Health and safety concerns around the increasing use of mobility scooters on New Zealand roads

Purpose: The Research and Guidelines Steering Group of the Road Controlling Authorities Forum has sought to establish an appropriate public policy response to mobility scooters.

Method: A literature review was undertaken to identify whether these resources tended to support development of local classification, regulation or standards related to mobility scooters.

Results: Mobility Scooters are becoming increasingly common in New Zealand as a popular personal mobility choice. There is a need to balance the benefits to the elderly and disabled from improved mobility against the need to ensure that these groups, whether as mobility device users or pedestrians, are not put at greater risk. Significant safety issues affect mobility scooters and evidence suggests that serious health concerns from increased use of mobility scooters by individuals should also be considered. The weight of international experience suggests mobility scooters should be classified and regulated as a special class of motor vehicle and their use should be on the recommendation and assessment of a health professional.

Conclusion: Significant health and safety issues attach to mobility scooters and a coordinated and consistent approach to ensure provision of safer infrastructure, safer mobility devices and safer device operators appears to be justified.

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RCA Forum Research and Guidelines Steering Group report, 2015

Health and safety concerns around the increasing use of mobility scooters on New Zealand roads

Introduction

Mobility Scooters are becoming an increasingly common sight on many suburban streets, especially in provincial centres. Improved designs and greater acceptance, or a decrease in a perception of mobility scooters as being for only the physically impaired, have seen these devices become an increasingly popular personal mobility choice.

Although there is a wide variation in regulatory approaches to motorised mobility devices in different jurisdictions, increasing recognition has been given to the need to balance the benefits to the elderly and disabled from improved mobility against the need to ensure that these groups, whether as mobility device users or as pedestrians, are not put at greater risk.

Significant safety issues can attach to mobility scooters used by elderly or disabled operators. These devices tend to be substantially heavier and faster than most pedestrians, and can be beyond the fitness or competence of some elderly or disabled operators to control effectively. Operators of mobility scooters appear to be at significantly greater risk of being in an accident, and of being seriously or fatally injured in accidents, than other groups using the road corridor.

There is also evidence to suggest that serious health concerns exist around increased use of mobility devices. Younger persons and those who have no disability are increasingly using mobility scooters for personal transport. Their adoption by individuals who could otherwise walk is likely to produce substantial personal and public health costs.

This paper presents a summary of recent research done in Australia and the United Kingdom as well as relevant research from several countries with similar demographic trends and socio-economic patterns to New Zealand.

Recent overseas research

From February to June 2012, the Australian Competition and Consumer Commission (ACCC), NRMA Motoring & Services (NRMA), CHOICE, EnableNSW, Flinders University and a number of other stakeholders worked together on Australia's first national survey of mobility scooter users.[1] The survey was designed to provide a better understanding of the demographics of mobility scooter users, and patterns of use, amongst the Australian population.

[1] Mobility scooter usage and safety survey report, September 2012

The survey included 515 current users of mobility scooters who volunteered to complete an extended survey. The survey confounded planning assumptions that the majority of mobility scooter users are elderly. The responses indicated that 51 per cent of mobility scooter users were aged less than 60 years. It also highlighted the value that the scooter represents for users. Mobility scooters are regarded as a lifeline to independence and emotional well-being. The ACCC study noted that scooter users use a scooter to 'replace' their legs when they are no longer able to walk long distances. The study concluded that, for this reason, it is imperative to find a way to ensure it is safer and easier for road users to incorporate mobility scooters into the transport mix.

In the United Kingdom a 480-person national survey by the Research Institute for Consumer Affairs (RICA) in early 2014 to investigate the profile and experiences of mobility scooter users had similar findings:

- 53% of respondents were under 65 years old, indicating that scooter users include many younger people.
- 48% of respondents owned a wheelchair as well as a mobility scooter and 27% owned more than one type of mobility scooter.
- 74% said they would not make the same journeys if they could not use their scooter.[2]

A 2010 Michigan, USA, study of 107 reported incidents involving mobility scooters and other vehicles on the road found that the average age of the mobility scooter operator was 56 years.[3]

Similar trends affect NZ

New Zealand is facing broadly similar demographic trends to those faced by the similar societies in Australia, North America and Europe. The population is aging and a large segment of the current population is moving towards being over 65. As a broad generalisation, mobility-related disability affects about one third of persons aged over 65. Nevertheless, high personal mobility and personal independence are seen as being particularly important for this age group.

At the time of the 2006 Census there were 496,612 people aged 65 and older in New Zealand, compared to 461,000 in 2001. Population ageing is expected to continue in all of the projections calculated by Statistics New Zealand. This means that people aged 65 and over will constitute a higher proportion of the population in the future, growing from just over 12 per cent in 2006 to 25 per cent in 2039.

At the same time there is a trend away from private car ownership among urban youth, with increasing interest in alternative personal mobility solutions. Personal mobility and independence are also particularly important for younger persons with injuries or disabilities, and obesity-related mobility

[2] Mobility scooters: a market study, May 2014

[3] LaBan and Nabity, 2010, Traffic collisions between electric mobility devices (wheelchairs) and motor vehicles: Accidents, hubris, or self-destructive behaviour

impairment is also an increasing issue. For all of these reasons, there has been increasing interest in motorised personal mobility devices.

This interest has been perceived to be stronger in provincial towns, possibly as a result of relatively less access to public transport or possibly simply symptomatic of the aging of many rural centres in the face of the agglomeration of economic activity in fewer and larger urban centres. The image of the elderly mobility scooter user is more frequently encountered in the smaller provincial centres.

The ACCC survey also found the incidence of mobility scooter use is higher in regional, rural and more remote areas than in capital cities, with 50 per cent of mobility scooter users living outside of the six capital cities. It calculated the incidence of mobility scooter use for Australians aged 18 years and over is 13 per 1,000 adults, equating to around 231,000 mobility scooter users nationally.

The RICA study estimated the total number of UK users at approximately 300,000 to 350,000 and noted that all data and consultation confirmed high levels of annual sales growth of 5 to 10 per cent per annum. The study saw evidence of increased advertising and a widening range of retail options. These include specialist and mainstream shops, charity trading arms, second-hand sales, catalogue-retail and, growing rapidly, on-line retailers.

Decisions to use a mobility scooter

For nine in ten users surveyed in the Australian study, reduced walking ability or physical mobility was the key trigger for taking up use of a motorised mobility scooter. This may have been either a gradual loss of walking mobility, due to ageing or chronic illness, or an acute loss, due to injury or surgery.

Other forms of physical impairment, such as difficulty carrying weight (37 per cent) or vision impairment (4 per cent) were found to be much less likely to be the trigger. Loss of drivers' licence was also found to be a trigger of low incidence, with only 13 per cent indicating this event prompted them to take up use of a scooter. A number of reasons might account for this:

- There can be a time lapse between the two events.
- Some users make concurrent use of both transport modes.
- Potentially, large numbers of users have never been licensed.[4]

The decision to start using a motorised mobility scooter was not typically a result of recommendation by a medical professional: only one in four users reported taking up usage following such a recommendation. A survey of 149 adult mobility scooter users in Sydney in 2010 similarly found that only 33 per cent consulted a health professional prior to purchasing their device.[5]

Scooter usage is in most cases a matter of personal choice. The New Zealand experience is likely to be similar to that found in Australia, where the

[4] Estimated in an earlier study at 15% of users in British Canada: Steyn and Chan, 2008

[5] Edwards and McCluskey, 2010, A survey of adult power wheelchair and scooter users

decision to start using a motorised mobility scooter is not typically made on a recommendation by a medical professional. A scooter is a mobility device to enable people to travel further than they choose to on foot and is used by those who are physically able to walk, albeit slowly. In choosing not to walk, however, often without professional advice or assessment, mobility scooter users may be taking a decision that has significant implications for their health and longevity, and future public health costs.

Mobility scooter usage has been shown to be a 'replacement' for the users' legs and walking, and other forms of physical activity. If this is the case, using a mobility scooter may hasten physical and functional decline. While scooter use increases participation in social activities outside the home that previously users would have been unable to access, leading to increased quality of life and wellbeing in users, scooter users may risk reducing their mobile capability at a greater rate than if they had continued to travel without a scooter.

Health risks from motorised mobility

The relative risk of all-cause mortality due to inactivity has been calculated as 55 per cent.[6] A mobility scooter provides inactive or sedentary mobility, and the effect of the reduction in activity needs to be considered.

Annual morbidity and mortality costs in New Zealand attributable to inactivity were calculated in 2007 at $2,488 to $3,270 per person.[7] The health sector (public and private) costs per inactive adult were calculated at $624 to $1,147 per person. The mean annual benefit per capita of walking was calculated in that study at $1,954 or $4.27 per km, equivalent to $2,250 or $4.92 per km in 2015 after adjusting for inflation.

There is compelling evidence to support the health benefits of physical activity, especially for older adults. Walking, the most common form of physical activity, especially for older adults, can make a great difference to overall health.[8]

An established body of research demonstrates that physical activity reduces the risk of numerous chronic conditions. Specific evidence exists for the protective effect of active transport engagement on cardiovascular disease, certain cancers, and obesity, all of which are serious health concerns in New Zealand.

The effect of inactivity can be described in terms of the relative risk reduction from activity, or the burden in New Zealand in terms of disability-adjusted life years lost (DALYL) by inactivity. For cardiovascular disease the relative risk

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[6] Andersen et al., 2000, All-cause mortality associated with physical activity during leisure time, work, sports, and cycling to work; Bijnen et al., 1999, Baseline and previous physical activity in relation to mortality in elderly men: The Zutphen elderly study; Erikssen et al., 1998, Changes in physical fitness and changes in mortality

[7] Genter et al., 2008, Valuing the health benefits of active transport modes

[8] Manson et al., 1992, A prospective study of exercise and the incidence of diabetes among US male physicians

reduction of activity is estimated at 20 to 35 per cent and the DALYL burden of inactivity is estimated at 24 per cent.[9]

For cancer of the colon the relative risk reduction of activity is estimated at 30 to 40 per cent and the DALYL burden of inactivity is estimated at 3.2 per cent. For breast cancer the relative risk reduction of activity is estimated at 20 to 30 per cent and the DALYL burden of inactivity is estimated at 2.4 per cent. For lung cancer the relative risk reduction of activity is estimated at 10 to 20 per cent and the DALYL burden of inactivity is estimated at 2.9 per cent.[10]

For depression the relative risk reduction of activity is estimated at 22 per cent and the DALYL burden of inactivity is estimated at 3.6 per cent (for all mental illnesses).[11] For diabetes the relative risk reduction of activity is estimated at 33 to 50 per cent and the DALYL burden of inactivity is estimated at 5 per cent (for all endocrine conditions).[12]

Effect of mobility scooter use on user's fitness

A recent study of current scooter usage sought to address whether mobility scooter use leads to increased decline in strength and mobility function, and increased levels of frailty.[13] The study used an existing longitudinal study of older persons in England, the English Longitudinal Study of Ageing (ELSA). ELSA explores quality of life, health, social interactions, household makeup and financial security. Waves one (W1) to wave four (W4) of the study surveyed the sample every two years between 2002 and 2009.

The study chose to look at those in the database aged 65 or above, reflecting the misassumptions about mobility scooter use revealed by the ACCC and RICA studies. Participants who were completely unable to walk were removed from the dataset and only those who participated in all waves were included in the subset analyses.[14] Physical differences between scooter users, cane users and unaided mobile older adults were analysed by Body Mass Index (BMI), chair rises, walking ability, lung function and grip strength.

The ELSA walking test was designed to measure a participant's normal gait. In this test participants were timed to walk a distance of 2.44 meters (eight feet). Scooter users were found to have the slowest gait of the groups in all waves. Crucially, the number of scooter users and cane users who were able to complete the walking test was low in both waves: only 60 per cent of scooter users were able to walk 2.44 metres in wave one and this had

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[9] Macera et al., 2003, Major public health benefits of physical activity

[10] Lee, 2003, Physical activity and cancer prevention: Data from epidemiologic studies

[11] Dunn et al. 2001, Physical activity dose-response effects on outcomes of depression and anxiety

[12] Lynch et al., 1996, Moderately intense physical activities and high levels of cardiorespiratory fitness reduce the incidence of non-insulin- dependent diabetes mellitus in middle-aged men

[13] Thoreau, 2011, Personal mobility scooters: Health differences between mobility scooter users and the unaided pedestrian

[14] Scooter users (n=20); Cane users (n=374); Other mobility device users (n=10); no device users (n=1720)

reduced to 45 per cent by wave four. The completed scores masked a larger decline by scooter users in ability to carry out the test. Additionally, the study noted that whilst by wave four less than half the scooter users were able to complete a short gait test, only one scooter user had a health condition that prevented walking. The test results are summarised in Table 1.

Table 1: Time taken to complete walking test in seconds in waves 1 and 4[15]

	Wave 1	**Wave 4**
Scooter user	6.02	6.74
Cane user	4.40	5.80
No mobility aid	2.92	3.52

A chair-rise test measures the length of time it takes an individual to stand up from a chair without the aid of their arms, an aid or the support of someone else. All groups were found to be slower to complete the chair rise task over time. Scooter users took significantly longer than the other two groups: 28 per cent longer in wave four than in wave two to complete five chair rises. Cane users took 3 per cent less time in wave four than wave two and those using no mobility aids took 5 per cent longer.

Scooter users were found to be significantly less likely to be able to complete a single unassisted chair rise than either cane users or those with no mobility aids. The results of the chair-rise tests are summarised in Table 2.

The percentage that was unable to complete the full test increased in all groups over time, but the change in percentage of any user group unable to complete the test was found to be greatest in scooter users. A total of 10 per cent of scooter users were unable to complete in wave four who were able to complete in wave two, higher than the additional 7 per cent of cane users and 4 per cent of no mobility aid users. This was interpreted as indicating that scooter users face steeper declines in capability over time than those remaining more active.

Table 2: Percentage of users unable to complete single and multiple chair rises[16]

	Percentage unable to complete a single chair rise		**Percentage unable to complete 5 rises**	
	Wave 2	**Wave 4**	**Wave 2**	**Wave 4**
Scooter user	60	80	70	80
Cane user	38	52	51	58
No aid	8	18	17	21

Body Mass Index (BMI) was measured during waves two and four. The scooter user mean BMI in wave two was 30 and in wave four was 32 (both of which are classed as obese). In wave two there were no significant differences in BMI between scooter users and other groups. However by

[15] After Thoreau, Table 1

[16] After Thoreau, Table 3

wave four the BMI of non-mobility aid users was significantly lower than that of scooter users.

Lung function was also measured during waves two and four. A general measure of the functionality of the lungs is called Forced Expiratory Volume (FEV). The participant is required to inhale as deeply as possible, and then exhale into the spirometer as hard as they are able, for as long as they are able. The volume of air that can be forcibly exhaled after a full intake of breath is measured. Scooter users showed the biggest declines in capacity whilst non-mobility aid users showed the least. Once more, scooter users were most likely not to be able to complete all tests, with 80 per cent completing compared to 83 per cent of cane users and 88 per cent of those using no mobility-aid.

The grip strength test measures the strength of each arm and hand. Grip strength is recognised to vary by gender and to decline with age. The study found that all groups decreased in strength over time, in dominant and non-dominant hands. Scooter users showed the greatest declines in strength; those who used no mobility aids showed the least decline. Of those in each group who completed the test, scooter users lost the most grip strength in their dominant hand in terms of proportion, losing 19 per cent of the strength they previously had in wave one by wave four. Cane users lost 12 per cent of their strength, whilst those using no mobility aids lost 9 per cent. The results of the grip-strength tests are summarised in Table 3.

Table 3: Grip Strength scores in kilograms[17]

	Wave 2	**Wave 4**
Scooter user	22.07	17.81
Cane user	21.94	19.20
No aid	27.27	24.69

The grip-strength test scores from the ELSA study data are significant, because reduced muscular strength, as measured by grip strength, has been associated with an increased risk of all-cause and cardiovascular mortality.

Between January 2003 and December 2009, a total of 142,861 participants were enrolled in the PURE study and 139,691 with known vital status were included in the analysis. During a median follow-up of four years after enrolment 3379 (2 per cent) of those participants had died. Grip strength was inversely associated with all-cause mortality, cardiovascular mortality, non-cardiovascular mortality, and stroke. Grip strength was found to be a stronger predictor of all-cause and cardiovascular mortality than systolic blood pressure.[18]

[17] After Thoreau, Table 4

[18] Leong et al, 2015, Prognostic value of grip strength: findings from the Prospective Urban Rural Epidemiology (PURE) study

The differences in ability to complete the ELSA tests indicates that scooter users have worse health than comparably aged, but more active, participants at specific points in time, and have steeper declines in health over time. Whilst the scores on the tests themselves don't reveal statistically significant differences between the groups, the completion rates provided evidence towards scooter users' capabilities declining at faster rates.

In all tests scooter users were most likely not to be able to complete the tasks. The percentage of the survey sample which was previously able to complete the tests, but by the last measurement taken was no longer able to complete the test, was also consistently higher for scooter users. For grip strength, this difference was significantly greater than for other participants. The relative differences are shown in Table 4.

Table 4: Percentage that completed first tests but were unable to complete final tests[19]

	Chair Rise	Walk test	Grip Strength	Lung Function
Scooter users	10	20	20	20
Cane users	7	7	1	17
No aid	4	3	1	12

There were several limitations in using ELSA data to answer questions regarding the health of scooter users. The study recognised that none of the results can show that the scooter is the cause of the differences. Whether the scooter users performed worse on the tests because they use scooters or they use scooters because they have worse health and mobility could not be answered from the ELSA data.

The need for individual participant data from all waves for the study also imposed a limitation by reducing the number of scooter users in the subset analysed. The number of scooter users participating in ELSA in wave one was 77; by wave four this was reduced to 20 users. By wave three, almost 60 per cent of the scooter user dropouts were caused by death, almost double the rate for dropouts from other groups.[20] These scooter users were not included in the study. Scooter users included within the study may, therefore, potentially represent a slightly healthier sample of scooter users than scooter users in the wider UK population.

Nevertheless, there is a strong correlation between the results of the study of the ELSA data and other research indicating a positive relationship between health outcomes and activity levels. It seems probable that annual morbidity and mortality costs in New Zealand attributable to sedentary mobility through

[19] After Thoreau, Table 5

[20] 33 per cent

scooter use would be equivalent to, or greater than, the high value estimate of $3,765 per person (in 2015 values) calculated as the cost of inactivity.[21]

An earlier study of mobility scooter users supports this interpretation of the results of the ELSA study.[22] The survey of 86 mobility scooter users in British Columbia with an average age of 77 years found 74 per cent of the sample rated their health to be fair or poor, whereas, the comparable figure for seniors over 65 within the general Canadian population was only 23 per cent. Specific findings of that survey are summarised in Table 5.

Table 5: Percentage of scooter users with impairment in at least one faculty

Hearing	Vision	Memory	Balance
38	34	19	17

All chronic diseases were found to measure higher among mobility scooter users than in the general population in Canada for comparable age cohorts. The survey found 80 per cent of mobility scooter users were taking four or more medications daily.[23]

According to the responses in the 2012 ACCC survey, only 51 per cent of scooter users sought advice or assessment from mobility specialists when buying a scooter and only 25 per cent had had safety training or tuition on their current scooter. The survey also found considerable variation in the quality and depth of safety training amongst retailers and suppliers.

Accident risks for scooter users

Based on responses to the survey, Australian scooter users take an average of 5.8 trips per week outside the perimeter of their homes and the occurrence of incidents and injury arising from these trips was five per cent. This included one or more of the following:

- scooter toppling over;
- collision with a stationary object;
- trip or fall from scooter; and
- collision with a moving object.

Factors that the scooter users felt contributed to their incidents included:

- cars backing out of driveways – unaware of the scooter behind them;
- scooters not being noticed on roads or parking lots;
- damaged roads and footpaths; and
- confusion at intersections amongst pedestrians, scooter users and other road users.

[21] Genter et al., 2008, Valuing the health benefits of active transport modes

[22] Steyn and Chan, 2008, The Mobility Scooter Research Project

[23] Steyn and Chan, 2008

A separate survey of 149 mobility scooter users in Sydney in 2010 found that 21 per cent had been involved in an accident involving their mobility scooter within the previous twelve months.[24]

Two studies have attempted to quantify the costs of accidents involving mobility scooters. A survey of 107 reported traffic collisions between mobility devices and motor vehicles in Michigan found that 60 per cent resulted in the death of the mobility device user.[25] A study of Australian hospitalisation data and data extrapolated from hospital admissions in Victoria concluded that there were 713 hospitalisations from motorised mobility scooter accidents in Australia between July 2006 and August 2008.[26] The study found hospitalisation was the result of:

- falls from the devices - 62% (442);
- collisions with vehicles - 15% (107);
- collisions with stationary objects - 7% (50);
- collisions with unspecified objects - 1% (7);
- tipping events - 6% (43);
- unknown causes - 9% (64).

Data from Victorian hospital admissions from mobility scooter accidents in 2008/09 revealed 36 per cent of admissions were for serious injury, which was significantly higher than the 16 per cent in the general population admitted for serious injury for all unintentional injury causes. As people get older they become more fragile and more likely to be injured in an accident, and if injured more likely to die, which explains the higher numbers of older people in adult accident fatalities and injuries data.

The Victorian hospitalisation data showed:

- 50% were persons aged over 85 years;
- 50% were for fractures;
- 40% were for lower extremity injury;
- 23% were for neck injury.

The average length of hospitalisation was 11.2 days and the average cost was Aus$5,665.[27] The severity of injury in a significant number of cases was likely to cause persisting health problems.

The Victorian study identified 62 certain and 14 probable fatalities for mobility scooter users in Australia between July 2000 and August 2010. The most common cause of death was head injury after collision with a motor vehicle. For New Zealand the Ministry of Transport identifies eight fatalities and 141 injuries of mobility scooter users in the period 2008-2012.[28] The NZ Transport

[24] Edwards and McCluskey, 2010

[25] LaBan and Nabity, 2010

[26] Cassell et al., 2011, *Targeted Study of Injury Data Involving Motorised Mobility Scooters*

[27] Aus$6,349 in 2015 after adjusting for CPI changes

[28] MoT Crash Factsheet November 2013: Pedestrians

Agency identifies 12 fatalities, 19 serious injuries and 81 less serious injuries in the period 2009-2014.[29]

Case for assessment and training

The RICA (UK) study found 21 per cent of respondents reported accidents or incidents on their scooter, mostly on pavements and involving tipping, not collisions. The survey also found that, although Class 2 "boot scooters" which are not to be used on roads were the most common type of scooter owned, 45 per cent of respondents travelled on roads.

The UK has two classes of mobility scooter, distinguished by speed and weight: a Class 2 "invalid carriage" is treated as a pedestrian and is not to be used on roads; a Class 3 device is a road vehicle, but able to travel on footpaths at less than 6.4kph. A Class 2 device needs no registration, whereas a Class 3 device requires registration and licensing.

Although the RICA study concluded that the requirement to register class 3 vehicles should be reviewed, because local and police authorities were not clear where responsibility lies for ensuring compliance, the survey found that new purchasers of Class 3 devices are not guaranteed access to good information or assessment of their needs, due to a lack of available product information or advice about how to determine scooter suitability for the individual user. There was a perceived lack of training and familiarisation opportunities necessary to ensure safe use of these mobility scooters.

The RICA study indicates a trend for the level of training in the UK to be increasingly similar to that observed by previous studies elsewhere. A survey of 86 mobility scooter users in British Columbia found 47 per cent had ceased to drive a motor vehicle and 15 per cent had never driven.[30] Failing health was cited as the reason for ceasing to drive for 80 per cent of those who had given up driving. Despite this, the survey found:

- 34% used their mobility scooter on roads regularly;
- 53% used their mobility scooter on roads occasionally;
- 40% of users had no prior assessment of fitness; and
- 48% of users had no prior training before operating their device.

These proportions were noted by the Canadian study as being significantly higher than found in the UK in a 2005 study where only 18 per cent of users had received no prior training.[31] The difference was attributed to the higher incidence of purchases of second-hand devices in Canada, with 38 per cent of mobility scooters having been bought second-hand, compared to the UK, where only 12 per cent of mobility scooters were bought second hand with little or no prior training provided.

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[29] NZTA: Safety - Driving safely - Senior drivers - Mobility scooters

[30] Steyn and Chan, 2008

[31] Barham et al., 2005, Review of Class 2 and Class 3 powered wheelchairs and powered scooters

The widening range of retail options, including second-hand, catalogue and on-line retailer sales, observed by the RICA study is the most likely explanation for this change. New Zealand could be expected to experience a similar retail pattern, with similar low levels of prior assessment and training. An average of about 150 used mobility scooters are being advertised at any one time on TradeMe alone now.

The case for prior assessment and training was supported by a study in Queensland in 2008. A group of fifty able-bodied adults with an average age of 34 years was tested on basic driver competency on motorised mobility scooters. Even with the relative advantage in age and level of impairment, 66 per cent failed at least one test. The study concluded that driving skills needed to be taught and mobility scooter operators needed to be assessed for competency.[32]

Risks to vulnerable pedestrians

Ensuring competency in mobility scooter users is necessary to reduce the risk of injury to those users, but also to reduce the risk of injury to other users of the same infrastructure. At the moment in New Zealand all personal mobility devices are treated as pedestrians and expected to behave as pedestrians. They must use a footpath, or the side of the road where no footpath is present.

The increasing use of mobility scooters is a potential risk to the safety of pedestrians, particularly when used at speed or without consideration. Where cyclists and skateboarders share footpaths with pedestrians, this can increase the risk of injury to elderly, deaf or visually-impaired pedestrians through falls and collisions as well as making them feel unsafe. Shared pedestrian and cycle lanes have been noted as a safety issue and resulted in injuries to pedestrians and cyclists.[33] Adding mobility scooters to the mix of modes increases the risk for all users, especially the most vulnerable.

Older pedestrians are especially vulnerable as road users. People aged 70 or older made up 12.5 per cent of pedestrian casualty figures in 2012 and 11.4 per cent in 2013. Walking accounts for a higher proportion of journeys by the 65 plus age group than for the adult population aged 15 and over. As people age, and age beyond 80 in particular, the percentage of pedestrian trips increases and the percentage of trips as drivers decreases.[34]

The width of footpaths has been identified as a potential safety risk where they may be too narrow to accommodate the increasing variety of users. Constrained provision of footpath space can bring vulnerable pedestrians into potential conflict with mobility scooter users. Even the fear of collisions with other footpath users can constitute a constraint for frailer older pedestrians. Risks for older pedestrians from shared path use were identified by all but one

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[32] Nitz, 2008, Evidence from a cohort of able bodied adults to support the need for driver training for motorized scooters before community participation

[33] Wilton and Davey, 2007, Improving the safety of older pedestrians

[34] Davey and Nimmo, 2003, Older People and Transport

focus group in a 2006 study by the New Zealand Institute for Research on Aging.[35]

Travel on foot is relatively more important for older people and of particular value for their health and longevity. The 2001 New Zealand Positive Ageing Strategy identified community participation as an important element of positive ageing, related to greater life satisfaction and perceived quality of life. Reduced mobility and reaction times also make older people more vulnerable to injury. In some cases the experience of accidents as pedestrians, or fear of such accidents, can deter older people from using streets and roads, thus reducing their activity and threatening social isolation.

Mobility scooter users tend to have reduced mobility or a physical disability. Vision, hearing, perception, reflexes, reaction time, balance, posture, strength, co-ordination, endurance, cognition, lucidity, memory and judgement are all likely to be potentially impaired in scooter users.[36] There is a need, therefore, to balance avoiding creating barriers to greater independence of the elderly and disabled against putting them at greater risk.

Mobility scooters have potentially excessive speed as pedestrians. Normal walking speed is 4.5-5.6kph (1.25m per second to 1.5m per second), with elderly and disabled pedestrians generally walking at 3.5-4kph (about 1.0m per second).[37] There is no legal speed limit for mobility scooters in New Zealand, although they should not be used at speeds greater than the walking pace of other pedestrians. A mobility scooter can weigh more than 150kg and travel at speeds between 6kph and 15kph (1.66m per second to 4.2m per second). The Canadian Council of Motor Transport Administrators (CCMTA) found that mobility scooters are a hazard for pedestrians with impaired hearing or vision, and concluded that mobility scooter speeds are too fast for footpaths and too slow for roads.[38]

The legal status of mobility scooters as pedestrians also leads to clashes with cyclists, other pedestrians and traffic on the roadside. Pedestrians are required to travel against the flow of traffic, but mobility scooter users prefer to travel with the flow. The CCMTA noted that mobility scooter users often fail to obey basic road rules. Their study also observed that mobility scooter users frequently fail to maintain their scooters, or remember to charge the batteries or calculate the distance able to be travelled on a charge, leading to heavy, awkward devices and their unprotected, often frail, users being frequently stranded in places where a suitable service vehicle cannot have ready access to them.

This might be in part because mobility scooter users without prior driving experience can lack experience in planning a journey and the stages needed

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[35] Wilton and Davey, 2007

[36] Steyn and Chan, 2008

[37] Pedestrian Planning Guide, Chapter 3

[38] Managing motorized personal mobility devices, 2010

to reach an objective, as well as in reading traffic, making spatial judgements, assessing risk and hazards, using peripheral vision and reacting appropriately to hazards. Alcohol use and medications preventing operation of machinery have also been identified as issues for mobility scooter users.[39]

Implications for pedestrian infrastructure

In New Zealand the quality of footpaths has been identified as a risk for older pedestrians.[40] Many of the same factors that contribute to unsafe situations for elderly and disabled pedestrians are equally hazardous for users of mobility scooters, including uneven pavements, high kerbs and dangerous road crossings. The physical condition of footpaths affects how safe people feel when walking and when using mobility scooters. Uneven pavements can hinder the safe passage of mobility scooters and increase users' risk of tipping.

By far the most commonly identified safety issue in the 2006 NZIRA study was the physical condition of footpaths and walkways. This included the need for smooth footpath surfaces to prevent tripping and tipping, widths suited to multiple users such as pedestrians and mobility scooter users, and free of obstructions such as shop pavement displays, sandwich boards, and overhanging vegetation.[41]

Despite the tendency of most New Zealand advertisements to portray mobility scooters in external settings and often on slopes, the ability of mobility scooters to safely negotiate changes in gradient and surface level can be limited. This limitation is particularly relevant to the design of infrastructure used by mobility scooters, including temporary footpaths and detours around worksites, as well as crossings.

Crossings that not are lipless can be a barrier to mobility scooter users, as well as a trip hazard to older or visually impaired pedestrians. This was identified as particularly important in areas with high numbers of older people, for example near retirement villages, but also at crossing points at intersections, in the 2006 NZIRA study.

Increasing use of footpaths by mobility scooters has implications for the design of a variety of pedestrian infrastructure. For two mobility scooters to pass safely without risk of collision and without risk of tipping off a path or colliding with a wall or stationary object requires a minimum path width of 2.0m.[42] Current pedestrian-island design guidance in New Zealand provides for a 1.5m wide path, creating the potential for one mobility scooter to need to pause in a traffic lane to give way to another on a crossing.[43]

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[39] Deverell and Pannier, 2011, Orientation and Mobility with Motorised Mobility Scooters and Electric Wheelchairs; Edwards and McCluskey, 2010; Cassell et al., 2011

[40] Davey and Nimmo, 2003

[41] Wilton and Davey, 2007

[42] King and Dutta, 2010, Scooters in the Built Environment

[43] Pedestrian Planning Guide, Chapter 15

The Canadian Standards Association in 2004 calculated the minimum turning area for a mobility scooter as 3.15m.[44] A more recent UK study found that the turning circle of a 1.50m x 0.695m mobility scooter is 4.35m and a 90° turn needs 2.2m.[45] This is possibly a reflection of the increase in size of mobility scooters and the increased proportion that are four-wheeled, rather than three-wheeled. Use of chicanes within pedestrian islands, creating two 90° turns within a 1.8m wide pedestrian island, has the potential to trap a mobility scooter within the island in the centre of the road.

Crossfall gradients on paths and vehicle access crossings on paths have been identified as a significant issue for mobility scooter users. Mobility scooters are highly responsive to changes in surface texture or gradient, and a user without the strength, alertness or reactions to avoid or respond to a sudden change can easily lose control.[46] A crossfall of 1:50 is recommended as the maximum in New Zealand.[47] Ramps and flares for crossings, however, frequently introduce abrupt gradient changes into adjacent paths. A mobility scooter driving onto a crossing flare with a recommended maximum gradient of 1:6 would potentially lurch onto the flare and ramp or even into the road, or tip over into the road.

Crossing ramps can create a variety of problems for mobility scooters. Many scooter users prefer to wait behind the slope of the ramp when intending to cross a road. Most mobility scooter users in the 2012 ACCCC study (72 per cent) were found to employ at least one safety feature, with visibility flags being the most common safety feature used, and a flag at least a metre and a half off the ground is recommended for New Zealand users.[48] These are usually placed at the rear of a scooter, however, and where a 1.5m long scooter is waiting behind a 1.4m ramp the flag would be about 3m behind the kerb. This can significantly reduce the visibility of the mobility scooter and the user's intentions to approaching traffic.

A mobility scooter-user's eye position will not only be lower, but can be up to 2.4m back from the kerb edge at a crossing, as a result of this positioning behind the ramp. This has the potential to significantly reduce the visibility of any approaching traffic for the mobility scooter user.

Adequate vision for a person within the road environment, including mobility scooter users, requires not just an ability to focus, but an ability to be able to rotate the angle of vision to be aware of potential or approaching hazards to each side and from the rear (as in a situation where an approaching vehicle intends to turn into the road being crossed). This can be a significant challenge for many mobility scooter users.[49]

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[44] Accessible Design for the Built Environment, B651-04, 2004

[45] Schoon, 2010, Mobility Scooter and User Characteristics at Crossings and Intersections

[46] Cassell et al., 2011

[47] Pedestrian Planning Guide, Chapter 15

[48] Keeping mobile: How to safely use your mobility scooter, 2012

[49] Schoon, 2010

The standard time allowed in the UK for a pedestrian to complete a crossing of a 7m road is 8.7 seconds. The time taken for a mobility scooter user to look both ways and commence crossing a road can be up to 8 seconds and, as a result of the care needed to negotiate the gradient of the crossing and any edge onto and off the carriageway, the time taken for a mobility scooter to cross a 7m road can be up to 12.7 seconds. [50]

In New Zealand the standard time allowed for a pedestrian to complete a crossing is frequently based on a default 15th percentile walking speed of 1.3m per second for a healthy adult. Even the most mobile elderly participant in the ELSA gait test walked at only 0.8m per second, or 0.5m per second more slowly, which would be just sufficient to cross 7m in 8.75 seconds.[51] At an average walking speed of 0.67m per second, the more mobility-impaired participants in the ELSA tests would need 10.45 seconds to cross a 7m road-crossing.

A 1998 study which examined pedestrian experiences and behaviour at five urban intersections in Miami found that older people had insufficient time to cross at signalled intersections and 47 per cent of pedestrians of all ages reported not having sufficient time to cross.[52] Similarly, an earlier study in California compared younger and older pedestrians' ability to cross a busy signalled crossing and found that, of the 592 older pedestrians observed, 27 per cent were unable to reach the opposite kerb before the light changed, and a quarter of this group were stranded at least a full traffic lane away from safety.[53]

The researchers concluded that the timing of the pedestrian signal did not allow adequate time for many older pedestrians to cross, thereby putting them at risk. Providing more crossing time may become increasingly necessary in New Zealand in response to an aging population and an increasing use of mobility scooters.

The 2006 NZIRA study also noted that mobility scooter users increasingly needed a place to park their scooters within retail precincts, as there was not the space on the footpath.[54] With increasing use of mobility scooters this may become a significant planning issue in provincial towns, suburban centres and some city centres.

Issues to be considered

Although no country has set minimum standards for wheel diameter, tyre width, ground clearance or stability, France, Switzerland, Belgium, Sweden, Denmark and the UK require lights and reflectors, and apply tests for braking,

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[50] Schoon, 2010

[51] Thoreau, 2011

[52] Guerrier and Jolibois, 1998, The safety of elderly pedestrians at five urban intersections in Miami

[53] Hoxie and Rubenstein, 1994, Are older pedestrians allowed enough time to cross intersections safely?

[54] Wilton and Davey, 2007

turning, climbing capacity, dimensions and weight for mobility scooters. Australia requires a scooter capable of more than 10kph to be equipped and registered as a road vehicle. The high incidence of injuries from falls from mobility scooters tends to suggest that operators should be restrained by seat belts, too.

Issues to be considered in any approach to determining the status of mobility scooters have been addressed in several studies over the past decade and have included:

- Classification of devices
- Regulatory approaches
- Assessment of operator competency
- Limits based on age, health or weight for operators
- Requiring certified mobility impairment for use
- Registration and licensing of devices or operators
- Conditions on use, and where a device can be used
- Limits on speed
- Direction of travel on the road
- Requiring minimum levels of insurance
- Requiring extra safety equipment

The appropriate classification and regulatory approach towards mobility scooters has been recognised to have significant implications for the extent to which other issues can be addressed. Treatment of mobility scooters as pedestrians raises philosophical and potentially legal issues of consistency of treatment if any barrier to use is considered that would not apply equally to a person who is walking. Being intoxicated is not a legal impediment to walking, but is potentially hazardous in operating a machine or a device within a road.

Classification of essentially similar devices as being pedestrians, bicycles or motor vehicles depending on the speed environment in which they theoretically operate, and applying the appropriate regulatory approach for each environment, has been the most widely adopted response. The literature suggests the result is confusing and potentially contributing to higher accident rates among mobility scooter users. Devices classed as pedestrians and not equipped with suitable safety and security equipment are nevertheless being taken onto roads. The weight of the international experience tends towards classification of mobility scooters as a special class of motor vehicle.

Conclusion

Mobility Scooters are becoming a common sight on New Zealand streets, especially in provincial centres. Significant safety issues can attach to these devices, which use pedestrian infrastructure, but tend to be substantially heavier and faster than most pedestrians. Their steering can be highly responsive to changes in surface texture or gradient, or the balance of the user, and can be beyond the fitness or competence of some elderly or disabled operators to control effectively. They can be a significant hazard for elderly or disabled pedestrians. Operators of mobility scooters also appear to

be at significantly greater risk of being in an accident, and of being seriously or fatally injured than the general public or other road users.

There is also evidence to suggest that serious health concerns exist around increased use of mobility scooters. These devices are increasingly being used, without prior assessment or expert advice, by younger persons and by those who have no disability. Their adoption by individuals who could otherwise walk seems likely to produce substantial personal and public health costs. Mobility scooter users appear to experience a more rapid decline in functional mobility and ability than those who remain even marginally more active.

The literature suggests that that prior assessment and training is necessary. The significant risk of injury from falls from these devices indicates a need to consider requiring seat belts to be fitted, and the high incidence of head injury would indicate that mandatory helmet-wearing should be considered.

Mobility scooters cannot be considered equivalent to pedestrians. They are motorised devices that tend to be substantially heavier, and have potentially excessive speed as pedestrians. The legal status of mobility scooters as pedestrians also leads to clashes with other pedestrians and traffic.

Increasing use of footpaths by mobility scooters has implications for the design of a variety of pedestrian infrastructure. Providing wider crossings and longer crossing times may become increasingly necessary in New Zealand in response to both an aging population and an increasing use of mobility scooters.

Increasing numbers of mobility scooters will create an increasing need for a place to park scooters off the footpath within retail precincts, which may become a significant planning issue in provincial towns, suburban centres and some city centres.

In the majority of jurisdictions that have addressed the issue, where a mobility scooter is used on or able to be used on the road, it is required to meet minimum requirements for road-worthiness. Several jurisdictions require lights and reflectors on mobility scooters, and apply tests for braking, turning, climbing capacity, dimensions and weight. No country has set minimum standards for wheel diameter, tyre width, ground clearance or stability.

Devices classed as pedestrians and not equipped with suitable safety and security equipment are nevertheless being taken onto roads by persons with limited training and competence. The weight of the international experience suggests mobility scooters should be classified and regulated as a special class of motor vehicle and their use should be on the recommendation and assessment of a health professional.

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