



SHORT REVIEW

Mobility Scooter Accidents - Need for Preventative Action?

Emilie S Bækgaard*, Lars Christensen, Roar B Medici and Hans-Henrik Bulow

Intensive Care Unit, Holbæk Hospital, Denmark

*Corresponding author: Emilie S Bækgaard, Intensive Care Unit, Holbæk Hospital, Marstalsgade 37, 2.th, DK-2100 København Ø, Denmark, E-mail: emilie.s.baekgaard@gmail.com

Abstract

Background: Mobility scooters are three- or four-wheeled vehicles, powered by an electric engine. Often acquired by the elderly population, they neither require a drivers' license, nor an assessment of operator skills prior to use. Other vehicles used primarily by older people are powered wheelchairs and electric bicycles. Comparable to regular bicycles or scooters, similar traffic rules apply for mobility scooters, wheelchairs and electric bicycles. Users experience improved quality of life; however studies report accident rates of up to 21%.

The use of helmets is known to decrease rates of traumatic brain injury in accidents involving motorcycles, regular bicycles and regular scooters, and it may thus be important to consider helmet legislation in the case of mobility vehicles used by the elderly population.

Aims: In this short narrative review, the authors examined current literature surrounding accidents and injury, with focus on traumatic brain injury, in relation to mobility scooters. The aim was to shed light on whether there might be a case for mandatory helmet use for drivers of mobility scooters-as seen with motorbikes.

Findings: Although data sets are small, there appears to be a heightened risk of accidents and injury, including traumatic brain injury, among users of mobility scooters and powered wheelchairs.

Recommendations: The authors recommend specific national data registration regarding accidents involving mobility scooters. We would endorse mandatory helmet use, a pre-purchase user assessment and specific prescriber training, so as to minimize the risk of accidents involving mobility scooter users.

Background

Demographics

All developed countries in the world show an increase in the number of older people. Along with increasing age,

decreasing mobility, increasing muscle weakness and impaired reflexes often follow. As a result, older people can find themselves both with poorer walking skills, but also unable to drive a standard car. Fortunately, many different vehicles are available to resolve these situations, allowing those unable to drive a standard car to participate in routine activities and transport themselves around regardless. These vehicles include mobility scooters, also known as motorized mobility scooters (MMS), powered wheelchairs and electric bicycles, and are all primarily used by older people as an instrument to increase their mobility.

What are mobility scooters and what are characteristics of these?

Mobility scooters are three- or four-wheeled vehicles, powered by an electric motor. Their advantage consists in them being legal to drive, even for those unable to drive a standard car.

Due to limitations in speed, mobility scooters do not require a drivers' license, as they fall into the category of "bicycles" under traffic regulations. The Danish legislation states that powered wheelchairs and mobility scooters class 2 (speed limit 4 mph/ 6 kph) must be used on pavements-and, thus, are classed as pedestrians-whereas class 3 mobility scooters (12 kph/ 8 mph) can be used on both roads and pavement [1]. Those reaching speeds of up to 15 kph (9 mph) are only allowed on bicycle lanes and roads, and are classified as bicycles, with equal regulations regarding lights etc.

Denmark has seen an explosive rise in the sale of mobility scooters [2] as well as electric bicycles, and the Danish Association of Bicycle Vendors predicted a rise in the sales of these bicycles from 6 to 9% of total sales

between 2014 and 2015 [3].

In the United States (US), it has been reported that 1.7 million people use mobility scooters or wheelchairs [4]. The United Kingdom (UK) has an estimated 300,000-350,000 mobility scooters in use [5].

In many other countries, these numbers are roughly estimated or unknown. This is, at least partly, because mobility scooters and powered wheelchairs fall into the categories of other types of vehicles, and hence are not commented upon separately in traffic statistics.

The elderly population have been shown to have an increased risk of traumatic brain injury (TBI) compared to the general population, most commonly resulting from traffic accidents and falls [6]. Furthermore, the mortality after TBI increases with concomitant anticoagulant use-drugs commonly prescribed in older age groups-due to both the overall increased risk of intracranial haemorrhage, as well as the increased severity of the haemorrhages after TBI [7,8].

As users of mobility scooters have a mean age of 81 [9], an accident resulting in TBI could therefore have fatal outcomes. However, with the use of helmets for motorcyclists, a Cochrane review from 2008 [10], found a 42% decrease in the risk of death, and a 69% decrease in the risk of head injury. Similarly, reductions in the rates of brain trauma have been found with helmet use on regular bicycles [11], and other recreational, low-speed vehicles, such as skateboards [12]. Whether this is the case for users of mobility scooters remains unknown, but seems plausible.

In this narrative review, the authors examine current available literature on the topic of mobility scooter use and associated injury, especially TBI. The aim was to shed light on whether there might be a case for mandatory helmet use- as seen with motorbikes- for drivers of mobility scooters.

Search methods

In September 2015, Pubmed and bibliotek.dk (Danish online library service) were searched. The search strategy was designed and conducted by an experienced medical librarian with input from the authors.

The search in PubMed was limited to MeSH-terms and Major Topics-apart from "Motorcycle Helmet", which did not have MeSH-terms.

Our search identified six studies commenting specifically on mobility scooters. One further study was included, commenting on "open-top, two-, three- or four-wheeled vehicles".

Please see [Appendix 1](#) for a table overview of studies.

Results

Users of mobility scooters have been shown to experience a large increase in quality of life [13,14]. However, the negative effects on fasting blood glucose and diabetes amongst users have also been noted [14]. Al-

though these effects may be, attributed to a more sedentary lifestyle with less physical activity, another study found no decrease in physical capabilities of users [15]. Users have been found to report low knowledge, lack of concise information, and lack of trialing and training prior to purchase [16].

Accident rates involving mobility scooters

Studies have reported accident rates involving mobility scooters of 18-21% [15,9]. In the Australian state of Victoria, 151 accidents involving mobility scooters were seen between 2001-2005, of which six were fatal-three due to TBI [13].

The US has a thorough traffic accident data collection system, including a series of studies on mobility scooters, powered wheelchairs and the effect of protective helmets while operating open-top two-, three- and four-wheeled vehicles. In 2003, more than 100,000 accidents involving mobility scooters were treated in American Emergency Departments-a 100% increase since 1991 [17].

In Denmark, it is recognized that by far the commonest reason for injury involving mobility scooters, relates to the scooter tipping over. Other common injury patterns relate to the user being involved in a road traffic accident, colliding with other persons, running over his or her own feet, or sustaining injuries while mounting or descending the vehicle. Almost half of all reported injury resulted in hematomas and small wounds; 25% resulted in fractures, and 20% in open wounds [1].

When it comes to similar vehicles, one Danish study reporting on electric bicycles (similar speeds) showed seven fatal accidents over two years, six of which occurred in people over the age of 70 [18], somewhat confirming the tendency to accidents and injury with these relatively low-velocity vehicles.

Discussion

The obvious limitations of this study stem from the limited current data available, preventing us from conducting a rigorous systematic review. Most studies on the topic comment on small populations, and there is no consensus as to the definition of "mobility scooter", nor at which age patients are classified as "elderly".

In order to review the topic, we have had to include studies focusing on several different types of vehicles, as well as populations not specifically limited to the elderly, which decreases homogeneity of our results.

However we have chosen to group these vehicles as they all cater to people with mobility problems, enabling them to transport themselves around- sometimes at speeds difficult for this group of persons to control.

Recommendations

We recommend that national registers start collecting specific data on accidents with electric bicycles, mobility scooters and powered wheelchairs. The number of

older citizens is rising in the western world, and it seems likely that the incident rate is higher than thought. Reliable figures may lead to focus on these easily preventable head injuries in a group of vulnerable older citizens. For accurate data collection, we also recommend a standard definition of "mobility scooter" be developed.

Another possibility in Scandinavia could be to add a registration of accidents in the tool "Nordic mobility related participation outcome evaluation of assistive device interventions (NOMO1.0)" which is used in all Nordic countries, when assessing if potential users of mobility devices actually benefit from having such a device. Participants are evaluated after one month and one year, and the benefit would be, that accidents that do not lead to contact with hospitals or emergency departments will also be registered [1,19].

All in all, we would endorse mandatory helmet use for users of mobility scooters, development of a pre-purchase assessment including specific score skills for scooter use as well as education and training of prescribers and suppliers of scooters.

Acknowledgements

Pernille Pless, Research Librarian, Intensive Care Unit, Holbæk Hospital, Zealand, Denmark.

Conflicts of Interest

None.

Funding

None.

References

1. <http://tekst.socialstyrelsen.dk/ref.aspx?id=6738>
2. Broksoe K (2013) Flere tilskadekomne på el-scootere med fører ny test. *Ældre Sagen Nyt* 6: 11.
3. <https://ing.dk/artikel/elcyklen-boomer-og-nye-modeller-myldrer-frem-180043>
4. <http://www.disabled-world.com/disability/statistics/mobility-stats.php>
5. (2014) "Mobility Scooters- a Market Study", Research Institute for Consumer Affairs.
6. Coromado V, Thomas K, Sattin R, Johnson RL (2005) The CDC traumatic brain injury surveillance system: Characteristics of Persons Aged 65 Years and Older Hospitalized With a TBI. *J Head Trauma Rehabil* 20: 215-228.
7. Gaetani P, Revay M, Sciacca S, Pessina F, Aimar E, et al. (2012) Traumatic brain injury in the elderly: considerations in a series of 103 patients older than 70. *J Neurosurg Sci* 56: 231-237.
8. Ho S, Thakkar V, Jallo J (2013) Outcomes in Traumatic Brain Injury Patients on Preinjury Anticoagulation and Antiplatelet Agents. *JHN Journal* 8: 3.
9. Edwards K, McCluskey A (2010) A survey of adult power wheelchair and scooter users. *Disabil Rehabil Assist Technol* 5: 411-419.
10. Liu BC, Ivers R, Norton R, Boufous S, Blows S, et al. (2008) Helmets for preventing injury in motorcycle riders. *Cochrane Database Syst Rev* 23.
11. Forssé A, Eskesen V, Springborg JB (2015) Bicycle helmets prevent brain damage. *Ugeskrift Laeger* 177: 1417-1420.
12. Ganti L, Bodhit AN, Daneshvar Y, Patel PS, Pulvino C, et al. (2013) Impact of helmet use in traumatic brain injuries associated with recreational vehicles. *Adv Prev Med* 2013: 450195.
13. http://www.monash.edu/__data/assets/pdf_file/0005/218435/haz62.pdf
14. Zagol BW, Krasuski RA (2010) Effect of motorized scooters on quality of life and cardiovascular risk. *Am J Cardiol* 105: 672-676.
15. Hoenig H, Pieper C, Branch LG, Jay Cohen H (2007) Effect of motorized scooters on physical performance and mobility: a randomized clinical trial. *Arch Phys Med Rehabil* 88: 279-286.
16. Fomiatti R, Moir L, Richmond J, Millsteed J (2014) The experience of being a motorized mobility scooter user. *Disabil Rehabil Assist Technol* 9: 183-187.
17. Xiang H, Chaney AM, Smith GA (2006) Wheelchair related injuries treated in US emergency departments. *Injury Prevention* 12: 8-11.
18. <http://www.fdm.dk/nyheder/aeldre-elcykler-er-en-doedelig-kombination>
19. Löfqvist C, Pettersson C, Iwarsson S, Brandt Å (2012) Mobility and mobility-related participation outcomes of powered wheelchair and scooter interventions after 4-months and 1-year use. *Disabil Rehabil Assist Technol* 7: 211-218.

Appendix 1: Study overview with review of quality.

Quality assessment following standards set by Bob Phillips, Chris Ball, Dave Sackett, Doug Badenoch, Sharon Straus, Brian Haynes and Martin Dawes, November 1998. Updated by Jeremy Howick March 2009. <http://www.cebm.net/oxford-centre-evidence-based-medicine-levels-evidence-march-2009/>

Danish national board of social services	Mobility scooters	Mobility Scooter Users	Comments on types of injury, rate of injuries resulting in fractures	4
Cassell E, Clapperton A	Mobility scooters	State of Victoria, Australia	2001-2005: 6 fatalities (3 Traumatic Brain Injury), 151 injuries. Improvement in Quality of life.	4
Hoenig H, et al. [15]	Mobility scooters	22 patients with rheumatic conditions	18% of users sustained accidents (9 accidents in total) over 3 months.	4
Zagol BW, et al. [14]	Mobility scooters	Users of scooters	Big improvement in quality of life, negative effect on fasting glucose and diabetes.	4
Fomiatti R, et al. [16]	Mobility scooters	Users of scooters	Users revealed low knowledge, lack of concise information, and lack of adequate trialing and training prior to purchase of a scooter	4
Broksoe K [2]	Mobility scooters	Denmark	Explosive rise in sales of mobility scooters	3c
Xiang H, et al. [17]	Open-top, 2-,3- or 4-wheels	Road traffic accident victims in the US	100,000 accidents relating to these in 2003, 100% increase since 1991	3c