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Pedestrian and motorised mobility scooter safety of older people

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Abstract

Objectives: Walking is older adults' second most preferred mode of transport and preferred recreational activity. This leads to greater exposure to traffic, increasing their risk of pedestrian-vehicle crashes, with older adults being more likely to die as a pedestrian when compared to other modes of transport. However, less focus has been placed on this particularly vulnerable group. This review summarises issues associated with older adult pedestrian and motorised mobility scooters (MMS) safety and interventions that have been conducted.

Methods: A literature search was undertaken from Pub Med, MUARC publications, Curtin University Library Catalogue and Google Scholar. Keywords included *older pedestrians, older adult road injury, mobility scooter injury,* and *injury prevention*. Publications from 2000 onwards were used, unless an earlier publication had significant relevance and worth.

Conclusion: Maintaining older adults' mobility and independence during a time of decreasing physical and mental capacity is a priority. Walking provides a key mode of transport that needs to be given higher priority within the road environment by policy makers, transport planners and drivers. Therefore governments need to consider appropriate and comprehensive urban planning and road safety policies that accommodate 'active ageing' to provide pedestrians and MMS users with environments that facilitate active living and safe transport. In addition there is a need for

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community programs that raise awareness about safe road crossing for this growing vulnerable age group.

Keywords

older adults; active transport; pedestrians; motorised mobility scooters; road safety

INTRODUCTION

The proportion of elderly adults is growing faster than any other age group (Department of Economic and Social Affairs. Population Division 2006). Walking represents an important activity for the older population, increasing their independence and quality of life. It is also this group's second most preferred mode of transport (Council on the Aging 2004) and their preferred recreational activity (Australian Bureau of Statistics 2011). As more older adults are exposed to traffic as pedestrians, their risk of pedestrian-vehicle collisions rises (Australian Transport Safety Bureau 2002).

Worldwide, approximately 1.3 million people die each year in road traffic crashes, and another 20-50 million are seriously injured (Peden et al. 2004; National Highway Traffic Safety Administration 2010; Fisher et al. 2010). Older adults are more likely to die as a pedestrian than in other modes of transportation (Sleet et al. 2010; Austroads 2001). For example, nearly half of all pedestrian deaths in OECD countries involve older adults (Martin, Grabo, et al. 2010). In the US in 2009, 19% of all pedestrian deaths and 8% of all pedestrian injuries were to those age 65 and older. In the Netherlands, 50% of pedestrians killed were age 65 and older (Fisher et al. 2010) (9). In Ireland, older adults represent 15% of the Irish population but accounted for 19% of the pedestrian road collisions and 36% of adult pedestrian road deaths (Martin, Hand, et al. 2010). And in Australia, those aged 65 and older represent less than 12% of the population, but account for 20 and 40% of pedestrian deaths on the roads (Office of Road Safety 2010; Rouse 2002). With an estimated cost of approximately $2 million per fatal crash and $500,000 per serious injury crash, safe mobility for the aged population should be an urgent priority (Meuleners, Hendrie, and Lee 2011) for all countries. Some older people who cannot walk prefer to remain active in the community, and gravitate to the use of motorized mobility scooters on footpaths to shop, visit friends, and actively engage in their community.

Motorized Mobility Scooters

In addition to walking, the ageing populations' desire for independence has led to an increase in demand for motorised mobility scooters (MMSs) in Western countries (Gibson et al. 2011).

Motorised devices are for use by people who are unable to walk or have difficulty in walking. These devices and include mobility scooters and electric wheelchairs. Under the Australian Road Safety Act (1986) these devices are not defined as motor vehicles and therefore cannot be registered and must have a have a maximum speed of 10km/h on level ground and a maximum mass of 110kg (see Figure 1). They are to be used only by people with an injury, disability or medical condition, which means they are unable to walk or have difficulty walking. People using MMSs devices or manual wheelchairs are considered pedestrians, and therefore must obey the same road rules as pedestrians. These devices must be manufactured such that their operation does not put other road users at risk, and therefore pedestrians and MMS users must often share the road.

In 2008 in the US, the national registry for MMS reported that MMS were used by more than 291,000 Americans. In Canada provincial subsidies for MMS increased by 340% between 1995-2001 (Auger et al. 2008), along with an increase in MMS-related injuries. In Australia between 2006 and 2008 there were 442 injury hospitalisations related to MMS use. Between 2000 and 2010, there were 62 MSS deaths (Gibson et al. 2011).The largest proportion of deaths occurred in those aged over 80, mostly as a result of crashes with motor vehicles. In the state of Victoria (Australia), emergency department presentations for injury related to MMS has increased by over 255% in the last decade (Gibson et al. 2011).

The increasing number of injuries is thought to be underestimated due to inconsistent coding of hospital data (Gibson et al. 2011). Adding to the problem of inadequate MMS injury surveillance, registration of scooters is not required in many countries, including Australia, and anyone with the financial means can purchase and use and MMS without any actual training or education (Brownsdon and Marcar 2002).

Research related to both older adult pedestrian injuries and older adult MMS –related injuries is lacking, as is evidence associated with intervention programs designed to prevent injuries to older pedestrians and MMS users (Evans et al. 2007).

This paper reviews the issues associated with older adult pedestrian and MMS safety and the potential for relevant interventions. Recommendations for improving the safety of older adults as pedestrians and MMS users’ discussed.

METHODS

A literature search was undertaken from Pub Med, MUARC publications, Curtin University Library Catalogue and Google Scholar. Keywords included *older pedestrians, older adult road injury, mobility scooter injury,* and *injury prevention*. Publications from 2000 onwards were used, unless an earlier publication had significant relevance and worth. Research papers from scientific journals, review papers, government and agency reports and websites of reputable organisations were incorporated. Due to the limited data available in this area and the lack of randomised control trials, a systematic review was not conducted.

RISK FACTORS FOR OLDER PEDESTRIANS AND MMS USERS

Physical factors

As people age they experience significant sensory impairments that include deteriorating visual acuity and reduced field of vision; a reduction in depth and motion perception; and a loss of hearing, all of which may contribute to older pedestrian /MMS users risk of injury. In addition there is cognitive degeneration resulting in a reduction in the speed of information processing, problem solving and the ability to make appropriate decisions (Council on the Aging 2004; Oxley, Charlton, and Fildes 2005; Oxley and Fildes 1999). There is a loss of bone and muscle mass reducing strength, flexibility, balance and the ability to twist and turn, along with a reduction in walking speed. Aging is often accompanied by chronic medical conditions such as arthritis, osteoporosis, osteoarthritis, macular degeneration and glaucoma (Oxley and Fildes 1999), conditions that further compromise older pedestrians' ability to detect hazards and execute the necessary actions, such as crossing the road safely. The higher prevalence of chronic health conditions means older adults are more likely to use medications (Oxley et al. 2004; Gibson et al. 2009) that may impair central nervous system functioning and impact their decision-making in interacting with the road environment (Oxley et al. 2004; Cooper et al. 2011; Meuleners et al. 2011). These factors affect the ability of older pedestrians/MMS users' to judge the distance and speed of approaching traffic; all of which makes crossing the road more difficult and dangerous (Council on the Aging 2004; Oxley, Charlton, and Fildes 2005; Oxley and Fildes 1999).

Behavioural factors

As people age, driving is often reduced and public transport and walking are used more frequently, increasing their exposure on the roads as pedestrians (Rouse 2002). When using the road system, older pedestrians often become overly cautious; possibly as a result of their reduced physical and cognitive skills (Oxley, Charlton, and Fildes 2005). Older pedestrians prefer to cross at signalised intersections and use crosswalks and footpaths (Bernhoft and Carstensen 2008). However, due to the ageing process they may not allow an adequate safety margin when crossing in front of oncoming traffic (Bernhoft and Carstensen 2008; Oxley, Charlton, and Fildes 2005). Also their reduced mobility and poor health may at times prompt them to take the shortest and possibly the least safe route (Bernhoft and Carstensen 2008). On the other hand, some may not fully recognise their diminishing skills and fail to compensate adequately, particularly when traffic demands are complex (Oxley, Charlton, and Fildes 2005). It is also reported that older pedestrians may have a false sense of security, based on their assumptions that drivers will stop for them (Koepsell et al. 2002; Retting, Ferguson, and McCartt 2003). Research has reported that a significant proportion of drivers are not aware they must give way to pedestrians (Hatfield et al. 2007; Cassell et al. 2010).

Environmental factors

Older pedestrians/MMS users are most at risk of being injured in urban built-up areas due to the large amount of vehicle activity (Zegeer and Bushell 2012; Naumann et al. 2011). Crashes involving pedestrians often occur when crossing the street and often involve vehicles turning at intersections (Hatfield et al. 2007) and marked crosswalks (Koepsell et al. 2002). Risks associated with walking and MMS use include: access to appropriate pedestrian facilities, slower crossing speed, poor upkeep of footpaths, vehicle speed (Constant and Lagarde 2010) and complexity of the road environment (Dumbaugh 2008). A lack of wide, walkable areas; and absence of footpaths are associated with a higher likelihood of pedestrian crashes (Zegeer and Bushell 2012; McMahon et al. 2002). Almost 25% of older pedestrians injured in falls in the road environment report curb involvement (Naumann et al. 2011). In addition the length of time for signalised crossing can also be a factor associated with pedestrian injury, with some older pedestrians reporting an inability to complete road crossing in the time given by the pedestrian lights (Romero-Ortuno et al. 2010).

Challenges of sharing the footpath

MMS and pedestrians sharing the footpath come with additional challenges and risks. The ability to operate an MMS safely, the recognition by pedestrians that MMS users have a legitimate plane on the footpath, negotiating right-of-way, sudden reactions to road hazards such as potholes or absence of ramps, traffic signs and signals, and reactions from merchants can be potential barriers to safe mobility for older people using MMS. Moreover, even where there are safe pedestrian crossings or median refuges available to MMS users, they are sometimes of insufficiently width to accommodate the MMS (Gibson et al. 2011).

INTERVENTIONS

Older adult community interventions

Globally there are limited interventions aimed at stemming the high rate of pedestrian crashes involving elderly adults (Department of Infrastructure Transport Regional Development and Local Government 2009) and fewer documented program evaluations. Most pedestrian safety programs have focussed on children (Cross et al. 2000; Stevenson et al. 1999), with no evaluated programs for MMS users found.

Recent US community-based interventions aimed at elderly adults include *Walk Wise Drive Smart* and *Safe Streets for Seniors*. *Walk Wise Drive Smart* combined education, encouragement, enforcement and environmental activities to create a safer and more inviting walking community and to promote policy change (Hunter and Hunter 2008). *Safe Streets for Seniors* focused on environmental safety concerns identified by elderly pedestrians (Pedestrain Bicycle and Information Center 2011). No formal evaluations for either of these programs have been published. Recently in Australia, VicRoads collaborated with local government on *Walk with Care* an intervention using education and engineering countermeasures to address road dangers. The program content and delivery was reviewed but not the countermeasures (Kent and Fildes 1997; Oxley et al. 2004), with recommendations supporting a local government focus and a need to raise community awareness of elderly pedestrian safety issues. In Western Australia a pilot intervention, *Stepping Out Safely Project (SOSP)* was conducted in local government areas, using local media and established seniors' groups. This program was evaluated and reported an increase in knowledge on various aspects of road crossing behaviours as well as the adoption of safe road crossing behaviours (Iredell et al. 2003), supporting the direction of larger scale research in this area.

MMS interventions

Some local governments have begun providing scooter training days but this is without any evaluation or evidence-based program use (Brownsdon and Marcar 2002). In Canberra the COTA *Scooter Safe program* included training materials and Scooter User Guide (Council on the Aging and Able Access 2002) but there was no formal evaluation of the program (Brownsdon and Marcar 2002). Other MMS educational material reported in the literature was limited to brochures and users guides (Evans et al. 2007).

Framework for Pedestrian Safety

The Framework for pedestrian/MMS user safety, summarised in Table 1 was developed from the comprehensive literature review. Any framework for the prevention of pedestrian injury and MMS users must consider the multiple target groups (pedestrian/MMS users, drivers, policy makers, planners and driving instructors), along with the concurrent implementation of appropriate education (Oxley and Fildes 1999; Retting, Ferguson, and McCartt 2003; Cross et al. 2000; Stevenson et al. 1999; Howat et al. 2004; Ulfarsson, Kim, and Booth 2010; Howat et al. 1997) (Zegeer and Bushell 2012), enforcement of traffic safety laws, and modifications to the built environment (Howat et al. 2004; Schuurman et al. 2009) so as to support safer road user behaviour (Anowar, Yasmin, and Tay 2010; Martin 2006). There has been no attempt here to grade the quality of evidence of effectiveness for these interventions/ actions (See Table 1).

Education

Pedestrian/MMS—Education is useful for raising community awareness and knowledge, supporting behaviour change and improving safety skills (Redmon 2011). It can be used to increase road safety knowledge; making drivers and pedestrians/MMS users aware of their unsafe road safety practices; promote desirable attitudes towards walking as a legitimate form of transport; teach strategies to minimise injury risk; and increase awareness of other road users (Martin 2006). Research suggests that education targeting both drivers and pedestrians/MMS users is needed to address confusion regarding rules and responsibilities associated with pedestrian crossings (both marked and unmarked) (Hatfield et al. 2007). Inadequate knowledge on the part of both drivers and pedestrians, in regards to traffic rules has been identified as a possible association for vehicle-pedestrian crashes (Rouse 2002; Hatfield et al. 2007; Martinez and Porter 2004). Education campaigns need to remind drivers that turning vehicles must give way to pedestrians, regardless of whether it is a controlled crossing or not. Pedestrians should be made aware that they do not have right of way at a zebra crossing and should not assume that traffic will stop (Hatfield et al. 2007).

The development of training programs aimed specifically at older pedestrians/MMS users could raise awareness of their declining physical and cognitive abilities and adoption of safer road crossing practice (Oxley, Charlton, and Fildes 2005). Australia has an excellent reputation for its school-age pedestrian safety programs which could serve as an example for other age groups (Zegeer and Bushell 2012; Cross et al. 2000; Stevenson et al. 1999; School Drug Education and Road Aware 2009). The whole-school approach to road safety education, where schools, communities and parents work together, is the most effective approach to reducing road-related harms. These partnerships create a supportive environment to learn, understand and practise road safety (School Drug Education and Road Aware 2009) serving as a model for other age groups.

Planners, officials and other professionals—Training and education of road safety managers is needed (Martin, Hand, et al. 2010) to better understand the human dynamics of older adult crossing behaviour, as well as the limitations in the environment that are barriers to older adults crossing safely (Zegeer et al. 2006). Road infrastructure designers, urban planners, government officials and others involved in pedestrian safety planning must have a clear understanding of how new and existing facilities operate and how older pedestrians will act within given circumstances. Important characteristics for consideration include understanding why and where older pedestrians walk and MMS users ride; what types of appropriate environmental features create a safer environment; what types of decision-making behaviours are likely to occur and whether or not immobility issues need to be addressed (Zegeer et al. 2006).

Enforcement—Enforcement of traffic laws targeting both drivers and pedestrians/MMS users can be effective in reducing the severity and frequency of pedestrian/MMS crashes (Oxley, Fildes, and Dewar 2004). Police enforcement is an integral part of a strategic approach to reduce pedestrian / MMS injury (Zegeer and Bushell 2012), yet legislation often focuses on the needs of vehicles rather than those of pedestrians / MMS users (Oxley, Fildes, and Dewar 2004). Law enforcement officers also need to be provided with training regarding traffic laws that affect pedestrian / MMS safety. Training should include information on what, when, where and how law enforcement should occur to maximise behaviour change and to reduce the number of crashes involving pedestrians / MMS users. The provision of warnings to pedestrian for offences, such as jaywalking or crosswalk violations should also be considered (Anowar, Yasmin, and Tay 2010; Oxley, Fildes, and Dewar 2004).

Environment

Speed reduction—The severity of pedestrian / MMS users crash injury depends largely on the collision speed of the vehicle and a small reduction in speed can lead to valuable gains in preventing severe road trauma (Oxley, Diamantopoulou, and Corben 2001). When struck by a vehicle at 45 km/hr, less than 50% of pedestrians survive, however, at 30 km/hr, more than 90% survive (Constant and Lagarde 2010). In Australia, all jurisdictions have introduced 50km/hr speeds in residential areas and 40km/hr speeds within school zones (Oxley 2005). Many European countries have also adopted speed limits of 50km/hr or lower within urban areas, with some high pedestrian areas of London having speed limits of 20 mph (~32km/hr) (Martin 2006). These London zones are associated with a 42% reduction in road injury (Steinbach et al. 2010; Grundy et al. 2009). In Baden, Austria, almost 75% of the road network has a speed limit of 30km/hr and this has purportedly resulted in a 60% reduction in road casualties (Breen 2002). Traffic calming devices such as roundabouts, refuge islands, speed humps, chicanes and rumble strips reduce speed, giving drivers more time to become aware of pedestrians and pedestrian’s time to respond (Martin 2006; Oxley, Fildes, and Dewar 2004). Photo enforcement of vehicle speeds is purported to be one of the most cost-effective measures to reduce pedestrian injury (Constant and Lagarde 2010).

Pedestrian-vehicle separation—Guard rails and barrier fencing can prevent mid-block crossings and shepherd pedestrians / MMS users to access only formal crossing points (Oxley, Fildes, and Dewar 2004), however, research is inconsistent as to whether guard railings reduce pedestrian/MMS and vehicle collision risk (Retting, Ferguson, and McCartt 2003; Martin 2006; Zheng and Hall 2003). Garden bed barriers or raised planter boxes may be more appropriate as pedestrian-vehicle separators and less overt in their redirection of pedestrians/MMS users. Overpasses and underpasses substantially reduce the potential for conflict associated with pedestrian crashes (Retting, Ferguson, and McCartt 2003; Zegeer and Bushell 2012).

Median or crossing refuge islands are useful, especially for those who walk at a slow speed. They simplify the task of crossing, reduce exposure time on the road and provide the pedestrian with a safe section in which to rest, enabling a two-stage crossing with attention only focused in one direction (Zegeer and Bushell 2012; Retting, Ferguson, and McCartt 2003). Roads with raised medians significantly lower pedestrian crash rates, particularly on multi-lane roads (Zegeer et al. 2001), however, painted medians, or those that are not raised, do not offer significant safety benefits (Zegeer et al. 2001; Martin 2006).

Crossings and crosswalks—Uncontrolled crossings such as painted crosswalks on roads are a low cost option compared with signal-controlled crossings (Martin 2006) but the literature is conflicting as to whether no signal crosswalks increase or decrease pedestrian safety (Koepsell et al. 2002; Zegeer et al. 2001). No signal crosswalks on multi-lane, high density traffic roads are often associated with an increase in pedestrian crash rates (Zegeer et al. 2001; Retting, Ferguson, and McCartt 2003).

Controlled crossings with traffic signals are reported to substantially reduce pedestrian-vehicle conflicts, especially at intersections with exclusive traffic signals (which stop all vehicle traffic for pedestrian crossing) (Retting, Ferguson, and McCartt 2003). Signalised pedestrian crossings are commonly regarded as safe but many older pedestrian crashes occur at these sites (Oxley, Fildes, and Dewar 2004), due to the short time of the walk phase in the walk-don't walk signal (Romero-Ortuno et al. 2010).

Increasing the walk phase at intersections or increasing Pedestrian User-Friendly Intelligent (PUFIN) crossings can be a beneficial road safety device. At an intersection the PUFIN detects the presence of pedestrians on the kerb and uses pedestrian detection on the crossing to vary the length of time of the walk phase (Parliament of New South Wales 2009), benefiting slower moving pedestrians. Countdown timers at crossing can also be useful, displaying the amount of time pedestrians / MMS users have to wait until the next walk phase and/or the amount of time left to safely cross the road (Parliament of New South Wales 2009). Additionally, auditory signals at crossings are designed primarily for people who are sight impaired but could also prove to be beneficial for all pedestrians / MMS users (Oxley, Fildes, and Dewar 2004).

Lighting—Increasing roadway lighting at pedestrian crossings is associated with reductions in night time pedestrian crashes (Retting, Ferguson, and McCartt 2003). Enhanced overhead lighting at marked crosswalks is also recommended to improve the safety of pedestrians crossing at night or times of low light (Zegeer et al. 2001). Pedestrians can be more visible to drivers in low light by carrying torch lights or wearing retro-reflective clothing/material (Cassell et al. 2010; Zegeer and Bushell 2012). Pedestrian visibility could also be improved at crossings by restricting cars parked close by, as parked vehicles are known to obstruct the view of pedestrians for drivers (Retting, Ferguson, and McCartt 2003; Breen 2002).

Pathways and sidewalks—The widening of footpaths and kerb extensions can reduce the risk of pedestrian / MMS crashes, particularly in residential areas (Retting, Ferguson, and McCartt 2003). Well designed, wide footpaths with no overhanging vegetation or parked cars and kerb ramps are recommended with particular attention near public transport stops and stations (Zegeer and Bushell 2012). Kerb ramps assist those in MMS and those with physical impairments, while tactile surfaces at the change of elevation assist those with visual impairments (Zegeer and Bushell 2012).

CONCLUSION

Maintaining independence through maintaining mobility is a key goal for older adults. Walking provides a mode of transport that needs to be given higher priority within the road environment by policy makers, transport planners and drivers. Therefore governments need to consider appropriate urban planning and road safety policies that accommodate ‘active ageing’, so as to provide pedestrians and MMS users with environments that facilitate active living and safe transport.

Designing neighborhoods that facilitate increased community interaction, and opportunities for greater physical activity is the goal of many urban re-design projects (New York City 2012). However less focus has been placed on older adults, who may be particularly vulnerable to injury (King et al. 2011). Older adults living in more walkable neighbourhoods have more mobility, more moderate-to-vigorous physical activity levels, and lower body mass index, relative to those living in less walkable neighbourhoods (Parliament of New South Wales 2009), and these environments can be designed to also reduce injuries.

Neighbourhood design can influence mobility, independence, safety and social connectedness. The World Health Organization is preparing a global pedestrian safety manual in 2013, to help address the problem of pedestrian injuries and the influence of urban design for planners, decisions makers, and public health workers (World Health Organization In press). Certainly, society ought to help older adults maintain greater independence through design and evaluation of safer and more affordable transportation options.

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Figure 1:
Examples of MMS on pedestrian paths

Table 1:

A framework for pedestrian and MMS safety**

	Pedestrians	**MMS users**	**Drivers**	**Policy/Law Makers**	**Urban Planners & Roadway Designers**	**Schools (K-12)**	**Learner Driver Instructors**
Education & Behavioural Strategies							
Prioritise pedestrians/ MMS users on the transport hierarchy – cultural shift	✓	✓	✓	✓	✓	✓	✓
Legitimate walking as an active form of transport in a sustainable society	✓		✓	✓	✓	✓	✓
Raise awareness of pedestrian/ MMS users right of way traffic laws	✓	✓	✓	✓	✓	✓	✓
Raise awareness that small increments of vehicle speed increase the severity of pedestrian/ MMS users crash injury (particularly older pedestrians)	✓	✓	✓	✓	✓	✓	✓
Raise awareness that older pedestrians may have reduced cognitive & physical ability to negotiate road systems	✓	✓	✓	✓	✓		✓
Raise awareness of the importance of pedestrian visibility and conspicuity	✓	✓	✓	✓	✓	✓	✓
Increase knowledge of the risk & protective factors for pedestrian/ MMS users injury	✓	✓	✓	✓	✓	✓	✓
Increase knowledge of what exactly is considered a crossing (marked & unmarked)	✓	✓	✓	✓	✓		✓
Conduct comprehensive social marketing campaign to raise awareness, increase knowledge and change attitudes, priorities pedestrians/ MMS users.				✓			?
Target group and key stakeholder community consultation	✓	✓		✓			✓
Targeted information sessions within older adult community	✓	✓		✓			✓
Use simulator to demonstrate reduced ability to assess safe distance/time gaps when crossing roads	✓	✓					
Increase road rules and responsibility knowledge and skills of mobility scooter users.			✓				✓
Increase stakeholders knowledge of environmental modifications to reduce pedestrian injury				✓	✓		
Environmental Strategies							
Conduct walkability audits in areas of high pedestrian activity				✓	✓		
Conduct safe route audits in areas of high pedestrian/ MMS activity				✓	✓		
Reduce travel speed in high density pedestrian/ MMS areas*				✓	✓		
Reduce traffic in high density pedestrian areas*				✓	✓		
Develop guidelines for adequate crossing times for older pedestrians*				✓	✓		
Improve maintenance of sidewalks, surrounds, and street lighting*				✓	✓		

	Pedestrians	MMS users	Drivers	Policy/Law Makers	Urban Planners & Roadway Designers	Schools (K-12)	Learner Driver Instructors
Develop safer access for older people at bus and tram stops *				✓	✓		
Improve public transportation access for older people *				✓	✓		
Provision of pedestrian-friendly enforcement of pedestrian traffic laws such as warnings and/or education cards for violations such as jaywalking.				✓			✓
Provision of access to a maintenance service for MMS, perhaps by local government contracts.				✓			✓
Development of MMS registration system				✓			✓

* Oxley &Fildes (2004) p.187

** There has been no attempt here to grade the quality of evidence of effectiveness for these interventions/actions.