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Mobility scooters in urban environments: A research agenda

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ABSTRACT

Introduction: As our society ages, mobility scooters are a fast-growing mode of transportation. The growing prevalence of mobility scooters as a mode of transportation has the potential to not only affect the lives of older adults who use them but to impact urban environments at large as well as have implications for the safety of pedestrians and of other vehicle users.

Goal: The goal of this paper is to explore the gaps in the existing literature regarding mobility scooters, laying out key areas for future research.

Results: We propose three areas of research that focus on mobility scooter use by older people: (1) research involving users – impacts on older people employing mobility scooters; (2) studying the impact on urban space - public spaces and passageways used as travel routes, the barriers impeding travel and lack of appropriate parking solutions in the urban environment; and (3) issues of safety - mobility scooter driving and travel regulations and infrastructure design regulations.

Discussion: Addressing these gaps in knowledge has the potential to contribute to the social and physical sustainability of future urban environments as well as to the wellbeing of older adults.

1. Introduction

As population ages, one of the challenges that older people living in urban environments face is remaining mobile. Due to physical changes that become more common with age, older adults’ mobility may be limited, restricting their autonomy. As a result, restoring older adults’ autonomy may require mobility solutions other than driving cars or using public transportation. One possible solution for alternate, more accessible travel could be achieved by using mobility scooters (Clarke, 2014; Samuelsson, & Wressle, 2014). Mobility scooters are simple, electricity-powered vehicles that are suitable for short-distance travel at low speeds. Mobility scooters have been in use by older people for several decades. Having been used by a small proportion of the population, mobility scooters have mostly been neglected by researchers, planners and policy makers and have not been studied in ways that other vehicles have been.

The growth in the number of mobility scooter users and the expected increase in mobility scooter prevalence creates a rising need to address this form of transportation from multiple perspectives. According to the US Census Bureau (2014), the Release Report CB14-218 for the years 2008–2012, 40% of people aged 65 and older have to contend with disabilities. Two thirds have difficulty walking or climbing. With the population over 65 in the US nearly doubling from 51 million in 2017 to 95 million by 2060 the number of older people that have to contend with mobility disabilities is expected to reach 24 million. This leads to an expected compound annual growth rate in purchase of mobility scooters, worldwide, between 2020 and 2026 is expected to reach 7.3%, not accounting for COVID-19. The following research note addresses this need by examining the uniqueness of this transportation mode and by calling attention to possible impacts that the growth in mobility scooter use may have in three domains. These include: the impacts on those

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who adopt mobility scooters into their lifestyle, potential implications for urban and transportation planning, and impacts on enacting laws and regulations pertaining to the safety of those operating and riding mobility scooters, as well as those surrounding them.

Following the introduction, this paper consists of two parts. First, mobility scooters will be introduced, describing their uniqueness as a transportation mode. The legal aspects of mobility scooters will be explored, outlining current laws and regulations of relevance to mobility scooter usage from different parts of the world. Second, the knowledge gaps that exist in each of the three domains discussed above will be reviewed. These gaps need to be addressed in regard to the growing number of older mobility scooter users.

1.1. Mobility scooters and their use

Mobility scooters are dedicated assistive vehicles that allow people who have difficulty walking to perform tasks requiring mobility. These include electric-powered wheelchairs and electric-powered mobility scooters (Karmarkar et al., 2011; La Plante and Kate, 2010). Electric-powered wheelchairs have provided a partial solution to mobilizing people with mobility impairment, limited mostly to the confines of their homes and their homes’ surroundings. Mobility scooters are suitable for farther-reaching travel, and therefore provide a complete solution to mobilizing people by expanding the travel range, allowing users to regain autonomy outside of their homes (Su et al., 2010). Mobility scooters have become affordable and reliable vehicles that serve their purpose of mobilizing those in need in an easy to use, efficient, and manageable manner. Mobility scooters have a varying seating capacity of one or two passengers.

There are two types of mobility scooters (see Fig. 1). The division is made based on size and motor power: Class 2 and Class 3, both with three or four-wheeler options (DVLA, 2018):

1. Class 2 mobility scooters are smaller and lighter-more compact, enabling easy handling and convenient storage. Mobility scooters in this class can be folded and stored in the trunk of a car. They are appropriate for indoor use (such as shopping malls and public transportation) as well as outdoor use. Their speed is limited to 4 m/h (6.44 km/h).

2. Class 3 mobility scooters are larger vehicles that can only be used outdoors. These vehicles include safety features such as lights, reflectors, a horn, and side mirrors. The UK Driving and Vehicle Licensing Agency require that the maximum width of Class 3 mobility scooters be restricted to 85 cm, and the maximum speed limited to 8 m/h (12.9 km/h).

Autonomous mobility scooters are currently being developed and at the time of writing, are not available commercially (Anderson et al., 2017). Once available commercially, autonomous mobility scooters possess great potential to assist those who need them and may change behavior in significant ways.

1.2. Laws and regulations regarding mobility scooters

Regulations applied to the use of mobility scooters vary worldwide. In the process of writing this paper, the laws and regulations pertaining use of mobility scooters in North America (USA & Canada), Western Europe (UK, Germany), and Australia were examined. None of the countries listed above require driving licenses in order to drive mobility scooters. Out of the listed countries, only Queensland (Australia), and The UK require vehicle registration. In these countries, registration is required for larger mobility scooters, class 3 vehicles. Regulations regarding use vary as well. The USA, Canada, and The UK allow driving on roads sidewalks or pedestrian pathways, while Australia, Japan, and Germany allow driving only on sidewalks and pedestrian pathways. An exception is made when sidewalks are not available.

![Class-2 Mobility Scooter](image1.png) ![Class-3 Mobility Scooter](image2.png)

Fig. 1. Class 2 and Class 3 mobility scooters.
1.3. Three research perspectives derived from the growing use of mobility scooters

The remainder of this paper lays out a research agenda that is derived from the growth in the use of mobility scooters and covers the ways in which the growing use of mobility scooters may affect those who use them, the urban environments in which they live, and society at large.

1.4. Mobility scooter users

Many people perceive driving not merely as a mode of transportation but as a symbol of independence and wellbeing (Cobb and Coughlin, 2000; Davey, 2007). Driving cessation due to physical or cognitive decline can make day-to-day life difficult as well as undermine people’s independence and sense of autonomy. Older people are not the only ones affected by their loss of mobility. Family members and caregivers who care for older people are burdened by the need to transport those in their care.

Mobility scooters have the potential to change the lives of those who adopt them when struggling with retaining independent mobility. Previous research has found that the average mobility scooter users are between the ages of 75 and 81, with modest walking impairments and who live in their own homes (Gitelman et al., 2017; LaPlante and Kaye, 2010).

Topics that future research should address include:

1. Better understanding of the mobility scooter user profile – broadening the understanding of who uses mobility scooters, defining type of transportation mobility scooters are used for, and outlining who can benefit from their use and in what ways (Pettersson et al., 2014; Sullivan et al., 2014; Mortenson and Kim, 2016).

2. Understanding the effect of mobility scooter use on the wellbeing of older adults – Understanding the impact that the adoption of mobility scooters has on users. How does using a mobility scooter change older adults’ actual mobility? How does mobility scooter use affect the ways in which older adults perceive their mobility? How does adopting the use of mobility scooters affect specific populations differently? Specific populations may include divisions on the lines of gender, previous driving experience, education, and life-long disability (Thoreau, 2011; Löfqvist et al., 2012; Lukersmith et al., 2013).

3. Understanding barriers to the adoption of mobility scooters – Who are the most successful adopters of mobility scooters? What kind of people try to adopt mobility scooters but are unsuccessful? What are the best practices that can be used to promote mobility scooter adoption among populations that can potentially benefit from their use? What barriers exist to adoption, and how can these barriers be negotiated?

4. Issues related to families and caregivers – How are caregivers affected by the adoption of mobility scooters? Does the use of mobility scooters relieve or increase caregivers’ burden?

1.5. Urban environments and mobility scooters

The growing use of mobility scooters has the potential to impact urban environments in several ways (King et al., 2011; Clarke,
Mobility scooters provide users with the ability to access a broader range of destinations, possibly affecting the destinations which are frequented by users. Making moving about easier may make distance less of a factor when choosing the location in which to carry out day-to-day activities such as grocery shopping and receiving primary medical care (Blais et al., 2012; May et al., 2010). Mobility scooters require appropriate parking facilities: Once reaching a destination, mobility scooters need dedicated space in which to be parked safely.

An important aspect in regard to the urban environment is the availability and accessibility of travel routes. At present, most countries consider mobility scooter riders and drivers as pedestrians and only permit driving mobility scooters on sidewalks and pedestrian paths (not on roads). Operating mobility scooters on sidewalks and pedestrian paths raises difficulties of two types. First, pedestrian spaces may have obstacles that are difficult for mobility scooters to navigate. Pedestrians are nimble and quick, while mobility scooters are wide and not as flexible. Garbage cans, trees, and benches for example can all make moving on sidewalks difficult for mobility scooters (Gitelman et al., 2017; Thoreau, 2015; May et al., 2010). Su, Schmoker & Bell (2010) have found that mobility scooter users complain about the need to plan their travel routes before traveling to ensure route accessibility (Newton et al., 2010).

Next, when operated on sidewalks, mobility scooters compete for space with the most vulnerable users of public space, pedestrians. Sidewalks should be a safe refuge for pedestrians, a sanctuary that is threatened when mobility scooters are driven on sidewalks. The prevalence of mobility scooters in pedestrian spaces is creating a conflict among older adults who are both the majority of mobility scooter users as well as some of the most vulnerable pedestrians. Injury as a result of a collision between a pedestrian and a mobility scooter can have particularly dire implications when the pedestrian is a (sometimes frail) older adult.

Another aspect in which the growing prevalence of mobility scooters may influence urban environments is in the need to allocate parking space for mobility scooters. Parking spaces need to be located in very close proximity to users’ homes as well as in close proximity to the locations to which they travel. Optimal parking should protect the vehicles from theft and from sun and rain and should possibly have the infrastructure needed to charge the vehicle’s battery. Fig. 2 shows a mobility scooter parked on the sidewalk in a dense and crowded urban area. Lacking a better solution, the owner of this mobility scooter installed an anchor to which the mobility scooter can be chained, indicating that this is not a casual parking spot but rather the location in which the scooter is frequently parked.

With the rise in the number of mobility scooters driven on streets within cities, the transportation infrastructure needs to be modified to accommodate mobility scooters. Urban and transportation planners need to address creating accessible passageways and allocating secured parking spaces that do not interfere with pedestrian movement and safety within cities.

Topics that need to be addressed in a research agenda include:

1. Examining the relationship between the built environment and mobility scooter use. This includes understanding how different urban morphology, such as road layout and density, enables MS use or makes it difficult.
2. Creating a fuller understanding of the existing situation in cities regarding the use of sidewalks as mutual travel routes for mobility scooters, pedestrians, and other types of vehicles.
3. Furthering the understanding of the nature of obstacles to mobility scooter travel incurred by faulty design, construction, or maintenance of public space.
4. Development of best practices in planning mobility scooter travel routes in existing urban fabric. This includes developing measurements and indexes that indicate areas and locations that are favorable for mobility scooter use. Such indexes may help planners, policy makers as well as older adults make decisions regarding the location of future plans and investments.
5. Planning for connectivity with public transit and other existing travel modes needs to be examined. How would one transfer from MS to other transport mode? Can one board a train or bus with a MS? What would be the limitations for boarding with a MS? Limitations may include size and weight specifications of the MS.

1.6. Safety

Unlike other vehicles, most countries do not impose regulatory requirements on mobility scooter use, such as mandatory training, obtaining a driver’s license, and registration of the mobility scooter. Although mobility scooters are driven at low speeds, collisions, especially those involving pedestrians, can have dire results (Murphy et al., 2014; Carlsson and Lundälv, 2019). Like other vehicles, mobility scooters must be serviced to ensure safe usage. The breaking and steering systems need to be in particularly good working order. The lack of vehicle licensing and routine inspections leaves maintenance at the users’ discretion.

User safety has become a major controversial issue regarding mobility scooters with a growing number of mobility scooter-related collisions (Jancey et al., 2013). Many are self-inflicted crashes due to driving with a lack of proper training and proficiency. Some collisions can be accredit to the poor physical capabilities of some older mobility scooter drivers. Obstacles on travel paths are another source of frequent collisions that involve mobility scooters (Gitelman et al., 2017). Driving MSs posses.

Driver training and licensing remain a topic that needs to be addressed by regulation (Nitz, 2008; Mortenson et al., 2016). Training those who are transitioning from driving cars to driving mobility scooters as well as instructing first time drivers or those who have not driven for several years to drive a mobility scooter.

Topics that need to be addressed concerning safety include:
1. Developing a better understanding of who can safely drive a mobility scooter. What impairments affect one’s capability of being a safe mobility scooter driver?
2. How can training, user licensing, and vehicle inspection and registration be introduced in a way that is sustainable to existing licensing systems?
3. What regulations regarding the use of mobility scooters need to be developed, and who should enforce these regulations?
4. How would regulating mobility scooter endorse its use, receding, or expanding adoption?
5. Development of crash testing protocols for MSs that take into consideration driver as well as pedestrian safety. How can MSs be designed and built to minimize injury and damage in the event to a collision?

2. Conclusion

This paper has presented a research agenda that is warranted by the growth in the number of mobility scooters that are used, and that will be used in urban areas. The research agenda presented in this paper has the potential to benefit the community of mobility scooter users. More importantly, this agenda may have a broader impact by affecting those who do not use mobility scooters. This may be achieved by making urban environments more inclusive of specific populations, by ensuring a safe environment for pedestrians and mobility scooter drivers and by promoting paths clear of obstacles, proper mobility scooter driving training and permitting, and appropriate maintenance of the mobility scooter. Stakeholders involved include not only pedestrians and mobility scooter drivers but city administrators and planners who should take charge by providing the proper solutions pursuing appropriate research. At stake are the safety of pedestrians and mobility scooter drivers, aspects of inclusion and sustainability in cities, as well as the wellbeing and independence of older people.

CRediT authorship contribution statement

Michal Isaacson: Conceptualization, Formal analysis, Formal analysis. Dov Barkay: Formal analysis.

Declaration of competing interest

A conflict of interest may exist when an author or the author’s institution has a financial or other relationship with other people or organizations that may inappropriately influence the author’s work. A conflict can be actual or potential. At the end of the text, under a subheading ‘Disclosure Statement’, all authors must disclose any actual or potential conflict of interest including any financial, personal or other relationships with other people or organizations within three (3) years of beginning the work submitted that could inappropriately influence (bias) their work. Examples of potential conflicts of interest which should be disclosed include employment, consultancies, stock ownership, honoraria, paid expert testimony, patent applications/registrations, and grants or other funding.

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