-mobility devices and to propose potential mitigating solutions for these challenges. Whilst e-scooters do present an alternative to cars, measures need to be in place to ensure the safety of e-scooter users as well as other road users and pedestrians.

Definition

There is no single agreed definition of an e-scooter. This has hampered research efforts and data collection on their use and safety. Indeed varying terminology was identified as a key limitation to 2019 Road Safety Authority Commissioned report, 'Review of Current Practice and Safety implications of electronic personal mobility devices' – terms noted to vary from 'personal electric vehicle' to 'micro-mobility device' (3).

A recent review in the journal *Injury Prevention* defined electric scooters as, *'personal mobility devices….These scooters are typically comprised of a shaft that connects handle-bars to a thin metal deck with two wheels, leaving riders only a few inches from the ground. Electric scooters can reach speeds up to 25 km/hour which allow the rider to travel on roadways or bicycle lanes. Conversely, the compact size of electric scooters also allows riders to easily manoeuvre through pedestrian traffic'* (4).

Context

There is a paucity of Irish data, however a survey conducted in the UK in 2021 found that 7% of respondents had ever used an e-scooter, with males and those in the 16-24 year age group more likely to have than their respective counterparts (5). It could be expected that findings would be similar in Ireland.

Although data on the use of e-scooters in Ireland is not readily available, the Road Safety Authority and An Garda have recently released figures indicating that the number of traffic incidents relating to

e-scooters is increasing, likely reflecting an increase in the ownership and use of these vehicles. In the first 7 months of 2022, 453 traffic incidents involving e-scooters have been reported, compared to 640 in 2021 and 280 in 2020 (6).

Unlike other European cities, e-scooter rental schemes are not currently available in Ireland and so e-scooters being used at present are privately owned.

Legislation

In Ireland, across Europe and internationally, legislators have struggled to keep pace with emergence of e-scooters.

Ireland

In October 2021 the Irish Government published a proposed amendment to the Road Traffic Offences Act 1961 (7). The Road Traffic and Roads Bill 2021 will clarify for the first time the legal status of e-scooters. To date those using e-scooters in Ireland have done so in a legislative grey area (7). Internationally e-scooters may be privately owned and used at an individual level, or accessed via shared rental schemes operated by commercial providers. In Ireland, it is anticipated that the introduction of new legislation will pave the way for operators of shared schemes.

The bill provides a definition of e-scooters under the term 'powered personal transporters' which refers to *'a vehicle—*
(a) designed and constructed for the carriage of a single person, but not designed or constructed for a person with restricted mobility or for the carriage of goods,
(b) with a maximum unladen weight of 25 kilograms,
(c) with a maximum design speed of no less than 6 kilometres per hour and no greater than 25 kilometres per hour, and
(d) equipped with an electric motor having a maximum continuous rated power less than or equal to 0.25 kilowatts' (8).

E-scooters will, in general, be subject to the same laws as apply to bicycle users and will be exempt from registration, tax, licencing, and insurance, if they are not able to travel at speeds of more than 25kph (7). They will be allowed on cycle lanes but prohibited from use on footpaths and motorways (7). Helmet use will be mandated for those aged between 16-18 years but will not be compulsory for adults (7).

The bill sets out new offences including operation while:

- intoxicated,
- while using a mobile phone or other information or "entertainment equipment",
- or if known to be defective.

The Road Traffic and Roads Bill 2021 is currently before the Oireachtas although legislation is not expected to be passed until 2023 (7).

Europe and Internationally

The European Transport Safety Council 2019 report, 'SAFER ROADS, SAFER CITIES: HOW TO IMPROVE URBAN ROAD SAFETY IN THE EU' noted a 'legislative gap' in Europe in the regulation of e-scooters –

highlighting that they are covered by neither EU regulation, nor national legislation in many European countries (9).

In 2019, the Road Safety Authority (RSA) commissioned a report, 'Review of Current Practice and Safety implications of electronic personal mobility devices', to identify international evidence on which to base recommendations for legislation in Ireland (3). The report found that:

- Most countries do not mandate helmet use - likely reflecting the fact that helmets are not mandated for cyclists in the majority of countries (3).
- There is little evidence of enforcement, even where requirements exist or where it is illegal to use an e-scooter (3).

The RSA updated this report in 2021, reviewing legislation changes and including additional case study countries (10). The report found that the initial regulatory approach adopted in some countries had subsequently been modified on safety grounds (10,11). For example, introducing age limits and banning use on footpaths. Many countries now mandate helmet use, particularly for younger age groups. However, the report still expressed concern that "depending on the political context, enforcing helmet use may be difficult" and recommended incentivising helmet use until such time, as enforcement is possible (10).

Some measures have been implemented internationally which have aimed to enhance safety of e-scooter users and other road users (12). These measures include:

- **Speed limits**, e.g. France 25km/h; Germany 20km/h.
- **Mandating wearing helmets** e.g. several Australian states, Portugal, Finland.
- **Age restrictions** e.g. in Germany users must be aged 14+
- **Restricting use to roads and/or cycle lanes** rather than footpaths e.g. Madrid
- **Mandating safety equipment** on e-scooters e.g. in Germany lights, bells, and reflective materials are required
- **Public awareness campaigns,** e.g. New Zealand
- **Only permitting e-scooter use in certain areas and limiting the number of e-scooters in use at any one time,** e.g. as is done in Canada.

Ongoing review of international practice is required, and e-scooter regulations in Ireland need to be responsive to emerging evidence and updates to regulations in other jurisdictions (11).

Reported Benefits of e-scooters

- Convenient, affordable, and easy to use.
- Greater transportation options and convenience.
- Potential environmental benefits:
    - By virtue of using an electric motor, e-scooters have no tailpipe emissions, resulting in fewer localised pollutants.
    - When used instead of car or taxi journeys, e-scooters also have the potential to reduce traffic congestion.
    - E-scooter motors are substantially quieter than combustion engines, resulting in less noise pollution.
    - These environmental benefits may have consequential health benefits, as air pollution is associated with premature mortality, cardiovascular and respiratory

system diseases, and noise pollution with sleep disturbance, cardiovascular disease, and stress.

- E-scooters could help solve the "last mile" problem – this being the short distance one needs to walk from a bus or train stop to their final destination. This may encourage more people to use public transport rather than rely on car or taxi journeys.
- Tourism benefits through e-scooter share schemes.
- Economic benefits.

Environmental Impact of e-scooters

There is a perception that e-scooters are "green" – as described above, the lack of tailpipe emissions leads to less localised air pollution, and there is a reduction in noise pollution compared with gasoline engine motor vehicles (13,14). However, as with all electric vehicles, the most significant environmental impact comes from the manufacturing process and the raw materials (9,10). Therefore, to determine the environmental impact of e-scooters a life-cycle analysis approach is needed; two recent studies have performed life-cycle analysis of e-scooters, an American study which looked solely at shared dockless e-scooters (13) and a Belgian study which looked at shared e-scooters and e-scooters owned privately for personal use only (14).

In taking a life-cycle approach, a number of environmental concerns are identified:

1) The environmental impact of the manufacturing process and sourcing of raw materials; greenhouse gas (GHG) emissions, particulate matter (PM) formation and use of minerals and fossil resources all pose substantial impacts on the environment during the manufacturing process (13,14). One American study looking at the life-cycle impact of shared dockless e-scooters found that materials and manufacturing account for 50% of the environmental impact of e-scooters (13) and a recent Belgian study found that 68-90% of total impact of e-scooters came from the material phase – in particular from the extraction of aluminium and lithium (14).

2) High level of disposability; the average lifespan of shared dockless e-scooters tends to be less than 2 years, following which they are generally disposed of in landfill sites (14).

3) The environmental impact of the vehicles collecting shared dockless e-scooters for charging and relocation (13,14).

The environmental impact of e-scooters therefore depends on:

- Whether the e-scooter is privately owned or a shared dockless e-Scooter (which also influences the following two points);
- The mode of transport displaced; and
- The lifespan of the e-scooter.

1) Mode of transport displaced

Whether e-scooter use replaces a car journey or whether it replaces more environmentally-friendly modes such as walking and cycling, will influence the overall environmental impact of an e-scooter. Surveys showing the mode of transportation replaced by those opting to use e-scooters show that these vary by countries. The studies conducted in USA show that e-scooters more frequently replace car journeys when compared with the studies conducted in Europe (14).

An American study looking at the life-cycle impact of shared dockless e-scooters found that journeys replacing walking, cycling, or bus journeys with high ridership had higher Global Warming Potential (GWP), whereas those replacing car or taxi journeys resulted in improvements in global warming impacts (13). Similarly, a Belgian study found that with a GWP of 131 g CO2eq/pkm, shared dockless e-scooters emitted 21g CO2-eq/pkm more than the transport modes they replaced (14). However, the same study also found that the GWP of privately-owned e-scooters was only 67g CO2eq/pkm, resulting in emissions of 50g CO2-eq/pkm less than the transport modes they displaced (14).

2) Lifespan of the e-scooter

The relative importance of material phase depends on total distance travelled over lifetime of the scooter, resulting in reduced environmental impacts with increased lifespan.
The lifespan of an e-scooter depends on:

- The design and quality of the e-scooter,
- Use / misuse damage (e.g. due to poor road quality/paving or additional passengers),
- Vandalism,
- And maintenance (14).

The Belgian study found that the average lifespan at present for dockless e-scooters is 7.5 months, but with a hypothetical lifespan of 5 years, the GWP can reduce to only 40g CO2-eq/pkm (14). The study suggested that as the design and quality of e-scooters improves, the lifespan should increase, reducing the environmental impact of e-scooters, and in particular, the environmental impact of shared e-scooters (14). Similarly, the American study concluded that ensuring that the shared dockless e-scooters are used for at least two years, decreases the average life cycle emissions from 202 g CO2-eq/passenger-mile to 141 g CO2-eq/passenger-mile (13).

3) Private owned v shared dockless e-scooters

The Belgian study also looked at personal use e-scooters and found that the GWP or environmental impact of personal e-scooters was lower than that of shared e-scooters, but also of the modes of transport they tended to replace (14). They suggested a number of reasons for this:

- Personal use e-scooter lifespan tends to be longer – due to better usage or less misuse, and less vandalism;
- No vehicles are needed to collect the e-scooters for charging and redeployment;
- GWP of displaced mode of transport by personal scooters tends to be higher than that replaced by dockless scooters (based on this particular study) (14).

A significant proportion of the environmental impact of shared dockless e-scooters is due to the vehicles used to collect the e-scooters to facilitate charging/deployment around the city, with one study estimating it contributes 43% of the environmental impact (13). The same study went on to recommend ways to reduce life cycle global warming impacts through improved scooter collection and charging approaches, by:

- Using fuel-efficient vehicles for collection;
- Limiting scooter collection to those with a low battery state of charge; and
- Reducing the driving distance per scooter for e-scooter collection and distribution (13).

The Belgian study also indicated that using a battery which can be removed for charging could reduce the environmental impact of this process by facilitating transport of multiple batteries in place of a smaller number of e-scooters (14).

After conducting the life-cycle analysis of both shared e-scooters and personal use e-scooters, the Belgian study concluded that privately owned e-scooters were likely to be a sustainable transport option (14).

Health Impact of e-scooters

The evidence of e-Scooter health impacts is mixed, with some quite tangible negative health impacts at a personal and health system level, but some potential benefits to overall community health, through reduced air and noise pollution.

1. Improved local air and noise pollution levels

E-scooters may provide benefits to health. Improved air quality and reduced noise pollution, as discussed above, may have beneficial effects on cardiovascular diseases, respiratory disease, stress, and premature mortality (15).

However they are not without health risks which should also be taken into consideration, particularly injuries, and the potential to reduce more active modes of transport.

2. Injuries

The use of e-scooters and other micromobility vehicles can result in a range of injuries to both the driver, pedestrians and cyclists, with presentations of complex orthopaedic injuries, which affect the user, other road users, but also the healthcare system, being expensive to treat (16-21). In a recent study in Ireland, 36% of presentations to the hospital with e-scooter related injuries required surgery, whilst 68% had radiologically confirmed fractures, 60% of users were not wearing a helmet, and only 45% held a full Irish driver's licence (16). Other studies have found that facial and upper extremity injuries are the most common (17,18). A high proportion of those presenting with injuries require radiology (16,18).

Head injury is a common injury sustained from use of e-scooters leading to calls for universal helmet use (22). While the evidence-base for helmet use to prevent injuries from the use of e-scooters is developing, there is strong evidence that wearing helmets significantly reduces the risk of brain injury and death in cyclists (23). A recent comprehensive review of the evidence indicated that helmet wearing reduced serious injury and death by 34%, head injury by 48%, serious head injury by 60%, traumatic brain injury by 53% and facial injuries by 23% (23).

Some causative factors in e-scooter injuries have been highlighted, such as their ability to travel at high speeds (up to 25 km/hr), and the proximity of the driver to the ground, thus resulting in low fall heights, and short reaction times (16).

A high-level literature review of recent e-scooter injury data conducted by RSA in 2021 found that although there was limited data availability, there was some evidence to suggest that increased helmet use and restrictions on alcohol use whilst riding led to a decrease in the number and severity of injuries (10). However, the report also concluded that there is a lack of good quality data on e-scooter injuries and collisions and that data collection needs to be a priority for road safety agencies (10).

3. Reduced physical activity

E-scooter use can reduce participation in more active forms of transport (19). Physical activity, such as walking and cycling, has been shown to have health benefits, including reductions in cardiovascular

disease, Type II diabetes and certain cancers, and improvements in mental health (22). Many e-scooter journeys are replacing more active forms of transport (14), which may therefore have a negative health impact. However, when replacing a car journey, it is possible that e-scooters do provide low intensity and core strength activity relative to this sedentary travel mode (19).

Addressing vulnerable road users and inequalities

There are road safety challenges associated with the use of e-scooters, which may affect other vulnerable road users (23). For example, pedestrians may be put at risk if e-scooters are ridden on the pavement and cyclists may be put at risk if e-scooters use cycling infrastructure, such as bike lanes. Measures need to be in place to ensure e-scooters are not ridden on footpaths, but adequate infrastructure needs to be in place to ensure the safety of cyclists if bike lanes are to be used. In addition, e-scooter users may be more at risk due to infrastructure defects, such as potholes, and so for the benefit of all road users, appropriate quality infrastructure needs to be in place (19).

Given the lack of noise produced by the e-scooters, they also pose a risk, particularly to those who are visually impaired (25). There has been suggestion that e-scooters should be equipped with noise emitting devices to alert other road users to their presence (25). This is in addition to other recommendations to improve visibility, such as mandated use of lamps and reflectors.

Shared dockless e-scooters can also pose a risk to vulnerable road users when they are parked in such a way that blocks pavements (19). This can cause significant difficulties for those with disabilities and those with pushchairs. Suggestions have been made that e-scooter companies should have to track parking behaviours of their users and to provide education to their users on appropriate parking (3).

There remains debate over whether e-scooters may contribute to or detract from social cohesion, which may already be lacking in disadvantaged communities (19). Whilst some argue that access to e-scooters may facilitate access to recreation facilities and public spaces for socialising, others have argued that increased pedestrian injuries, incorrect parking of e-scooters, and misuse or vandalism of e-scooters may further compromise social cohesion (19).

In regions where shared e-scooter schemes already exist, there has already been a need to address inequalities, with calls for e-scooters to be distributed in low-income and underserved communities, rather than just in central locations (19). Requiring a smartphone to access shared e-scooter schemes may limit access for those without such technology, which may include those from low-income households. Suggestions to tackle these inequalities include the use of non-smartphone access (e.g. text-to-unlock) and alternative payment methods (26).

Summary

- Electric scooters (e-Scooters) have quickly become a popular option for short distance transportation.
- Evaluating the benefits and limitations of e-scooter use is a nuanced area and requires further research.

- E-scooter accidents can result in complex orthopaedic injuries to both users, pedestrians and cyclists.
- Participation in more active forms of transport may be reduced by e-scooter use.
- The environmental impact of e-scooters is dependent on a multitude of factors, including mode of transport displaced, lifespan of the e-scooter, and whether rented as part of a shared scheme or privately owned.
- When replacing car journeys, e-scooters have the potential to reduce local noise and air pollution.

Recommendations

1. In order for e-scooters to be used safely, several optimisation strategies are recommended, as advised previously by other authors (16,19):

- Increased enforcement of rules around helmet use and use of e-scooters on footpaths.
- Helmet wearing should be mandatory for all users.
- Speed limits.
- Prohibit parking and riding of e-scooters on footpaths.
- Limit use of each e-scooter to one rider at a time – in particular, children not to be passengers on e-scooters.
- Encourage the use of other protective equipment such as elbow and knee protectors.
- Promote greater use of visibility equipment such as lights and reflective clothing and use of audio alert systems (e.g. bells).
- Prohibit use of headphones whilst riding.
- Provide road safety training for e-scooter users (as a high proportion of e-scooter users did not have a full driving licence), and include in awareness training for other road users (e.g. cars and trucks).
- Improved infrastructure for all road users – including segregated cycle paths and improved road surfaces – and increased road signage for both e-scooter users, and other road-users.

2. To reduce the environmental impact of e-scooters, several suggestions are recommended:

- Encourage ideal use of e-scooters to ensure a lifespan of >2 years.
- Encourage e-scooter use to replace car journeys; discourage replacement of walking or cycling.
- Shared schemes requiring vehicles to relocate e-scooters should use fuel-efficient vehicles, limit collection to those with low battery and reduce the driving distance per scooter.

3. Further research is necessary to determine the potential benefits and limitations of e-scooters in an Irish context. This needs to include standardised data collection that specifically focuses on e-scooter collisions and injuries.

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