



MONASH University

Accident Research Centre

AN INVESTIGATION OF SELF- REGULATORY BEHAVIOURS OF OLDER DRIVERS

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An investigation of self-regulatory behaviours of older drivers

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Abstract:

This study surveyed 656 drivers aged 55 years and older and 29 former drivers in Victoria, examining the extent and nature of self-regulation in this group and the characteristics of those who self-regulate and those who do not. Participants were volunteers who responded to recruitment notices in newspapers, seniors' newspapers and an auto club magazine.

Most drivers (approximately 70%) drove daily and more than two-thirds drove 100 kilometres or more per week. Almost 80% of drivers said they were driving about as much as they would like to. Males and those aged less than 75 years were more likely to drive further and more frequently than females and those aged 75 years and older. Approximately 80% of drivers said their quality of driving was the same as it was 5 years ago. About forty percent reported driving slower and less compared to 5 years ago. Overall, the majority of drivers reported being very confident and that they had no difficulty in the majority of driving situations. Males and younger drivers (aged 55-74) tended to be more confident and had less difficulty than females and drivers aged 75 years and older. The proportion of drivers who reported avoiding driving situations varied across different driving situations. The most commonly avoided situations were driving at night (25%), at night when wet (26%) and in busy traffic (22%). Approximately three-quarters of current drivers said that they had thought about giving up driving one day, however, only 20% said that they had actually made plans for this. The single most important issue that would concern drivers about not being able to drive one day was a loss of independence.

Regression modelling was conducted to identify key characteristics of those who avoided *any* of the eight specific driving situations. Those drivers tended to be female, aged 75 years and older, with vision problems, not the principal driver and were involved in a crash in the last 2 years. In addition, those who drove 100 kilometres or less (compared with those who drove more than 100 kilometres) tended to be female, aged 75 years and older, retired, with arthritis, lower ratings of speed of decision making for safe driving, not the principal driver and not married.

Of those former drivers interviewed, about half had stopped driving in the last year and the majority of others had stopped between 12 months and 2 years previously. They were generally quite mobile and most were satisfied with their ability to get places. Half went out either daily or three to four times per week. However more than a third indicated that they went out only one or two days a week and about one-quarter said they were not satisfied with their current ability to get places. Frequently used transport options included car (as a passenger) or public transport. About one-half reported they often walked and about one-quarter used taxis often. Ill-health, safety concerns and crash involvement were the three most important reasons given for stopping driving. Around one-third of former drivers said they had made the decision to stop driving without the advice or involvement of others. Most said they felt they had stopped driving at about the right time.

This study has provided a rich source of information about drivers' self-regulatory practices. Based on the findings of this study a number of recommendations were made for future research and for strategies to enhance the awareness of self-regulatory practices and to encourage older people to drive for as long as it is safe for them to do so.

Key Words:

Drivers, Older Drivers, Mobility, Travel, Licensing, Self-regulation,
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EXECUTIVE SUMMARY

BACKGROUND

Driving is of fundamental importance for older people and there is a strong emphasis around the world for older people to maintain their mobility for as long as possible. Older drivers are generally considered to be safe and cautious drivers, however, as people age, there are declines in sensory, cognitive and motor skills that can affect the ability to drive safely. Moreover, crash statistics indicate that older drivers currently face high levels of crash risk. It is frequently claimed that older drivers 'self-regulate' their driving behaviour to minimise the risk of crashing. It remains, however, that there are large gaps in our knowledge about self-regulation among older Australian drivers and about the effectiveness of these practices in reducing crash risk. It is possible that there is a sub-set of this group that may be unable to self-regulate their driving adequately and is therefore at higher risk of crash involvement.

SURVEY OF CURRENT AND FORMER OLDER DRIVERS

The broad aim of the study was to describe the prevalence and types of self-regulatory practices adopted by older drivers and to identify characteristics of those who self-regulate and those who do not. Telephone interviews were conducted with 656 current drivers and 29 former drivers aged 55 years and older from urban areas, country towns and rural areas in the State of Victoria.

RESULTS FOR CURRENT DRIVERS

Driving patterns

More than two-thirds of all current drivers reported driving daily and the majority were satisfied with the amount that they were driving. Males were more likely than females to drive daily and drive greater weekly distances. Similarly, drivers aged less than 75 years old were more likely to drive more frequently and greater weekly distances than those older than 75 years.

Changes in Driving

The majority of drivers (80%) said that their quality of driving was about the same as it was five years ago. Despite the general perception of stability in driving quality, around 40 percent of drivers said that they were driving less (41%) and slower (40%) now than they were five years ago. Those aged 75 years and older were more likely to report that their amount of driving had decreased over the last five years. Females were more likely than males to drive slower now than five years ago.

Reasons for reductions in the amount of driving included general lifestyle changes, such as moving house and employment changes while fewer than 20 percent of drivers who reduced their amount of driving attributed this to health or general ageing issues. Reasons for driving slower predominantly focussed on safety issues and adherence to road rules.

Self-rated health, medical conditions, medications and travel patterns

Not unexpectedly, a significant relationship was found between weekly driving distance and health status: those with poorer health ratings tended to drive less frequently and shorter weekly distances than those with better health ratings. Those with arthritis were also more likely to drive shorter distances per week than those without arthritis and those who took prescribed medications were more likely to drive fewer kilometres than those not taking prescribed medications. These patterns are suggestive of appropriate self-regulatory practices amongst those who were aware of declines in health or the presence of arthritis.

Confidence, difficulty and avoidance of driving situations

Overall, drivers reported being very confident and had no difficulty in the majority of driving situations. Not unexpectedly, this was particularly evident for making right-hand turns at fully controlled intersections, but around one-third said they were only moderately or not at all confident driving in busy traffic and also through intersections without lights. Similarly, around one-quarter said they found busy traffic and intersections without lights a little difficult. Around half of the drivers said they were moderately or not at all confident when driving at night and at night when wet. Generally, males were more likely than females to report being very confident and were also more likely to say they had no difficulty with the various driving situations. Drivers aged 75 years and older were less likely than younger drivers to be very confident in most driving situations. The oldest group were also less likely to report no difficulty in busy traffic and changing lanes.

In addition to rating confidence and difficulty in specific driving situations, drivers were asked if they intentionally avoided these situations. Overall, a relatively small proportion of drivers reported avoiding driving situations. Highest avoidance levels were seen for busy traffic, night driving and driving at night when wet. Females were more likely than males to avoid night driving and driving at night when wet. Drivers aged 75 years and older were also more likely than younger groups to avoid night driving and driving at night when wet as well as merging into traffic. Drivers aged 65 and older were more likely than younger drivers to avoid busy traffic. More than half of drivers who avoided night driving or driving at night when wet did so because of problems relating to vision (especially glare from lights) whilst the most common reason (40%) for avoiding busy traffic tended to be personal preference, with many reporting that busy traffic was not enjoyable and made them feel uncomfortable.

Self regulation, crashes and infringements

Reduction in driving exposure (driving distance and frequency) was related to infringements but not crash involvement. Avoidance of driving situations was marginally related to crash involvement but not to infringements. Those who had been involved in a crash were slightly more likely to avoid any of the eight specific driving situations than those who were not involved in crashes. Thus, rather than self-regulation being associated with a lower crash risk, evidence was found to the contrary. That is, crashes were more prevalent amongst those who self-regulated by avoiding potentially risky driving situations. It is important to note that the survey did not provide information about the relative timing of crashes and adoption of self-regulatory behaviour. However, it is plausible that older drivers were likely to avoid potentially risky driving situations following their involvement in a crash. Future research is needed to better identify the relationship between self-regulatory driving practices and crash involvement.

Characteristics of the self-regulating driver and the non self-regulating driver

Regression modelling was used to identify key characteristics of self-regulators amongst older drivers. Two variables describing driving patterns were selected to exemplify self-regulation: weekly driving distance (kms) and avoidance of potentially difficult and risky driving situations.

Those who drive no more than 100 kilometres per week were more likely to:

- be female;
- be 75 years and older;
- be retired;
- have arthritis;
- rate decision-making for safe driving as good/fair/poor (rather than excellent);
- not be the principal driver in the household;
- be not married (or de facto).

Those who avoid *any* specific driving situations (e.g., busy traffic) were more likely to:

- be female;
- be 75 years and older;
- have a vision problem;
- not be the principal driver in the household;
- have had a crash in the last 2 years.

Driving cessation: the experience of current drivers

Approximately three-quarters of current drivers said that they had thought about giving up driving one day, however only 20 percent said that they had actually made plans for this. Those who had made plans were more likely to be female, aged 75 years and older and living in either an urban area or a country town.

The single most important issue that would concern drivers about not being able to drive one day was a loss of independence. Others described a general loss of mobility, restricted activities, reliance on alternative (usually public) transport and the general inconvenience of not having a car.

Interestingly, more than two-thirds of drivers reported using alternative forms of transport, other than driving. Amongst those who use alternative transport about two-thirds used trains, while trams and buses were also used by about one-third. Buses and taxis were generally reported to be the most accessible forms of transport, although less so in country towns and rural areas.

RESULTS FOR FORMER DRIVERS

A secondary aim of this study was to explore issues relating to the decision to stop driving, factors that contributed to driving cessation, use of alternative transport options and the impact of driving cessation on various life areas for former drivers.

Of those former drivers interviewed, about half had stopped driving in the last year and the majority of others had stopped between 12 months and 2 years previously. Former drivers were generally quite mobile and were satisfied with their ability to get places. Half went out either daily or three to four times per week. However more than one-third said they went out only one or two days a week and about one-quarter said they were not satisfied with their current ability to get places. Frequently used transport options included car (as a passenger) or public transport. About one-half reported they often walked places and about one-quarter used taxis often.

A small sample of 29 former drivers was interviewed. Twenty former drivers said they made the decision to stop driving themselves, five indicated they made the decision together with others, while only four said that others made the decision for them. Most said they stopped driving at about the right time, however, five reported that they felt they gave up driving too soon.

Ill-health, safety concerns and crash involvement were the three most important reasons given for stopping driving. Many also reported that their decision was influenced by the fact that they no longer enjoyed driving or no longer felt comfortable when driving. The option of having access to other forms of transport was influential in the decision to stop driving for about one-third of the group. The influence of doctors' advice and family and friends' advice was also a factor for some. On face value, these reasons for stopping driving would appear to be generally appropriate self-regulatory behaviour.

CONCLUSIONS AND RECOMMENDATIONS

The results of this study confirmed for a sample of Australian drivers many of the findings from previous research with drivers in other countries [e.g. Ball, Owsley, Stalvey, Roenker, Sloane & Graves, 1998; Hakamies-Blomqvist and Wahlström, 1998; Lyman, McGwin & Sims, 2001; Kostyniuk, and Shope, 1998; Marottoli, Ostfield, Merrill, Perlman, Foley & Cooney, 1993; Persson, 1993]. In general, this study found evidence for age-related changes in reduced driving distances as well as avoidance of specific driving situations. In addition, a major contribution of this study has been to explore characteristics, other than age, that are associated with self-regulatory driving practices.

This study has provided a rich source of information about drivers' self-regulatory practices. The findings highlight the need for strategies to promote through educational materials and programs, the adoption of self-regulatory practices consistent with declines in functional ability and presence of medical conditions known to be associated with crash risk. The study also highlighted the need for further research to explore the relationship between self-regulation and functional impairment, using standardised tests of cognition, attention, visual perception, etc., to assess functional abilities. In addition, case control studies with crash-involved and crash-free drivers might be useful in developing a better understanding of the effectiveness of self-regulation in reducing crash risk.

AN INVESTIGATION OF SELF-REGULATORY BEHAVIOURS OF OLDER DRIVERS

1 INTRODUCTION

Driving is an important part of today's society and is an essential determinant of the quality of life of older individuals. Many older adults rely on driving to fulfil most of their transportation needs, and to maintain mobility and independence. While current emphasis around the world stresses the need for older people to maintain their mobility for as long as possible, it is also important to ensure that they remain safe drivers. As age increases, sensory, cognitive and motor skills decline and these changes can affect the ability to drive safely.

In general, older drivers are considered cautious and relatively safe drivers and in terms of absolute numbers of crashes, they are currently not a large road safety issue in most Western societies, compared with other age groups such as young drivers aged 18 to 25 years. However, there are relatively fewer older people in the population, fewer are licensed and they tend to drive less. Current crash rates suggest that older drivers are over-represented in serious injury and fatal crashes per head of population and distance travelled. Moreover, as the population ages, these rates are expected to increase up to three-fold over the following decades (Fildes, Fitzharris, Charlton & Pronk, 2001).

One of the widely held assumptions about older road user behaviour is that there is a high level of self-regulation. That is, older road users are thought to make adjustments in their driving and road-crossing behaviour that adequately match their changing cognitive, physical and sensory capacities in an attempt to minimise their risk of being involved in a crash. For example, it is claimed that older drivers drive less frequently at night, in poor weather conditions, make fewer right-hand turns at unsignalised intersections, drive less frequently in busy traffic and on complex roads and generally drive shorter distances. To date, however, there is little information from the Australian context about the prevalence and nature of self-regulatory behaviour of older road users. Moreover, it has been suggested that the practice of self-regulation may not be consistent among all older road users. However, we have very little Australian-based information describing these older road users who are adopting self-regulatory strategies, and those who fail to adapt their road behaviour to suit changing functional capacities.

1.1 PROJECT OBJECTIVES

The Monash University Accident Research Centre was commissioned by Austroads and its baseline sponsors (VicRoads, Transport Accident Commission, Victoria Police, RACV and Department of Justice) to address the issues surrounding adoption of self-regulatory practices among older drivers in Australia. The aim of the study was to gain a detailed understanding of older drivers' self-regulation abilities, practices and limitations. It also aimed to determine the extent and effectiveness of self-regulation in order to develop road safety initiatives aimed at improving this practice. Objectives of this study included:

- To estimate the extent to which older drivers adopt self-regulatory behaviour while driving;

- To identify the kinds of self-regulatory behaviours that drivers adopt;
- To explore the reasons why drivers self-regulate;
- To examine whether the pattern of self-regulation differs across age, sex and other demographic variables;
- To gain a clearer appreciation of the characteristics of those who are exercising self-regulation;
- To determine whether self-regulatory behaviour is related to crash risk.

The study progressed in two stages. The first stage entailed a review of national and international literature on the process of reduction and cessation of driving among older drivers (see Oxley, Charlton & Fildes, 2003). The second stage, as reported here, involved a study of older Victorian drivers and former drivers, using a survey technique, to gain more information about the nature and extent of self-regulatory driving practices in Australia.

This report provides a summary of the literature review, highlighting a number of issues surrounding older drivers including: the emerging older driver 'problem' in the context of the demographics of the ageing population; the importance of driving for older adults; licensing issues; and an examination of the factors that promote and inhibit the adoption of self-regulatory driving practices. A detailed description of the method and findings of the survey is also documented. Results describe the practice of self-regulation amongst the study group and highlight the profile of the 'self-regulating' older driver. They also describe the characteristics of older drivers who fail to regulate their own driving behaviour. The results of a survey of a small sample of former drivers are also presented and includes a summary of issues relating to their decision to stop driving, factors that contributed to driving cessation, availability and use of alternative transport options and the impact of driving cessation on aspects of their life. Some conclusions and recommendations are provided, specifically the development of educational materials and programs to raise awareness of factors that affect crash risk and to promote the adoption of appropriate self-regulatory practices, and strategies to help older people maintain their independence. Further research is also recommended to explore some of the outcomes of the current research program.

2 THE RELATIVE RISK OF OLDER DRIVERS

2.1 CURRENT CRASH RISK

Current research indicates that older drivers do not represent a large road safety problem in terms of the number of crashes. Older drivers constitute approximately 13 percent of fatal crashes and around 10 percent of serious injury crashes in Australia. By comparison, younger drivers aged 17-24 years account for around 29 percent of fatal and 32 percent of serious injury crashes (Australian Transport Safety Bureau, 2001). Similarly, in New Zealand in 1998, drivers aged 65 years and older accounted for 15.7 percent of the total number of fatalities: in contrast, younger drivers aged 15-24 years accounted for 28 percent of the total (Fildes, Pronk, Langford, Hull, Frith & Anderson, 2000). International figures show similar trends.

The overall number of older driver crashes, however, obscures the magnitude of the older driver problem. Notwithstanding the relatively small absolute numbers of older driver crashes compared with younger driver crashes, there are relatively fewer older drivers, their total annual distance travelled tends to be less and they are more frail than younger drivers. Thus, when crash statistics are adjusted to take account of any of these factors, the safety of older drivers is clearly of concern. Figure 1 shows the number of serious injury crashes per billion kilometres travelled by age group for drivers with and without adjustment for differences in physical vulnerability. These data indicate that both younger and older drivers have high levels of serious injury crash involvement compared to other age groups per billion kilometres driven. After controlling for differences in vulnerability (older people are more easily injured by a given physical insult than younger people) older drivers aged 70 years and older, have a higher serious injury crash risk than younger drivers with the exception of the youngest driver age group (under 25 years).

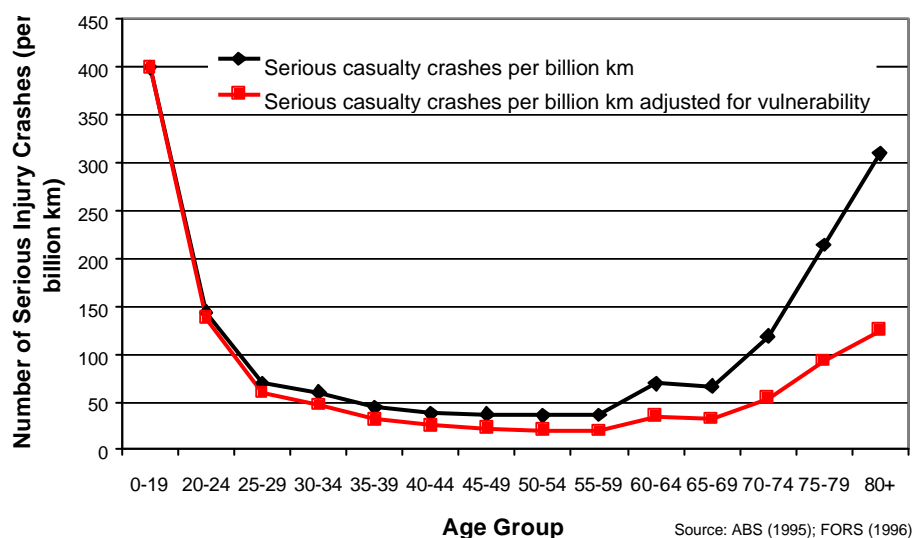


Figure 1 Involvement in serious injury crashes by age adjusting for exposure and vulnerability, Australia, 1996.

It should be noted here, that there may be an additional bias in the exposure-adjusted crash rates presented in Figure 1. Hakamies-Blomqvist (1998) argued that, independent of age, drivers who travel longer distances have a lower crash risk than those who drive shorter distances. Because older drivers commonly make shorter trips than other age groups, risk

estimates based on average distance driven exaggerate older drivers' crash rates when compared to younger drivers with higher annual kilometres travelled. Others too have questioned the use of distance travelled or time spent travelling, arguing that exposure to direct crash risk must be evaluated in a more precise manner, i.e., by examining travel paths and the frequency with which a trip encounters potential crash hazards (e.g., a 'black-spot' where crashes have occurred in the past or crossing the path of another vehicle at an intersection) (Julien & Carré, 2002; Kam, 2003). Applying an exposure measure predicated on number of crashes per trip-kilometre, Kam (2003) found contrasting crash rates to those found when the conventional exposure measure of number of crashes per kilometre travelled is applied. Rather than a U-shaped curve, Kam found that younger drivers were the most vulnerable group in terms of crash risk and that crash rates of older drivers were, in most instances, comparable to those of drivers in their late 30s and early 40s.

Nevertheless, it remains that at least some older people face high crash and injury risk as drivers, car occupants and pedestrians.

2.2 FUTURE CRASH RISK

More importantly, it is predicted that, with the ageing of the population and significant demographic and socio-economic changes, older driver safety is likely to become a much larger issue in the years ahead, in part, as a consequence of the increased number of older, potentially more mobile drivers in the community. Australia, like most western societies, predicts substantial changes in the proportion of older persons in the population in the foreseeable future. The proportion of persons aged 65 years and older in the Australian community is predicted to increase from 11.1 percent in 2001 to 24.2 percent in 2051. This growth will be most pronounced in the 85 year and above age group, particularly females, with the proportion of people in this age group expected to increase four-fold (Australian Bureau of Statistics, 1999).

In addition, it is likely that changes in the demographic and socio-economic profiles of the elderly will affect crash risk. For instance, licensing rates amongst the elderly are increasing. Currently, in Victoria, close to 100 percent of the population aged between 20 and 60 years hold a licence. From ages of 60 years and older, this proportion drops, with 64 percent of 70-79 year olds and only 35 percent of 80+ year olds holding a licence (the marked drop in the oldest age group is mainly due to the small proportion of older women holding a licence (19%), however, 64 percent of men in this age group hold a licence). Given that the next cohort of older people have grown up with the car, it is reasonable to expect that they will be more likely to retain their licences. The Organisation for Economic Co-operation and Development [OECD] (2001) estimated that the proportion of Australian licensed drivers aged 65 years and over would increase from 13 percent in 2000 to 22 percent in 2030. In the US, it is predicted that licensing rates of men over 70 years will double and that of women in this age group will triple by the year 2020 (Hu, Jones, Reuscher, Schmoyer & Truett, 2000).

Furthermore, it is generally noted that, on average, older people travel less than other age groups in terms of numbers of trips per day, distance and time travelled (OECD, 2001). The observations that older drivers spend less time in the car as either a driver or passenger, report using the car less than their younger counterparts as a means of transport, and travel fewer total kilometres in an average week is perhaps indicative of a diminished need for car use in retirement. It may also be related to changing driving patterns for other reasons such as discomfort in and avoidance of driving in particular traffic conditions. During the mid 1990's Fildes, Lee, Kenny and Foddy (1994) found that older drivers reported driving shorter distances than younger drivers (less than 200 km in a week for

older drivers vs over 200 km in a week for younger drivers). They also noted fewer weekly journeys generally and less work-related and holiday journeys but more shopping and health visits among the older group compared with the younger group. However, like for licensing rates, an increase in number of trips, length of trips and kilometres travelled is predicted for the next cohort of older people. Along with the trend for older city dwellers to move to towns outside of the metropolitan area will be an accompanying increase in travel. Even in the last 30 years, there has been an increase in the number of trips and amount of travel undertaken by older drivers in the US (US Department of Transportation, 2001). In the seventies, older drivers aged between 65 and 74 years drove around 6,000 miles per year, while those aged over 85 years drove around 2,750 miles per year. In 1995, those aged 65 to 74 years drove around 8,800 miles per year, while those aged 85 years and over drove 3,900 miles per year in 1995. Similarly, in New Zealand, an increase in total distances travelled from 1989 to 1998 was found for all aged drivers, but particularly for older drivers (Land Transport Safety Authority, 2000). This trend is likely to continue in the coming decades.

Fildes et al. (2001) established projections of the crash risk for future generations of older road users in Australia, taking into account driving behaviour, population migration, personal wealth and health, infrastructure and technological impacts. Figure 2 shows the projected outcomes from this modelling. They predicted an overall three-fold increase in fatal crashes involving older drivers without active intervention. In 1995 there were 121 older driver fatalities and this was expected to increase to 341 in 2025, an overall increase of 281 percent above 1995 figures (an increase of 261% for males and 336% increase for females).

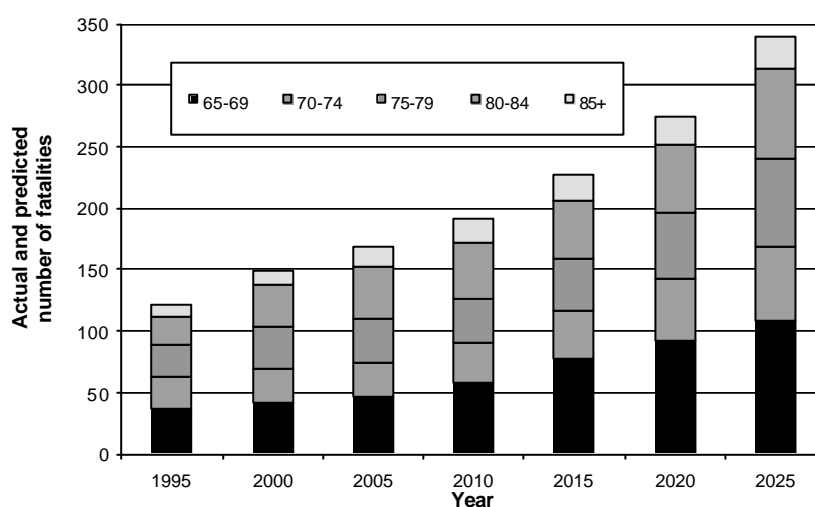


Figure 2 Projected older driver fatalities in Australia, 1995 – 2005.

In summary, the ‘greying’ of society and associated demographic changes will mean that older drivers, particularly those in the oldest age groups, will have a much higher presence on the road and therefore, a higher likelihood of crash involvement. Older road user safety will present a major challenge for road safety over the next 20 to 30 years and will require a better understanding of the driving behaviours, travel patterns and crash risk of older adults in order to develop effective strategies and programs to support continued mobility and safety.

2.3 RISK FACTORS

The causes of older road user crashes are undoubtedly complex and poorly understood, however, the over-representation of older drivers in serious casualty crashes can be partly explained by specific conditions associated with ageing which produce a heightened crash risk. It is often argued that the over-involvement of older adults in serious injury crashes is largely a consequence of their behaviour in traffic, ability to cope with complex traffic situations and their frailty (Benekohal, Resende, Shim, Michaels & Weeks, 1992; Cooper, Tallman, Tuokko & Beattie, 1993; Eberhard, 1996; OECD, 2001).

The argument that older drivers are over-involved in crashes as a result of declines in functional performance is, in part, supported by the findings that they have somewhat different crash patterns than drivers in younger age groups. In heavy traffic, traffic at high speed, at night on poorly lit roads, at complex intersections, or in a potential crash situation, the demands placed on older drivers can exceed their abilities to avoid a crash (Stamatiadis, Taylor & McKelvey, 1991; Benekohal, Michaels, Shim & Resende, 1994; McKnight, 1996; Staplin, Lococo & Byington, 1998; Fildes, Corben, Morris, Oxley, Pronk, Brown & Fitzharris, 2000; OECD, 2001).

It seems that the complexity of some road environments cause major problems for older drivers. It is interesting to note that older drivers are not over-represented in crashes that are more common to younger drivers such as single-vehicle crashes, crashes involving loss of control and speed, however, they are less able to avoid crashes in complex environments such as intersections. Negotiating an intersection is a complex task involving a range of perceptual, cognitive and motor functions that are known to deteriorate with age (Kausler, 1991). It seems plausible that an older driver's increased crash risk in these settings is related to the combined deterioration of a number of relevant functions and high demands of the road system on an older driver's ability to cope with such situations.

There is widespread agreement that the normal ageing process generally reduces or slows down sensation, perception, cognition, and physical functioning. Safe and efficient driving requires the adequate functioning of a range of these abilities and loss of efficiency in any function can reduce performance and increase risk on the road. There are a number of excellent reviews of functional and health issues and the relationship with driving, particularly those by Janke (1994) and Marottoli, Richardson, Stowe, Miller, Brass, Cooney and Tinetti (1998). The most pronounced effect of ageing for all people is the loss of sensory, cognitive and motor skills with advancing years. While there are many individual differences in the ageing process, even healthy adults are likely to sustain some degree of impairment. These changes include the following:

- Declines in visual acuity
- Declines in contrast sensitivity
- Visual field loss
- Loss of auditory capacity
- Reduced perceptual performance
- Reductions in motion perception
- Reduced dark adaptation and glare recovery
- Declines in attention capacity
- Decision time deterioration
- Loss of memory capacity
- Loss of strength
- Postural control and gait changes
- Slowed reaction time
- Declines in cognitive processing ability

While much research effort in the last decade or so has attempted to establish associations between various skills, medical conditions and crash risk, surprisingly few unequivocal

relationships have been found between declines in single functions and crash rates. Indeed, it is argued that moderate functional changes related to normal ageing do not appear to lead to a discernible increase in crash risk. Rather, it seems that simultaneous deterioration of several relevant functions and/or specific functional deficits linked to certain illnesses (especially those that lead to cognitive deterioration such as dementia) increases crash risk considerably (OECD, 2001).

Many researchers now contend that the older driver problem is mainly restricted to certain sub-groups of older people (for example, those suffering from dementia, those with little or no insight into their changing abilities), rather than encompassing all older people. This evolution represents a shift from a general approach of 'why older drivers have high crash risk?' to a differential focus on high-risk sub-groups and ask 'which older drivers have high crash risk?'

2.4 SELF-REGULATION

Many age-related changes occur gradually and many individuals learn to compensate for or adapt to these changes well. One of the widely held assumptions about older drivers is that there *is* a high level of self-regulation. That is, many older drivers are thought to adjust their driving behaviour adequately to accommodate age-related changes in sensory, perceptual, cognitive and motor skills that may affect driving and to minimise risk. Examples of such self-regulatory behaviour include: driving more slowly; travelling shorter distances; making fewer trips; avoiding driving under more difficult conditions such as at night, peak travel times and other stress-inducing situations; preference for longer time gaps when turning or merging; and avoidance of simultaneous activities while driving. The abilities of older drivers to regulate their driving according to their own abilities, to continue to drive safely, are thought to be important skills in reducing the incidence and severity of crashes.

What is known about self-regulatory behaviour

The processes involved in self-regulation and the factors that influence adoption of self-regulatory behaviours are complicated and not well understood. As indicated previously, some argue that the majority of older drivers can, and do, self-regulate effectively, while other evidence suggests that, at least some, older drivers do not self-regulate adequately.

For the most part, the literature refers to these behavioural changes as 'compensatory', implying that older drivers change their behaviour in response to a loss of function or as a counteracting measure for difficulties experienced. Indeed, a large proportion of the evidence points to caution and conservativeness on behalf of older road users (Rumar, 1986; Winter, 1988; Eberhard, 1996; Smiley, 1999) However, it may not be entirely accurate to label such behavioural adaptations as 'compensation'. While these changes may reflect a behavioural adaptation to age-related changes in performance levels, other explanations are possible, such as mature judgements about road use, lifestyle choices, and personal preferences brought about by changes in employment status, place of residence and proximity to services. Even younger drivers might avoid driving in darkness or during peak traffic periods if not forced to by their circumstances.

A popular view is that older adults are able to adapt and compensate successfully for age-related changes in sensory, perceptual, cognitive and motor performance because these functional changes occur gradually over the life-span. Thus, it is argued that appropriate adjustments can be made to maintain a similar level of performance (Verillo & Verillo, 1985; Lawton, 1990). Lawton added that older adults adopt the process of 'selective

optimisation with compensation' which he describes as follows: "Compensations are made, prostheses are utilised, sometimes human assistance is sought, and most important, an economy of acceptable gains and losses is maintained whereby some goals are relinquished gracefully in favour of others that are both highly valued and still within the realms of the person's expertise" (p.532).

Those that argue that most older drivers self-regulate point to the differences in travel patterns of older drivers compared to younger drivers. The most common difference that is reported is in terms of distance travelled. Even though older people (like all other age groups) rely heavily on private vehicles for their transport needs, driving distances seem to decrease as age increases. Trips tend to be shorter, closer to home, and for different purposes than those of younger drivers (the most common being for shopping for older women and social, recreational and medical visits for older men, as opposed to work-related trips for younger drivers) (Rosenbloom, 1999). Benekohal et al. (1994) examined the driving patterns of a sample of 664 older drivers aged 66 years and older in Illinois. They found that, although the older drivers in the sample drove fewer miles than younger drivers, overall they did not make fewer trips. Seventy percent of these drivers drove at least five days a week and 42 percent drove daily. However, within the older age group, the frequency of driving did drop as age increased, from an average of 5.7 days a week for 66-76 year olds to 4.4 days a week for 77+ year olds. Rosenbloom (1999), too, found that older people drove fewer miles each day than younger travellers, however, older men made longer non-work trips than younger men until they reached 75 years of age. In addition, Rosenbloom found a large drop in total miles travelled by those aged over 75 years compared with those aged 65-74 years, noting the danger of grouping all those aged over 65 years as if they had the same driving patterns.

In addition, as drivers age, they tend to become more conservative in driving habits, limiting when and where they travel. The conditions under which people choose to drive changes with increasing age. In general, older drivers tend to drive more in daylight and avoid driving at night (Benekohal et al., 1994; Mortimer & Fell, 1988; Stewart, Moore, Marks, May & Hale, 1991). Stutts, Waller and Martell (1989) found that night-time driving declines markedly between aged 55 and 65 years and continues to decline steadily after 65 years of age. Benekohal et al. (1994) further noted that while 25 percent of older drivers drove during the evening and at night, less than one percent drove after midnight. This may well be the result of vision difficulties with night-time driving including high sensitivity to and poor recovery from glare from oncoming vehicle headlights, and difficulty in reading signs and detecting other vehicles and roadside hazards in poor light. A recent US study also found that older adults with even small reductions in spatial vision, especially acuity in the presence of glare and binocular deficits, appeared to recognise their limitations and restricted their driving by avoiding driving at night or reducing mileage (West, Gildengorin, Haegerstrom-Portnoy, Lott, Schneck & Brabyn, 2003). This change in driving behaviour may also be explained in terms of a declining desire by the oldest-old to undertake activities at night.

Crash rates in the US support the notion that older drivers limit their driving to times and situations they feel capable of handling. Stutts and Martell (1992) examined crash rates in terms of exposure-related variables such as day of week, time of day and urban/rural locations. The results showed decreases in the overall proportion of week-end and night-time crashes with increasing age. They argued that this finding indicates that older persons drive less on weekends and at night-time and that when they do drive at these times their likelihood of crashing is not elevated compared to that of the overall population. Eberhard (1996), too, noted that when figures are adjusted for these types of exposure variables, most crashes involving older drivers occur during the day, in clear weather, and during off-

peak traffic periods and argued that the crash patterns of older drivers reflect their self-restrictive behaviours.

While it is likely that many older drivers adjust their driving adequately, it is also possible that some fail to self-regulate appropriately and, as a consequence, may be at higher risk of crash involvement. There is some evidence to suggest that older drivers, or at least some older drivers, do not self-regulate adequately. Indeed, if self-regulation was entirely successful, crash statistics would not show an over-representation of older drivers in serious casualty crashes. It is argued that some older drivers continue to drive, many into their eighth and ninth decade of life and are unwilling to forfeit their driving privileges. This may be due to a difficulty, particularly for older adults, in making judgements about their own competency to perform everyday tasks. Support for this comes from the work of Stutts (1998) who examined functional abilities and driving habits in a group of drivers aged 65 years and over in North Carolina who were applying for licence renewal. While a clear pattern of reduced driving exposure among this group was found, Stutts also found that a small but significant proportion of drivers with cognitive impairment did *not* limit their driving with around half of the drivers in the lowest quartile of cognitive performance still driving more than 3,000 miles a year. In fact, nearly 20 percent of participants reported driving more than 10,000 miles a year (a figure well above the average for this age group). Similarly, Dobbs (1996) found that, of 90 older drivers referred to by physicians to the Northern Alberta Regional Geriatric Program, 70 percent were recommended to stop driving altogether and a further 15 percent to restrict their driving. Dobbs, however, did concede that many of these people were diagnosed as having clinically significant memory and cognitive dysfunctions and may not have been necessarily representative of all older drivers. Nevertheless, this finding shows that there were some older people still driving that perhaps should not have been or, at least, should be restricting their driving. Ball and Owsley (1991) also noted that older drivers continued to drive for as long as possible and that, although they may cut down on their frequency of travel, they resisted any change to their preferred mode of travel. They concluded that self-regulation and self-imposed limitations are not a realistic strategy for reducing exposure to potential crashes among the elderly. Recent data confirm the view that the preferred mode of transport for older people is the private car and that older people generally report no problems for driving, but experience substantially more problems using other transport modes, particularly walking or using public transport (Ståhl, Brundell-Freij & Makri, 1993; American Association for Retired Persons [AARP], 2001; OECD, 2001).

It is also important to acknowledge that self-regulation (or the failure to self-regulate) is not the exclusive domain of the older driver. Rothman, Klein and Weinstein (1996) argued that people of all ages are poor at recognising the relationship between their own actions and potential risks and that they perceive themselves as less likely than their peers to suffer harm. They further suggested that this optimism about one's invulnerability could hinder the adoption and maintenance of preventive behaviours. Indeed, many attribute the high crash risk of young drivers to risk-taking behaviour, noting that they are simply more willing to take risks (Macdonald, 1994) and that they have under-developed risk perception and calibration, (i.e., matching one's driving performance with task demands) skills (Regan, Triggs & Godley, 2000). Other reports suggest that older drivers in particular are likely to overestimate their own driving ability and under-estimate the risk of being involved in a crash (Brainin, 1980; Matthews, 1986). Holland and Rabbitt (1992) examined age-related sensory and cognitive deficits and highlighted a lack of awareness of changes in visual ability amongst older adults. They found that older people were unaware of the extent of their declining eyesight and reaction times. They did not perceive complex intersections as posing any particular problem to them, considered their reaction time as

good as when aged 50 years, and felt that their ability to cope with intersections and roundabouts was much the same as it had been at younger ages. They argued that older drivers who are unaware of their deteriorating capabilities cannot make appropriate adjustments to their behaviour on the road. However, they also suggested that when people are aware of their declining abilities, they do make sensible changes to their driving behaviour. Indeed, a recent study showed some benefit of educational tools in promoting the avoidance of challenging driving situations and reduction of driving exposure through self-regulation and awareness of the impact of visual impairment on driver safety (Owsley, Stalvey & Phillips, 2003).

Another issue worth considering is that some older drivers who do not self-regulate may be part of a group who have always been unable to self-regulate. For instance, Kruger and Dunning (1999) argued that some people (at any age) tend to over-estimate their abilities in many social and intellectual domains and this is due, in part, to deficits in meta-cognitive skill. It would be interesting to know whether those who are unable to self-regulate appropriately as older drivers differ in some fundamental characteristics from those who have had difficulty self-regulating from youth.

The following chapters describe a survey of self-regulation amongst older drivers, identifying patterns of self-regulatory practices, reasons for adopting self-regulatory behaviours and the characteristics of the 'self-regulating' driver as well as those who fail to self-regulate. The survey also considers issues relating to driving cessation amongst current and former drivers, factors that contributed to driving cessation, alternative transport options and the impact of driving cessation on aspects of their life.

3 SURVEY OF CURRENT AND FORMER OLDER DRIVERS

To gather information on the self-regulatory practices of older drivers in Australia, a comprehensive survey was conducted among a sample of older drivers and former drivers, aged 55 years and older, in metropolitan, regional and rural Victoria. A detailed description of the recruitment phase, development of the questionnaire, interview procedure and characteristics of the sample population is provided in Section 3.1. Following this, the findings of the survey are presented describing the driving and travel behaviour of participants. Key aspects of the analyses include the adoption of specific self-regulatory behaviours such as changes in driving distances, frequency and speed and behaviours; perceived confidence and difficulty in specific driving situations (at night, in busy traffic, etc.) and avoidance of these situations. Common reasons for self-regulatory driving patterns are also presented. Consideration is given to participant characteristics that are associated with the adoption of (or failure to adopt) self-regulatory behaviour(s). A particular focus is the association between driver characteristics, failure to self-regulate and crash risk. Last, the experiences of former drivers are described, including factors that contributed to their decision to stop driving, those involved in their decision-making and current availability and use of various transport options.

3.1 METHOD

Recruitment of Participants

Potential participants were recruited using a number of sources including articles in magazines, flyers distributed at groups, clubs and organisations frequented by seniors, and local council aged care services. The following organisations and agencies assisted with recruitment of volunteers:

- Royal Automobile Club of Victoria (RACV),
- Department of Human Services – Seniors Card Centre,
- Council On The Ageing, Victoria,
- Probus Victoria,
- Local Councils, Aged and Disability Care Services – metropolitan and regional councils in Victoria.
- Country Women’s Association – regional clubs,
- VicRoads – Road Safety Co-ordinators,
- Rosebud Police Senior Citizens Register,
- The Herald-Sun and Weekly Times newspapers,
- Neighbourhood watch newsletters, and
- Retirement villages – metropolitan and regional.

Newspaper and magazine articles and flyers sent to clubs and organisations provided a brief description of the background and aims of the study and contact details for participants to volunteer (see APPENDIX A). Potential participants expressed their interest in volunteering for the survey by contacting MUARC, either by telephone, mail or e-mail. Within 2-3 weeks of initial contact, participants were contacted by telephone and a time was arranged for the interview. At this time, potential participants were screened to

ascertain eligibility for inclusion in the study, that is, that they were aged 55 years or older and were either a current driver or had in the past been a driver. An explanatory letter was mailed to all participants prior to the interview (see APPENDIX B).

Questionnaire Development

The questionnaire was designed to gather information on the driving practices of older drivers, transportation needs and driving decisions. The project research team developed the survey questions with input from a number of sources, including:

- University of North Carolina, Highway Safety Research Center,
- American Association for Retired Persons (AARP),
- University of Michigan, Transportation Research Institute,
- University of Arizona, Department of Psychology,
- University of Alberta, Department of Psychology, and
- University of Queensland, Healthy Ageing Unit.

Draft versions of the questionnaire were sent to members of the Project Advisory Committee for comment. Revisions were made to the survey based on feedback from the Committee.

Two separate questionnaires were developed, one for current drivers and one for former drivers. Both groups were asked general questions about demographic characteristics, general health, crash and infringement history, and driver education courses. Current drivers were also asked questions relating to driving patterns, transportation needs, recent changes in their driving, driving situations, avoidance of driving situations, self-assessment of driving ability, driving cessation, and alternative transport options. Information sought from former drivers included questions relating to satisfaction with current mobility options, modes of transportation used, factors influencing their decision to stop driving, the process leading up to driving cessation, and the likelihood of driving in the future.

Interview Procedure

Telephone interviews were conducted between March 2002 and October 2002. Average interview times were around 25 minutes and ranged from 10 minutes (for former driver interviews) to 50 minutes. The interviews were conducted by five experienced telephone interviewers and were scheduled primarily during the daytime on weekdays, with some interviews scheduled in early evenings and on weekends according to participant preference.

Efforts were made to obtain adequate representation of male and female participants from metropolitan Melbourne, country towns and rural areas. In addition, recruitment targeted particular age groups of drivers in order to achieve a sample that adequately reflected the population of licensed drivers across the age span from 55 years.

3.2 RESULTS

Sample Characteristics

A large cross section of older drivers and former drivers (those who had stopped driving within the last two years) aged 55 years and over participated in a telephone interview. In total, 685 volunteers participated in the study. In this section, the demographic

characteristics of the participants are presented. Table 1 provides information on age, gender and place of residence of the survey participants.

Table 1 Summary of age, gender and place of residence of survey participants

	Proportion of overall sample (%) n=685	Proportion of current drivers (%) n=656	Proportion of former drivers (%) n=29
<u>Age</u>			
55 to 64 years	25	26	4
65 to 74 years	37	38	14
75+ years	38	36	82
<u>Gender</u>			
Male	65	65	52
Female	35	35	48
<u>Place of Residence</u>			
Metropolitan	62	61	76
Country town	19	20	0
Rural	19	19	24

The sample comprised 656 current drivers (96%) and 29 (4%) former drivers. Of those participants who indicated that they were a current driver, 26 percent were aged between 55 and 64 years, 38 percent were aged between 65 and 74 years old and 36 percent were aged 75 years and older. In contrast, former drivers were generally older than current drivers, with 82 percent of the sample aged 75 years or over. There were very few former drivers under 64 years of age (4%).

Recent data for the overall population of Victorian licence holders aged 55 years and older in 1997 (VicRoads, 2002) show that 58 percent are male and 42 percent are female. Of these, 48.6 percent are aged 55-64 years (50% of females and 48% of males), 35.3 percent are aged 65-74 years (35% of females and 36% of males), and 16.1 percent are aged 75 years and older (15% of females and 17% of males).

Figure 3 shows the distribution of the sample of current driver participants by age group and gender in relation to the population of Victorian licence holders. Even though only 35 percent of the sample was female, this was only marginally below the proportion of older licensed female drivers in Victoria (42%). Further, when broken down by age group, no gender differences were apparent when comparing the proportion of licensed drivers. A comparison showed that the sample may be over-representative of drivers in the oldest age categories (75 years and older) and under-representative of drivers in the youngest age group (55-64 years) for both male and female drivers.

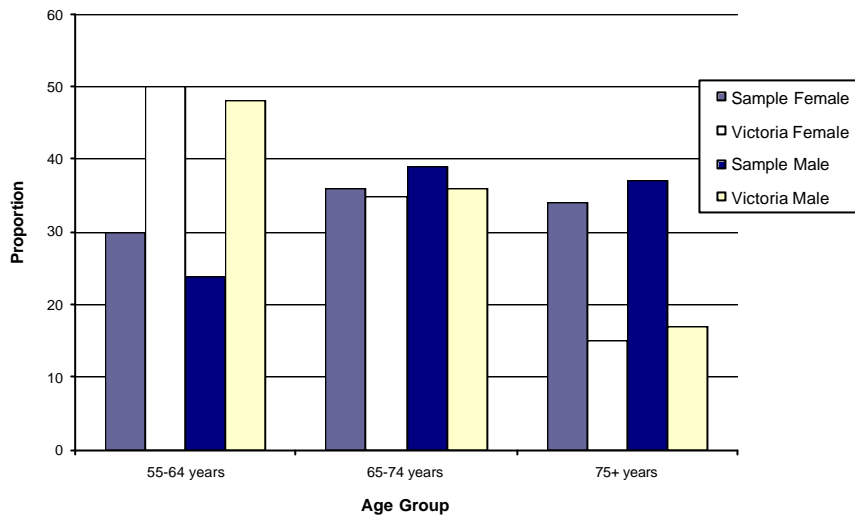


Figure 3 Age and gender distribution of sample and comparison with Victorian licence holders

Table 2 provides a summary of other demographic characteristics of the survey participants, including employment and marital status and highest level of education.

Table 2 Summary of other demographic variables

	Proportion of overall sample (%) n=685	Proportion of current drivers (%) n=656	Proportion of former drivers (%) n=29
<u>Employment status</u>			
Not working	62	61	90
Working part-time	28	29	10
Working full-time	10	10	0
<u>Marital status</u>			
Married	65	66	38
Divorced	8	8	14
Separated	2	2	0
Never married	4	4	0
De facto	1	1	0
Widowed	20	18	48
<u>Education Level</u>			
Primary school	<1	<1	3
Up to 3 yrs of high school	15	15	17
4 to 6 yrs of high school	41	41	55
College / university	43	44	24

The majority of current drivers indicated that they were not working. Approximately one-third were working part-time (this includes voluntary work and paid work) and 10 percent were working full time. As expected, the majority of former drivers (90%) were not currently working, and of those who were working, all were employed part time in either voluntary or paid positions.

Of those participants in the sample of current drivers, approximately two-thirds (66%) were married and 18 percent were widowed. For former drivers, just less than 40 percent were married and almost half (48%) were widowed.

The majority of both current and former drivers had at least 4-6 years of high school education. Surprisingly, a high proportion of current drivers indicated that the highest level of education they had reached was college, university or tertiary education (44%). Unfortunately, no additional details of the types of other tertiary education were available and this figure may include education at a Technical and Further Education (TAFE) institution, which encompasses trade apprenticeships and other vocational training. As expected, however, a much greater proportion of current drivers had completed college/university/other education compared with former drivers (24%).

Licensing and Driving Status

Participants were asked about their driving and licence status and car ownership. All current drivers held a valid drivers licence, while 16 of the 29 of former drivers (55%) held a valid licence, even though the majority had not driven for at least two years.

Table 3 summarises details of participant age at first licensing by age and gender for current and former drivers. Overall, the majority of current drivers obtained their licence between 18 and 30 years of age. The younger participants were more likely to have obtained their licence at a younger age (at 18 years) than older current drivers. Drivers aged 75 years and older were more likely than drivers in the two younger groups to have obtained their licences at age 31 years or older (14% compared with 3% and 5%).

Table 3 Age at first licensing by age and gender for current and former drivers by age and gender

Age (Years)	Overall current drivers (%) n=653	Age of current drivers (%)			Gender of current drivers (%)	
		55-64	65-74	75+	Male	Female
18 or less	48	52	46	42	58	29
19-30	44	35	48	45	38	55
31-40	6	2	4	10	3	12
41-50	1	0	0	3	1	1
Over 50	1	1	1	1	0	3

More males obtained their licence at early ages (18 years or younger) than females (58% vs 29%), while females were more likely than males to obtain their licence between the ages of 19 and 30 years (55% vs 38%). Interestingly, a higher proportion of females (16%) obtained their licence at aged 31 years or older, compared to only 4% of males.

For former drivers, the majority also obtained their licence under 30 years (86%) with 59 percent of these obtaining their licence between the ages of 19 and 30 years. This suggests that majority of former drivers were experienced drivers, having driven for over 45 years. An underlying assumption here is that years since obtaining first licence is an adequate proxy for years of driving experience, although this cannot be substantiated with the current set of data.

Participants were also asked to indicate if they had some kind of restriction on their licence. Seventeen percent of participants indicated that they had a restriction on their licence. As shown in Table 4, the most prevalent type of restriction (91%) was the requirement to wear glasses. A point of interest is that a further 10 respondents mentioned that they are not required to wear glasses as a condition of their licence but do so anyway.

Table 4 Summary of licence restrictions

Condition	Number and Percentage (%) of Licence Holders with Restrictions	
	n	%
Wear glasses	109	91
Car modifications	8	7
Other	7	6

Multiple response question – total may exceed 100%

The majority of participants (96%) owned a car. Of those who were current drivers, 99 percent owned a car. Interestingly, 35 percent of former drivers also owned a car, even though the majority had not driven for at least two years. No gender differences were found for current drivers.

CURRENT DRIVERS

Of the 685 participants interviewed, 656 (96% of the total sample) considered themselves current drivers and all still held a valid driver's licence. Current drivers were asked a range of questions relating to their driving experience, driving patterns, medical problems and use of prescription medications, self-assessment of driving ability, confidence and avoidance in particular driving situations, planning for driving cessation, alternative transport options, crash involvement and infringements, and driver education.

Driving experience and frequency of driving

All current drivers were asked general questions about their driving experience and frequency of driving. Drivers were asked to indicate whether they are usually the one who does most of the driving in their household (see Table 5). Overall, 86 percent of current drivers reported that they were the principal driver in the household. Males were more likely than females to be the principal driver (90% vs 78%) and drivers aged 75 years and older (90%) were more likely than younger drivers to be the principal driver (85% and 83%). Place of residence did not appear to influence principal drivers status.

Table 5 Proportion of drivers (%) reporting as the principal driver in household by Gender, Age and Place of Residence

	Overall (%)	Gender		Age			Place		
		Female	Male	55-64	65-74	75+	Urb	Cntry Town	Rural
Principal Driver	86	78	90	85	83	90	87	86	86

Table 6 summarises the reported number of days per week driven by gender, age and place of residence. Chi-Square analyses (daily vs less than daily) showed that males were 1.8 times more likely than females to drive daily ($\chi^2(1)=5.95$, $p=0.015$). Significant differences were also found between drivers grouped by age (75 years and older vs 55-74 years). Drivers aged 55-74 years were 2.4 times more likely to drive daily than those 75 years and older, ($\chi^2(1)=25.09$, $p<0.001$). Interestingly, no differences were found between drivers grouped by place of residence, $p=0.7$.

Table 6 Days driven per week by Gender, Age and Place of Residence

Number of Days Driven	Overall (%)	Gender		Age			Place		
		Female	Male	55-64	65-74	75+	Urb	Cntry Town	Rural
Daily	71	65	74	79	77	59	71	74	69
3-4 days per week	21	23	21	13	17	32	23	18	21
1-2 days per week	7	11	4	8	6	7	5	8	9
A few days per month	1	<1	<1	0	0	2	0	1	1
Don't know/NA	<1	0	<1	0	0	0	0	0	1
TOTAL	100	100	100	100	100	100	100	100	100

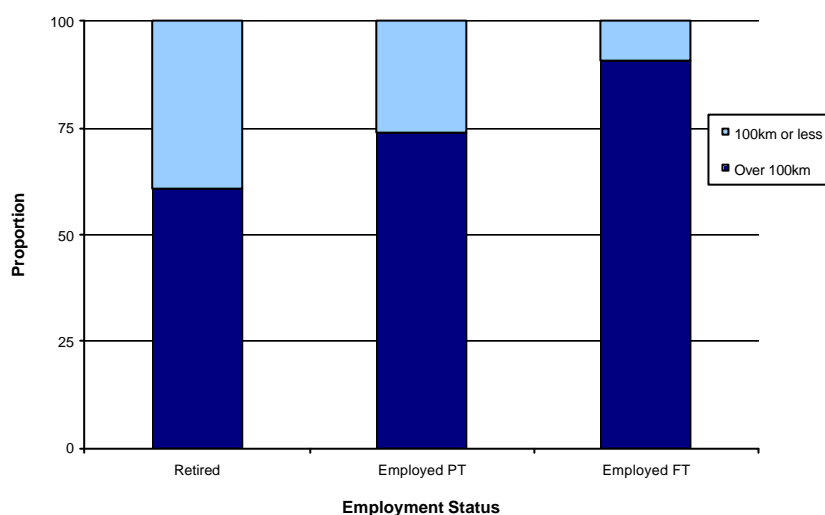
Table 7 shows the reported distances travelled each week in kilometres. Overall, the majority of drivers drove over 100 kilometres in a typical week (67%), with almost half of the participants indicating that they drove over 200 kilometres per week (46%).

Chi-square analyses revealed significant gender differences with males 2.5 times more likely to drive more than 100 kilometres per week than females ($\chi^2(1)=28.72$, $p<0.001$). Drivers aged 55-74 years were 2.7 times more likely than older drivers (those aged over 75 years) to indicate that they drove more than 100 kilometres per week ($\chi^2(1)=33.56$, $p<0.001$). Only 54 percent of this age group drove more than 100 kms compared to 76 percent of the younger drivers. No significant differences in distances driven by place of residence were observed, $p=0.6$. These findings generally mirror those for driving frequency.

Table 7 Kilometres driven per week by Gender, Age and Place of Residence

Distance driven	Overall (%)	Gender		Age (yrs)			Place		
		Female	Male	55-64	65-74	75+	Urb	Cntry Town	Rural
20 kms or less	4	6	3	3	2	6	3	4	6
21–50 kms	9	13	6	2	10	12	10	3	12
51–100 kms	20	27	16	14	16	28	19	23	18
101–200 kms	21	25	19	21	23	19	22	22	17
> 200 kms	46	29	56	60	49	35	46	48	48
TOTAL	100	100	100	100	100	100	100	100	100

Not surprisingly, weekly travel distance was also significantly related to employment status ($\chi^2(1)=33.56$, $p<0.001$). As shown in Figure 4, a higher proportion of drivers who were employed full-time (91%) reported that they drive more than 100 kilometres per week than either part-time employees (74%) or retirees and unemployed (61%).

**Figure 4 Weekly driving distances (kilometres) by employment status**

Drivers were also asked questions relating to their satisfaction with driving. In particular, drivers were asked “Would you say that you are driving: More than you would like; about as much as you would like; or less than you would like; (or don’t know)”. Table 8 summarises these responses.

In general, more than three-quarters of all drivers indicated that they were driving about as much as they would like (78%). Younger drivers (those aged 55 to 64 years) were slightly more likely to indicate that they drove more than they would liked compared with older age groups (14% vs 6% and 2%). Few differences in driving satisfaction were evident between male and female drivers and across the three places of residence.

Table 8 Amount of driving (more/less/as much as would like) by Gender, Age and Place of Residence

Amount of Driving	Overall (%)	Gender		Age			Place		
		Female	Male	55-64	65-74	75+	Urb	Cntry Town	Rural
More than like	7	7	6	14	6	2	7	5	6
About as much as like	78	76	79	72	82	78	77	84	76
Less than like	15	17	14	14	11	20	15	11	18
Don't know	<1	0	1	0	1	0	<1	0	0
TOTAL	100	100	100	100	100	100	100	100	100

Drivers were asked to indicate the places that they would drive to in a typical week (see Table 9). The most commonly reported destinations were the post office, bank and shops (87%) and visits to family and friends (83%). Other destinations included sports and social clubs (60%), the doctor (35%) and church (30%). Thirty-four percent indicated that they drove to and from work. This is not surprising, given that 39 percent of current drivers indicated that they worked full- or part-time.

Table 9 Places driven in a typical week

Places driven to	Proportion of drivers (%)
Post office, bank, shops	87
Work (driving to or from work)	34
Doctor	35
Sports/social clubs	60
Church	30
Friends and family	83
Other (e.g., work-related driving, recreational driving, library, other leisure activities)	18

Participants were also asked whether they had made any long-distance trips as a driver in the last 5 years. As summarised in Table 10, the majority of participants indicated that they had made at least one long-distance trip, i.e., going interstate or long-distance holidays, as a driver in the last 5 years (79%). Males were 2.3 times more likely than females to indicate that they made a long-distance trip ($\chi^2(1)=18.28$, $p<0.001$). Younger drivers (55-74 years) were also 2.4 times more likely to indicate that they made a long-distance trip than those aged 75 years and older ($\chi^2(1)=19.97$, $p<0.001$). Place of residence did not affect long-distance trip-making, $p=0.4$.

Table 10 Proportion of current drivers who make long distance trips as a driver by Gender, Age and Place of Residence

	Overall (%)	Gender		Age			Place		
		Female	Male	55-64	65-74	75+	Urb	Cntry Town	Rural
Make long-distance trips	79	70	84	87	83	70	78	81	83

Of those participants who indicated that they made long distance trips, 58 percent said that they shared the driving. Fifty-four percent of females and 45 percent of males indicated that they shared the driving. Additionally, younger drivers were more likely to indicate that they shared than older drivers (51%, 54% and 38%, respectively).

For those who did not share the driving, a range of reasons were given, such as driving alone (31%), passenger preference not to drive (22%), driver's preference to drive (20%), partner or passenger doesn't drive (18%).

Drivers in the current study were asked if they liked to have a passenger in the car while they are driving (see Figure 5). This was of interest because there have been reports suggesting that some older drivers prefer a front seat passenger while driving to assist them by helping to watch for cars, read signs and assist with route finding.

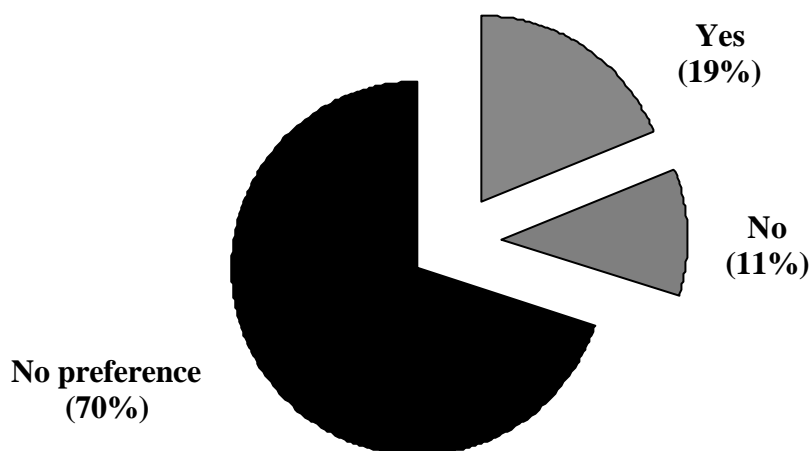


Figure 5 Preference for someone to accompany driver

Only 19 percent of drivers indicated that they preferred to have someone accompany them when driving. The majority said that they had no preference (70%) while 11 percent preferred no one with them when driving. Age differences in preference for passengers were minimal (15%, 20% and 19%, for 55-64, 65-74 and 75+ year olds, respectively). Females were less likely to report that they preferred someone with them when driving than males (12% vs 23%). Table 11 summarises reasons for preferences.

Of those who indicated that they liked to have company while driving, the most common reason was for the social aspect of having someone with them:

“I prefer the company. Someone to talk to and share the views with.”

Of those who indicated that they preferred company in order to assist the driver, reasons provided included: heightens alertness (11%), for navigation (7%), other practical assistance (3%), confidence and security (2%) and safety (2%).

Table 11 Reasons for wanting car passengers

Reason	Frequency	%
Social reasons (enjoys the company)	100	82
Assist driver	34	28
Other	4	2

Multiple response question: total may exceed 100%.

Self-rated health, medical conditions and use of medication

Medical conditions and use of medication

Drivers were asked about medical conditions including vision problems, heart problems, diabetes, respiratory problems, arthritis, and other conditions. Table 12 summarises conditions reported by current drivers.

Table 12 Medical conditions

Medical condition	Proportion of current drivers with condition (%)
Vision	77
Heart problems	23
Diabetes	6
Respiratory problems	10
Arthritis	41
Stroke	6
High Blood Pressure	13

The most commonly reported medical condition was ‘problems with vision’. The proportion of participants indicating they had vision problems decreased with age, with 84 percent, 75 percent and 73 percent of young, young-old and old-old participants reporting these problems respectively. The most commonly reported vision problems were long-sightedness (presbyopia) (33%) and short sightedness (myopia) (27%). Other conditions included cataracts (4%) and glaucoma (3%).

Of those 23 percent of participants who reported heart problems, the oldest group were more likely to report these problems (35%) than the two younger groups (11% and 18% for young and young-old groups respectively).

Of those participants with arthritis, the two older groups were more likely to report having this condition (42% and 48% for young-old and old-old groups respectively) than the youngest group (29%).

Drivers were also asked about medications and how they might affect driving ability. The majority (71%) of drivers were currently taking medications prescribed by their doctor for a medical condition and 22 percent also indicated that they were taking an over-the-counter (or non-prescribed) medication. Older participants were more likely to take medication than younger participants, with 83 percent of old-old and 89 percent of young-old taking medication compared with only 59 percent of younger participants. Only 22 percent of participants were taking one prescribed medication, and 42 percent took between two and five prescribed medications each day, with only six percent taking five or more prescribed medications per day.

Only three percent of drivers (or 14 respondents) felt that some of the medications they were taking had a negative effect on driving and 39% (or 5 respondents) said that they generally avoided driving while they were on medications.

Self-rated health and functional abilities for safe driving

An important factor in the adoption of self-regulatory behaviour is an awareness of functional abilities and health issues that can affect driving ability. Drivers were asked to rate their health and functional performance for safe driving and the findings are shown in Table 13.

Table 13 Current drivers' ratings of overall health for safe driving by Gender, Age and Place of Residence

Self-rated health	Overall (%)	Gender		Age			Place		
		Female	Male	55-64	65-74	75+	Urb	Cntry Town	Rural
Excellent	45	50	43	57	50	33	46	44	46
Good	53	49	56	43	49	64	53	56	51
Fair	1	<1	1	0	<1	3	1	0	3
Poor	<1	0	0	<1	0	0	<1	0	0
TOTAL	100	100	100	100	100	100	100	100	100

Almost all participants rated their health for safe driving as either excellent or good. Chi-square analyses were conducted to evaluate differences in ratings (excellent vs good, fair or poor) across gender, age and place of residence. Interestingly, females were more likely than males to rate their health as excellent (50% vs 43%), while males were more likely to rate their health as good, fair or poor (57% vs 50%), however, these differences were not significant, $p=0.08$. Age differences were found, with those aged 75 years and older less likely to indicate that their health was excellent compared with the two younger age groups (33% vs 57% and 50%) ($\chi^2(2)=26.5$, $p<0.001$). No differences were observed between participants grouped by place of residence ($p=0.9$).

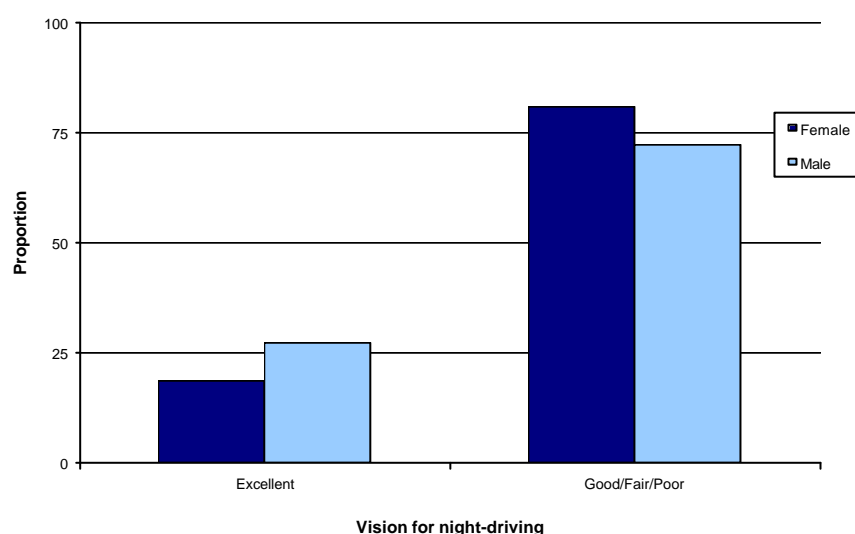
The majority of participants rated their functional abilities as either excellent or good, ranging from 76 to 98 percent, with most rating their abilities as good. Separate chi-square analyses were conducted for each of the functional abilities to evaluate differences in ratings (excellent vs good, fair or poor) across gender, age and place of residence.

Table 14 Summary of self-ratings of various functional abilities for safe driving

Self-ratings	Vision: Day driving	Vision: Night driving	Make decisions quickly	Upper body strength	Lower body strength	Head/neck mobility
Excellent	49	24	38	39	38	30
Good	49	52	58	57	58	59
Fair	2	19	4	4	4	11
Poor	<1	4	<1	0	0	1
TOTAL	100	100	100	100	100	100

Ninety-eight percent of participants rated their vision for safe driving during the daytime as either excellent (49%) or good (49%). Ratings of vision for daytime driving did not differ across place of residence and no differences were observed between males and females (p 's 0.53 and 0.76). However, drivers aged 75 years and older were significantly less likely (35%) to rate their day vision as excellent than drivers aged 55-74 years (56%) ($\chi^2(1)=25.82, p<0.001$).

Fewer participants rated themselves as excellent on vision for night driving (24%), than they did for any other driving-related ability (30-49%) (see Table 14). Females (19%) were less likely than males (27%) to rate their night vision as excellent ($\chi^2(1)=6.02, p=0.014$) (see Figure 6).

**Figure 6 Self-ratings of vision for safe night driving by gender**

Similarly, Figure 7 shows that drivers aged 75 years and older were less likely than those aged 55-74 years to rate their night vision as excellent (16%, vs 29%, respectively) ($\chi^2(1)=13.65, p<0.01$). Ratings of night vision were not affected by place of residence ($p=0.08$).

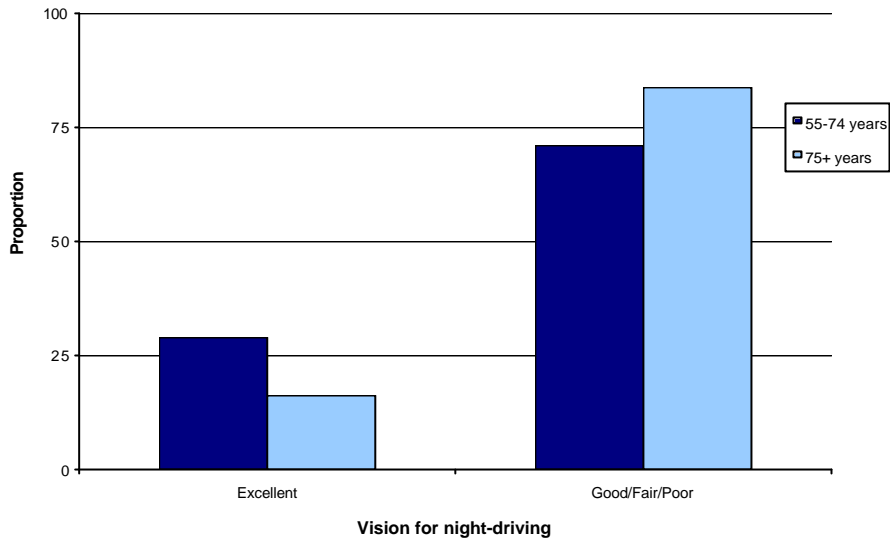


Figure 7 Self-ratings of vision for safe night driving by Age (75yrs+ vs 55-74 yrs)

Most drivers rated their ability to make decisions quickly for safe driving as either good (58%) or excellent (38%). As shown in Figure 8, drivers aged 75 years and older were less likely to rate themselves as excellent compared with those aged 55 to 74 years (27% vs 44% respectively) ($\chi^2(1)=19.88, p<0.001$). No differences were observed between male and female ratings and no effect of place of residence was found (p 's=0.7).

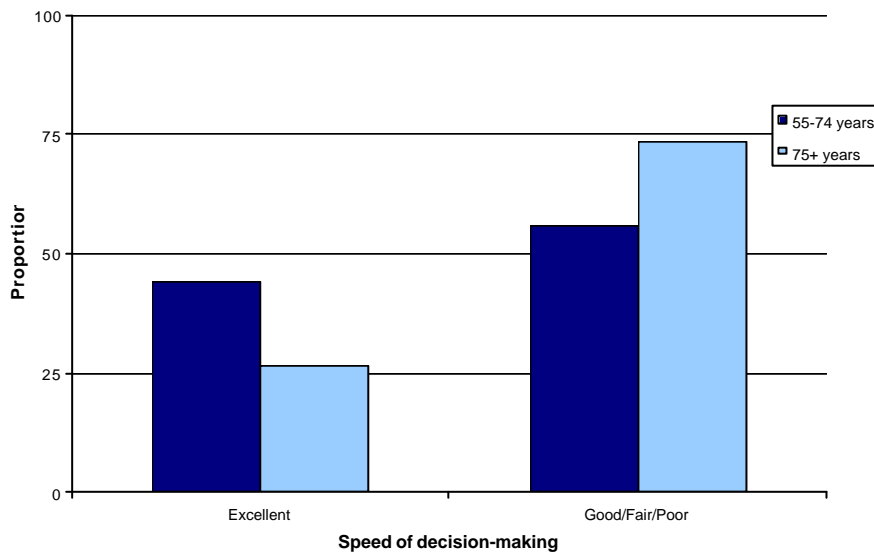


Figure 8 Self-ratings of speed of decision-making by Age (75 yrs + vs 55-74 yrs)

The majority of drivers rated their strength as either excellent (38-39%) or good (57-58%). As shown in Figure 9, older drivers were less likely to rate their upper body strength as excellent compared with drivers aged 55 to 74 years ($\chi^2(1)=40.42, p<0.001$). Patterns were similar for ratings of lower body strength (21% vs 47% for 75yrs+ vs 55-74 yrs) ($\chi^2(1)=44.05, p<0.001$). No differences in strength ratings were found for gender or place of residence (p 's ranged from 0.3-0.7).

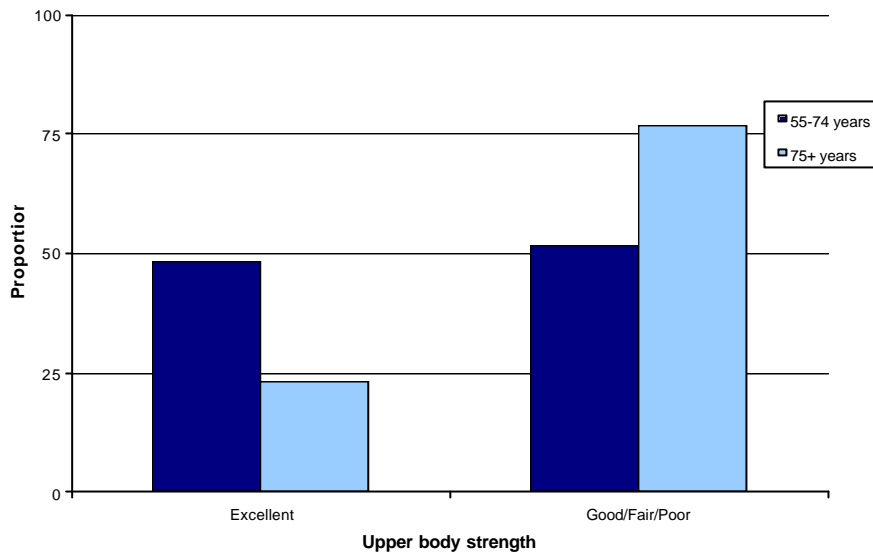


Figure 9 Self-ratings of upper body strength by Age (75 yrs + vs 55-74 yrs)

The same pattern of ratings was observed for head and neck mobility for safe driving. That is, most drivers rated their mobility as either excellent (30%) or good (59%). No differences were evident between ratings of males and females ($p=0.7$). Similarly, no effect was found for place of residence ($p=0.8$). Compared with those aged 55 to 74 years, significantly fewer drivers aged 75 years and older rated their head and neck mobility as excellent ($\chi^2(1)=42.02, p<0.001$) (see Figure 10).

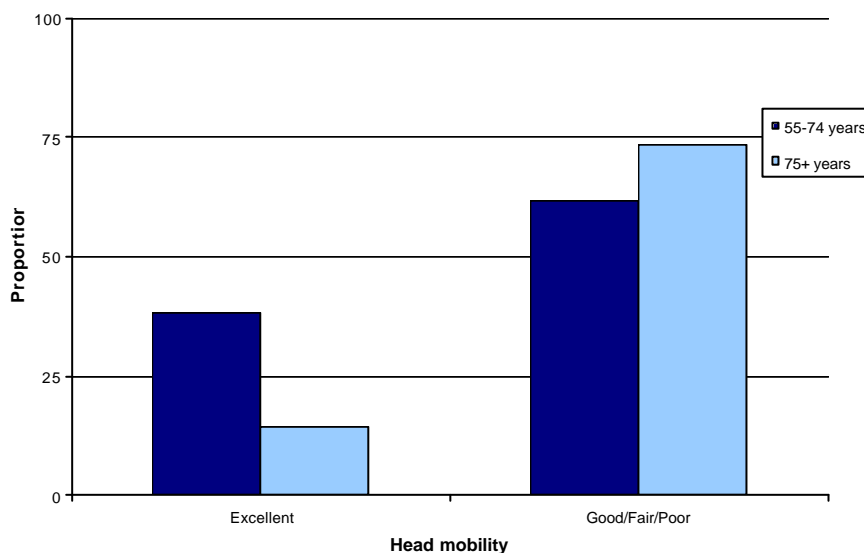


Figure 10 Self-ratings of head and neck mobility by Age (75 yrs + vs 55-74 yrs)

Travel patterns, medical conditions and health ratings

The amount and frequency of travel was examined across self-reported health ratings, medical conditions and use of prescribed medications. Of interest was whether health and medical status or use of medications affected travel distance or frequency of trips.

Analyses revealed that there was a significant relationship between overall health ratings (categories were grouped for analyses as ‘excellent’ vs ‘good, fair or poor’) and the reported weekly travel distances in kilometres (categories were grouped as ‘more than 100 km’ vs ‘100 km or less’) ($\chi^2(1)=5.91, p=0.015$) (see Figure 11).

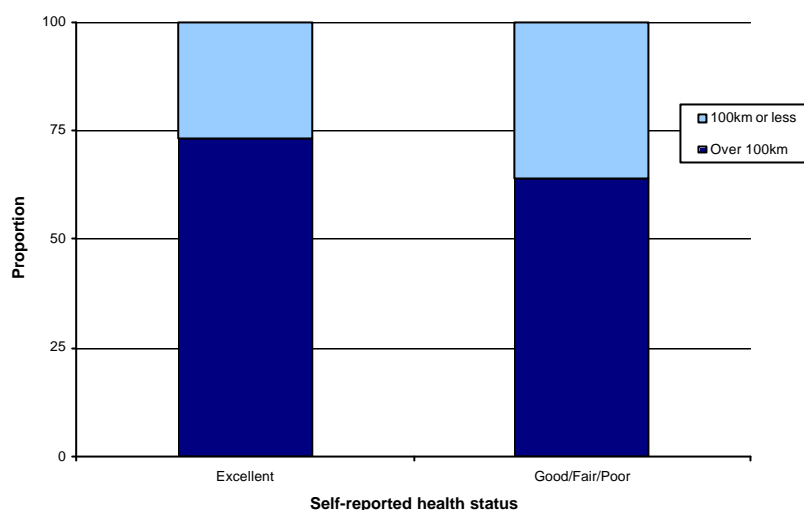


Figure 11 Weekly driving distance (km) by self-reported overall health status

The same pattern was observed for frequency of trips (categories were grouped as ‘daily’ vs ‘less than daily’) ($\chi^2(1)=5.27, p=0.022$) (see Figure 12). Drivers who rated their health as good, fair or poor, were 1.5 times more likely to drive 100 km or less and also 1.6 times more likely to drive less than daily than those who rated their health as excellent.

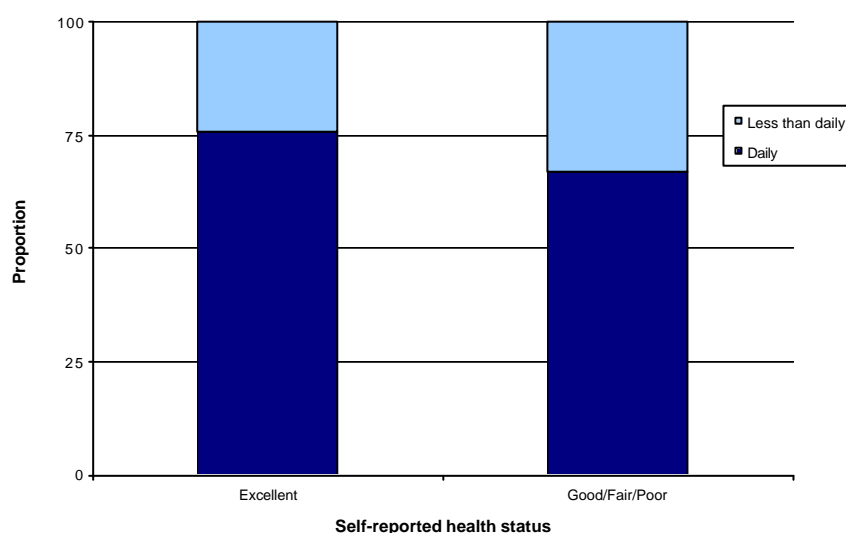


Figure 12 Frequency of driving by self-reported overall health status

Analyses of weekly driving distance and frequency of driving was also compared across medical conditions for each of the three most frequently reported medical conditions: vision problems, heart problems and arthritis. Those with arthritis were 1.9 times more likely to drive shorter distances (100 km or less) than those without arthritis ($\chi^2(1)=13.97, p<0.0001$) (see Figure 13).

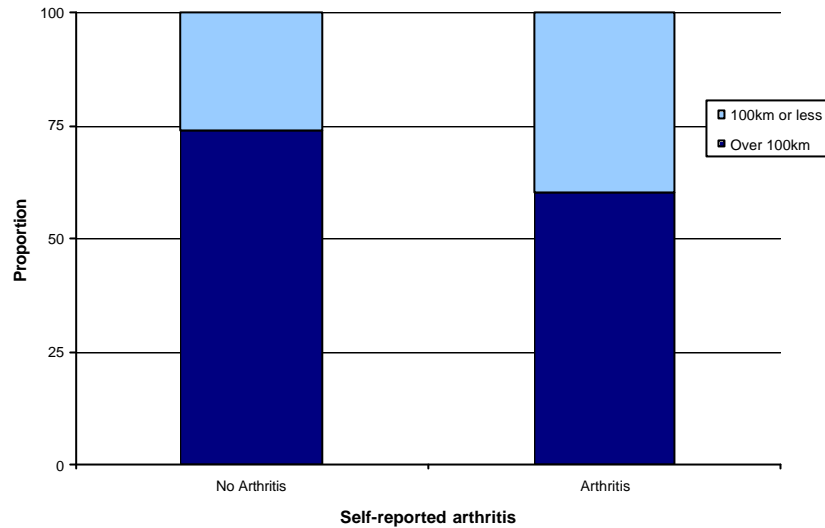


Figure 13 Weekly driving distance (km) by self-reported arthritis

Driving distance was also related to use of medications (taking any prescribed medications: yes/no) ($\chi^2(1)=5.50$, $p<0.019$) (see Figure 14). Those who took medications were 1.6 times more likely to drive only 100 kilometres or less than those who did not take medications. No significant relationship was found between driving distance and use of prescribed medication, $p=0.4$.

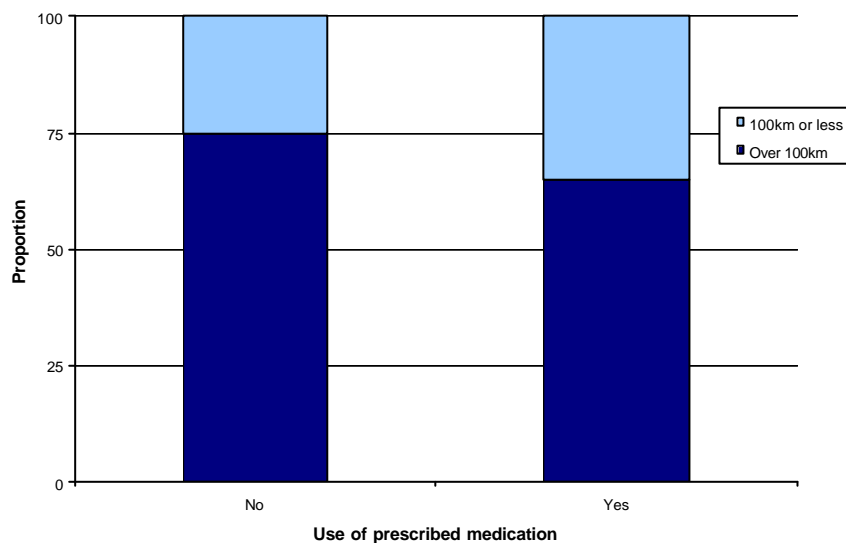


Figure 14 Weekly driving distance (km) by use of prescribed medication

Changes in driving

Drivers were asked if their amount of driving had changed over the past five years. As shown in Table 15, the majority of participants (86%) indicated that they either drove the same amount (45%) or less (41%), with few indicating that they drove more compared to five years ago (14%). No gender differences were apparent, $p=0.285$. However, significant differences were observed across age groups ($\chi^2(4)=30.3$, $p<0.001$). More drivers aged 75 years and older indicated that they drove less than they did five years ago compared with

the two younger age groups (49% vs 38% and 37%). In addition, change in driving frequency was influenced by place of residence ($\chi^2(4)=13.99$, $p=0.007$). Those living in country towns (84%) were more likely to report that their driving was about the same over the last five years compared with those living in urban (77%) and rural areas (76%).

Table 15 Change in frequency of driving by Gender, Age and Place of Residence

Change in Driving Frequency	Overall (%)	Gender		Age			Place		
		Female	Male	55-64	65-74	75+	Urb	Cntry Town	Rural
Drive more	14	15	14	25	13	7	7	5	6
Drive about the same	45	42	41	37	50	44	77	84	76
Drive less	41	43	45	38	37	49	15	11	18
Don't know	0	0	0	0	0	0	<1	0	0
TOTAL	100	100	100	100	100	100	100	100	100

Participants were also asked to indicate reasons why their driving had changed over the last five years. A substantial proportion of those who reported an increase in driving (34%) indicated that this was due to employment situations. Other reasons included changes in lifestyle including moving house, changes in activity patterns, family commitments, health or simply due to “ageing” (of self or partner/spouse), use of alternative transport options, and lack of confidence with specific driving situations. Tables 16 and 17 summarise these responses. The reasons given for driving more frequently were related to changed employment situations. Other reasons included a change in availability of another driver in the household, change in place of residence or other family-related circumstances.

Table 16 Reasons for driving more than five years ago

Reason	Current Drivers (n=92)	
	Frequency	%
Changed employment/taken up voluntary work	23	25
Retired/semi-retired - more time for travel	19	21
Spouse no longer able/available to drive	15	16
Moved house	15	16
Family moved/left home/commitments	8	9
Other	17	18

Multiple response question – total may exceed 100%

Some of the responses included:

“Got more time to go places instead of being locked up in an office all day”

“My husband has died so I am the only driver now”

“I have moved to the country, so to go to places we need to travel further”.

Similarly, of those who indicated that their driving had decreased over the last five years, about one-third (34%) reported that this was due to changes in employment situations or changes in lifestyle such as moving house (38%). Seventeen percent identified health or age-related issues and others a lack of confidence (6%) with specific driving situations, suggestive of appropriate self-regulation. Other reasons included changes in activity patterns, changes in family commitments and use of other transport options.

Table 17 Reasons for Driving Less than Five Years Ago

Reason	Current Drivers (n=272)	
	Frequency	%
General lifestyle changes	104	38
<i>Cut back on activities/less need</i>	38	14
<i>Moved house</i>	28	10
<i>Changed family commitments</i>	21	8
<i>Lifestyle changes – unspecified</i>	13	5
Financial reasons	7	3
Employment changes	92	34*
<i>Retired/semi-retired</i>	80	29
<i>Changed job</i>	12	4
Health/age (of self or spouse)	45	17
Use alternative transport	35	13
Driving issues	15	6
<i>Avoidance of certain road situations</i>	7	3
<i>Lack of confidence in safe driving</i>	11	4
Other	13	5

Multiple response question – total may exceed 100% for both categories and subcategories

* % category total may not equal subcategory total due to rounding

Some of the responses included:

“Have moved down to Melbourne – no need to drive as much”

“No longer the chauffeur for the children”

“Have retired – don’t have to drive to work anymore”

“I had a knee replaced 2 years ago and so we haven’t been travelling so much”

“We do more bus holidays now and therefore less driving”

“I don’t think I’m very safe on the roads for others and so I have curtailed my driving”.

Next, drivers were asked if they had noted a change in their driving speed over the last five years. Table 18 shows that very few participants indicated that they drove faster now compared to five years ago. The majority indicated that they either drove about the same (58%) or drove slower (40%).

Table 18 Change in driving speed by Gender, Age and Place of Residence

Change in Driving Speed	Overall (%)	Gender		Age			Place		
		Female	Male	55-64	65-74	75+	Urb	Cntry Town	Rural
Drive faster	2	4	1	4	2	1	1	3	3
Drive about the same	58	62	56	57	56	61	60	57	54
Drive slower	40	34	43	40	42	38	39	40	42
TOTAL	100	100	100	100	100	100	100	100	100

Female drivers were more likely than male drivers to indicate that their driving speed had not changed over the last five years, while male drivers were more likely than female drivers to indicate that they drove slower now compared to five years ago ($\chi^2(2)=6.9$, $p<0.032$). No significant age differences were found, $p=0.4$. Similarly, place of residence did not appear to influence change of driving speed, $p=0.6$.

Of those who indicated that they drove slower, most attributed this to safety-related issues (38%), including speed restrictions (34%) and enforcement (16%). Specific examples include:

“Age. Reflexes are not as good”

“Wiped off 5”

“Sick of being fined”

“Speed cameras”

“More hoons and road rage – need more caution”

Of those who indicated that they drove the same compared to five years ago, responses generally mirrored those noted above, that is, safety reasons were predominant. This suggests that this group of participants have generally complied with speed regulations. The majority of this group indicated that they drove at the same speed because they had always kept to speed limits (44%). Some of the reasons given included:

“I stay within the limits of safety. I prefer to operate on the side of caution and safety”.

Next, drivers were asked to rate the quality of their driving now, compared to 5 years ago (see Table 19). Most drivers indicated that their driving quality was about the same (80%). Of those who indicated that their driving had changed, similar proportions of drivers indicated that their driving was ‘better’ or ‘not as good’ (11% and 9%). No significant gender differences were found, $p=0.285$. Similarly, place of residence was independent of driving quality, $p=0.54$. In contrast, significant age differences were found across categories of driving quality, $\chi^2(4)=19.8$, $p=0.001$. The youngest participants (19%) were more likely to rate their driving quality as better than five years ago than both the young-old and the oldest participants (10% and 6%, respectively).

Table 19 Rating of driving quality by Gender, Age and Place of Residence

Driving Quality	Overall (%)	Gender		Age			Place		
		Female	Male	55-64	65-74	75+	Urb	Cntry Town	Rural
Better	11	12	11	19	10	6	12	12	9
About the same	80	81	79	70	83	84	79	79	85
Not as good	9	7	10	11	7	9	10	9	6
TOTAL	100	100	100	100	100	100	100	100	100

Relationship between changes in frequency, speed and quality of driving

Chi-square analyses were conducted to examine the relationships between changes in driving quality (better or same vs not as good), frequency (more or same vs less) and speed (faster or same vs slower). Of particular interest, for example, was whether those who rated their quality of driving 'not as good' would be more likely to also report that they were driving slower and less frequently than five years ago. The data are presented in Table 20 and Table 21. Results showed a significant relationship between changes in driving frequency and quality of driving ($\chi^2(4)=29.3$, $p<0.001$). Counter to expectation, those who rated their driving *not as good* were three times less likely to drive *less* than those who rated their driving quality as better or the same as it was five years ago. However, this figure needs to be qualified by the fact that a very high proportion of drivers (91%) reported that their quality of driving was better or the same as it was five years ago.

Table 20 Changes in driving frequency as a function of changes in driving quality

Driving Frequency	Quality of Driving		
	Better or Same	Not as Good	Total (%)
Driving more or same	53	78	65
Driving less	47	22	35
TOTAL	100	100	100

Table 21 Changes in driving quality as a function of changes in driving speed

Driving Speed	Quality of Driving		
	Better or Same	Not as Good	Total (%)
Driving faster or same	62	41	52
Driving slower	38	59	48
TOTAL	100	100	100

Driving quality and driving speed were also significantly related, $\chi^2(4)=39.1$, $p=0.002$. Drivers who reported that their quality of driving was *not as good* as five years ago were also 2.3 times more likely to say they were driving slower compared with those who reported that their driving quality was better or the same as it was five years ago.

Changes in driving, medical conditions and health status

The relationship between overall health status and medical conditions (vision and heart problems and arthritis) and changes in driving quality, frequency and speed was explored using chi-square analyses. The only significant relationship found was between overall health status (excellent vs good, fair or poor) and changes in driving quality (see Table 22). Of those who indicated that their driving was ‘not as good’ as it was five years ago, more rated their overall health as only good, fair or poor rather than excellent.

Table 22 Change in quality of driving by overall health rating

Overall health	Quality of Driving			
	Better	Same	Not as good	Total (%)
Excellent	52	47	24	45
Good/Fair/Poor	48	53	78	55
TOTAL	100	100	100	100

Driving situations: Confidence, difficulty and avoidance

Drivers were asked a series of questions about their driving in the last six months. These questions were designed to examine confidence, difficulty and avoidance of driving situations that are thought to cause problems for older drivers. These driving situations included:

- Driving in the rain
- Driving in busy traffic
- Driving at night and when wet
- Driving through roundabouts
- Making a right-hand turn at intersections without lights
- Making a right-hand turn at intersections with lights but without a right-turn arrow
- Merging into traffic
- Driving at night
- Changing lanes
- Driving through intersections without lights
- Making a right-hand turn at intersections with lights and with a right-turn arrow

For each of these driving situations, drivers were asked first to rate their level of confidence, second to rate how difficult they find this driving situation, and third, to indicate whether they intentionally avoided driving in this situation and if so, why. In addition, drivers were asked to identify any other situations in which they experienced difficulty or intentionally avoided.

Confidence in driving situations

Drivers' ratings of confidence in various driving situations are presented in Table 23. In general, participants indicated that they were very confident in the majority of driving situations. This was particularly evident for making right hand turns with signals providing a fully controlled turning phase (93%). In contrast, fewer drivers (55%) were very confident when driving at night and only 44 percent of drivers indicated that they were very confident driving at night when wet.

Table 23 Summary of confidence ratings for all driving situations

Driving Situation	Confidence Level (%)		
	Very	Moderate	Not at all
Rain	61	38	1
Merging into traffic	68	30	2
Busy traffic	71	28	2
Roundabouts	82	17	1
Intersections with no traffic lights	70	28	2
RH turns with no traffic lights	75	23	2
RH turns with traffic lights & no RH arrow	77	23	<1
RH turns with traffic lights & RH arrow	93	7	0
Night	55	36	9
Night when wet	44	44	12
Changing lanes	74	25	<1

Table 24 presents the proportion of 'very confident' responses by gender, age group and place of residence. In general, the results show that the likelihood of a 'very confident' response decreases with age. In all driving situations, the youngest group were more likely than the oldest group to give a 'very confident' response. Moreover, males, in general were more likely than females to give a 'very confident' response, particularly in the oldest age group.

Table 24 Summary of ‘very confident’ ratings for all driving situations by Gender, Age and Place of Residence

Driving Situation	Gender		Age			Place		
	Female	Male	55-64	65-74	75+	Urb	Cntry Town	Rural
Rain	48	68	66	64	54	58	66	64
Merging into traffic	53	77	78	68	62	68	66	74
Busy traffic	62	75	80	69	65	74	67	62
Roundabouts	76	85	86	83	79	80	84	89
Intersections with no traffic lights	60	76	75	69	69	66	73	79
RH turns with no traffic lights	63	82	81	76	70	74	77	77
RH turns with traffic lights & no RH arrow	70	80	86	76	70	76	79	79
RH turns with traffic lights & RH arrow	92	94	96	93	92	93	91	95
Night	39	64	63	63	43	56	56	54
Night when wet	25	53	48	49	35	41	49	45
Changing lanes	66	79	79	74	72	73	79	75

Odds ratios were also calculated for gender differences and age differences (comparing responses of those aged 75 years and older with responses of the two younger groups combined) (see Table 25). These analyses further revealed that males were more likely to be very confident in all driving situations, except for making right-hand turns at fully controlled traffic signals (those with right-hand turn arrows). Moreover, the oldest age group was less likely than younger drivers to be very confident in the majority of driving situations, except at intersections with no traffic control, making right-hand turns at fully controlled traffic signals and when changing lanes.

Table 25 Odds ratios for ‘very confident’ ratings for all driving situations by Gender and Age

Driving Situation	Gender	Age Group
	Female : Male	75+ yrs : Other Age Groups
Rain	2.3	1.6
Merging into traffic	3.0	1.6
Busy traffic	1.9	1.5
Roundabouts	1.8	1.4
Intersections with no traffic lights	2.1	1.1 NS
RH turns with no traffic lights	2.6	1.5
RH turns with traffic lights & no RH arrow	1.7	1.7
RH turns with traffic lights & RH arrow	1.3 NS	1.5 NS
Night	2.9	2.3
Night when wet	3.3	1.8
Changing lanes	2.0	1.3 NS

Note: Differences are significant at $p < .05$ unless otherwise indicated (NS)

Confidence ratings were also compared across place of residence using chi-square analyses. Differences were found for driving through roundabouts and intersections without traffic lights and in busy traffic. Figure 15 shows that for driving through roundabouts and intersections without lights, those living in rural areas were more confident than those in urban areas and country towns ($\chi^2(2)=6.07$, $p<0.05$; and $\chi^2(2)=8.25$, $p=0.02$). For driving in busy traffic, the reverse was true; that is, drivers living in rural areas were far less likely to be very confident than drivers living in urban and country towns ($\chi^2(2)=8.15$, $p=0.02$).

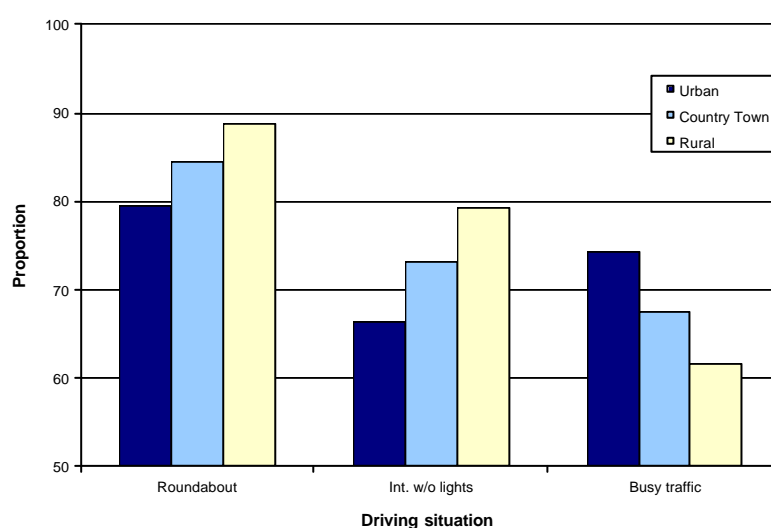


Figure 15 Ratings of ‘very confident’ for driving through roundabouts, intersections without lights and in busy traffic by place of residence

Difficulty in driving situations

Participants were asked if driving situations caused them difficulty or not. Table 26 shows for each driving situation, the proportion of participants that reported that the situation was not difficult, a little difficult or very difficult for them. The majority of participants reported no difficulty in the various driving situations.

Table 26 Summary of difficulty ratings for all driving situations

Driving Situation	Difficulty Level (%)		
	Not	A little	Very
Rain	75	24	1
Merging into traffic	76	22	1
Busy traffic	72	26	1
Roundabouts	89	10	<1
Intersections with no traffic lights	79	21	<1
RH turns with no traffic lights	78	20	1
RH turns with traffic lights & no RH arrow	84	16	0
RH turns with traffic lights & RH arrow	96	4	0
Changing lanes	81	19	<1

Table 27 presents the proportion of ‘no difficulty’ responses by age group and gender and shows that the likelihood of a ‘no difficulty’ response decreases with age.

Table 27 Summary of ‘no difficulty’ ratings for all driving situations by Gender, Age and Place of Residence

Driving Situation	Gender		Age			Place		
	Female	Male	55-64	65-74	75+	Urb	Ctry Town	Rural
Rain	65	81	75	74	76	75	76	77
Merging into traffic	67	81	79	72	78	74	78	81
Busy traffic	68	75	70	69	78	74	64	75
Roundabouts	85	92	89	90	89	88	88	94
Intersections with no traffic lights	71	83	76	79	81	79	78	81
RH turns with no traffic lights	69	83	75	81	80	77	80	81
RH turns with traffic lights & no RH arrow	78	87	85	83	84	84	82	86
RH turns with traffic lights & RH arrow	96	96	95	98	95	96	95	99
Changing lanes	75	84	82	76	84	79	84	82

Again, in all driving situations, the youngest group were more likely than the oldest group to report that they had ‘no difficulty’, and males were more likely than females to report ‘no difficulty’.

Odds ratios of difficulty ratings by age and gender distribution were calculated and largely confirmed the overall findings (see Table 28). In general, males were more likely than females to indicate no difficulty in all driving situations except for making a right-hand turn at fully controlled traffic signals. In contrast, however, few age differences were found. The oldest group of drivers was less likely to report no difficulty than younger participants only in busy traffic and when changing lanes. In all other driving situations there were no age group differences in reported difficulty.

Table 28 Odds ratios for difficulty in driving situations by Gender and Age

Driving Situation	Gender	Age Group
	Female : Male	75+ yrs: Other Age Groups
Rain	2.3	0.9 NS
Merging into traffic	2.1	0.8 NS
Busy traffic	1.4	0.7
Roundabouts	1.8	1.0 NS
Intersections with no traffic lights	2.0	0.8 NS
RH turns with no traffic lights	2.3	1.0 NS
RH turns with traffic lights & no RH arrow	1.9	1.0 NS
RH turns with traffic lights & RH arrow	1.3 NS	1.4 NS
Changing lanes	1.7	0.7

Note: Differences are significant at $p < .05$ unless otherwise indicated (NS)

Chi-square analyses for difficulty ratings (no difficulty vs a little/very difficult) revealed no differences between drivers from urban areas, country towns and rural areas (p -values range from 0.22 to 0.98).

Avoidance of driving situations

In addition to rating confidence and difficulty in driving situations, participants were asked if they intentionally avoided these situations (yes/no response) (see Table 29). Overall, the majority of participants indicated that they did not avoid the various driving situations. This is not surprising, given that the majority of participants indicated high confidence and no difficulty in most driving situations. The most commonly avoided driving situations were driving at night, particularly when wet, driving in busy traffic and changing lanes.

The oldest group were more likely than the youngest group to avoid the various driving situations, particularly driving at night and driving at night when wet. In addition, males were less likely than females to report avoidance behaviour.

No specific interview questions were asked about avoidance of particular types of intersections. However, responses relating to avoidance of ‘any intersections’ were followed up for types of intersections avoided. Of the 10 percent of drivers who indicated that they avoided some intersections, the majority indicated that they avoided intersections without traffic lights (77%). Others avoided intersections without fully controlled right-

hand turn arrows (30%). The most frequently reported reasons for avoiding intersections were concerns for safety and crash avoidance.

Table 29 Summary of avoidance of driving situations by Gender, Age and Place of Residence

Driving Situation	Overall (%)	Gender		Age (yrs)			Place		
		Female	Male	55-64	65-74	75+	Urb	Cntry Town	Rural
Rain	14	19	11	15	11	17	15	9	17
Merging into traffic	6	11	4	2	5	9	7	2	5
Busy traffic	22	22	22	16	26	23	20	22	28
Night	25	36	18	15	18	38	23	25	30
Night when wet	26	40	19	19	19	40	25	26	30
Changing lanes	15	14	15	12	16	16	16	12	13
Intersections*	10	15	7	8	9	12	12	4	9

Refers to response question regarding avoidance of *any* intersection (roundabout; intersection without light; intersection with light and without RH turn arrow; intersection with RH turn arrow).

Participants were asked to describe why they avoided driving situations. The most frequently reported reason cited by respondents for avoiding each of the above situations was:

Rain – safety factors (66%)

“It can be very dangerous and you can easily skid. Safety reasons.”

Merging – ‘personal preference’/comfort-related factors (28%)

“Hate freeways. Never go on them.”

Busy roads – ‘personal preference’/comfort factors (40%)

“Because we drive for pleasure...It’s not pleasurable to drive in busy traffic.”

Night driving and wet night driving – visual problems (53% and 54%, respectively)

“Lights dazzle you.”

“Vision. The lights bounce off the wet.”

Chi-square analyses and odds ratios for avoidance behaviour were also calculated (Table 30). In general, analyses confirmed the findings described above. Compared with males, female drivers were more likely to avoid driving in the rain, merging, night driving and driving at night when wet. No gender differences were observed for avoidance of busy traffic and changing lanes. Similarly, drivers aged 75 years and older were significantly more likely to avoid merging into traffic, night driving and driving at night when wet. No differences between age groups were observed for avoidance of driving in the rain, intersections, and changing lanes and a difference of borderline significance was observed for avoidance of busy traffic ($p=0.054$). A closer inspection of age differences in avoidance of busy traffic (see Table 29) shows that changes were more evident between the youngest

group and the two oldest groups; that is, fewer of those aged 55-64 years avoided busy traffic compared with those aged 65-74 and 75 and older (16% vs 26% and 23%, respectively).

Table 30 Odds ratios for driving avoidance by Gender and Age

Driving Situation	Gender	Age Group
	Female : Male	75+ yrs : Other Age Groups
Rain	1.8 **	1.4
Merging into traffic	3.2 **	2.4 **
Busy traffic	1.0	1.1 *
Night	2.6 **	2.5 **
Night when wet	2.9 **	2.4 **
Changing lanes	0.9	1.1
Intersections	2.2 **	1.4

** Differences are significant at $p < 0.01$

* Differences are significant at $p < 0.05$

Chi-square analyses conducted for each driving situation by place of residence revealed significant differences for avoidance of intersections only, ($\chi^2(2)=8.18$, $p=0.02$). Not unexpectedly, drivers in urban areas were more likely than those in country towns and rural areas to avoid any intersections (12%, 4% and 9%, respectively). A possible explanation for this is that traffic lights are not as common in country towns and rural areas.

Other driving situations

Drivers were asked to identify any other driving situations in which they did not feel confident, experienced difficulty or avoided. Thirty-one percent of participants identified other situations including freeways (14%) and parking (14%). Others nominated particular intersections and roads, other drivers, road conditions and weather (other than rain). Table 31 summarises these situations and lists strategies used by drivers in these situations.

Table 31 Summary of difficulty and avoidance of *other* driving situations

Situation	Avoidance Strategy	Number and Proportion (%) of Cases (n=204)	
		Frequency	%
Freeways		28	14
	Take alternate route	11	39
	Safe driving techniques	6	21
	Other	3	11
	No response/can't avoid	8	29
Parking		28	14
	Find easier park	21	75
	Other	4	14
	No response/don't avoid	3	11
Other drivers		24	12
	Defensive driving techniques/avoid them	14	58
	Other	2	8
	No response /don't avoid	8	33
CBD		24	12
	Take alternative route	13*	54
	Use alternative transport	6*	25
	Other	3	13
	Don't avoid	4	17
Road conditions		24	12
	Take alternative route	14	58
	Other	3	13
	No response /don't avoid	7	29
Weather conditions		22	11
	Go another time/don't go	14*	64
	Stop/slow down/pull off road	5*	23
	Other	4*	18
	No response/don't avoid	3	14
Big vehicles		20	10
	Overtake/change lane/ease back	8	40
	Go different time/route	4	20
	Other	3	15
	Don't avoid	5	25
Unfamiliar areas		14	7
	Take alternative route	7*	50
	Use maps/knowledgeable others	3*	21
	Other	2	14
	No response/don't avoid	3	21
Other		37	18

Multiple response were possible for this question, therefore total may exceed 100%

% total may not equal 100% due to rounding

*Multiple answers – section total may exceed raw & % total

Detailed examination of driving situations that are commonly avoided by older drivers

In this section, the driving situations that resulted in highest levels of avoidance behaviours are examined in more detail. These include driving in the rain, driving at night when wet, and driving in busy traffic. Some key variables were considered, including confidence and difficulty ratings, overall health ratings and the presence of one of the three most commonly reported medical conditions: vision, heart problem or arthritis. Of interest was whether drivers with lower ratings of confidence and higher ratings of difficulty were more likely to avoid these driving situations. Similarly, the analyses explored whether drivers with lower health ratings or the presence of any of these medical conditions were more likely to avoid these driving situations than those with higher health ratings or none of these medical conditions. More detailed multivariate analyses of potential variables influencing self-regulatory behaviours are presented in a following section.

Driving at night

As described in the previous sections 45 percent of drivers said they were only moderately confident or not at all confident about driving at night. However, only 14 percent of drivers indicated that they avoided driving at night. Of interest was the relationship between confidence ratings and avoidance behaviours. That is, do drivers who have lower confidence avoid driving at night?

To address this question, avoidance rates were examined to determine whether or not those who were *not at all confident* or those who found this particular driving situation *very difficult*, tended to avoid driving at night (see Table 32). A significant relationship was found between confidence ratings and avoidance behaviour ($\chi^2(1)=189.1$, $p<0.001$). Those who were very confident were 24 times more likely to say they did *not* avoid driving at night than to say they avoid this driving situation. In addition, of those who said they were only moderately or not at all confident driving at night, one half reported that they do not avoid this driving situation as a general rule. This suggests that only about one half of drivers who are less confident are self-regulating appropriately.

Table 32 Drivers' confidence and difficulty ratings by avoidance of driving at night

Confidence Level	Avoidance	
	Yes	No
Very confident	4	96
Moderate / Not at all confident	50	50
TOTAL	25	75

Those who rated their overall health for driving as good, fair or poor (rather than excellent) were also significantly more likely to avoid driving in the rain ($\chi^2(1)=14.66$, $p<0.0001$) (see Table 33). The majority of those with excellent health ratings (83%) did not avoid driving at night. Arguably, these may be the drivers who did not need to self-regulate. Those with good, fair or poor health ratings were 13.1 times more likely to avoid driving in the rain than those who rated their health as excellent. However, 70 percent of those with lower health ratings did not intentionally avoid driving at night, suggesting a high proportion of non self-regulation amongst these drivers.

Table 33 Avoidance of driving at night by self-reported health

Avoidance	Health rating		Total (%)
	Excellent	Good/Fair/Poor	
Yes	17	30	25
No	83	70	75
TOTAL	100	100	100

A significant relationship was found between avoidance of driving at night and self-rating of vision for night driving ($\chi^2(1)=42.09$, $p<0.0001$) (see Table 34). Sixteen percent of people with vision problems avoided driving at night compared with seven percent of participants without vision problems. That is, those with lower ratings for vision for safe night driving were approximately eight times more likely to avoid driving at night than those with excellent night vision ratings. While 30 percent of drivers with lower night vision ratings did avoid this driving situation, a high proportion (70%) said they did not intentionally avoid night driving, suggesting a high level of non self-regulation amongst this group.

Table 34 Avoidance of driving at night by self-rated vision for safe night driving

Avoidance	Vision for night driving		Total (%)
	Excellent	Good/Fair/Poor	
Yes	5	30	25
No	95	70	75
TOTAL	100	100	100

No significant relationships were found between avoidance of driving at night and vision problems, heart problems and arthritis (p 's=0.62, 0.76 and 0.25, respectively).

Driving at night when wet

Avoidance rates were examined to determine whether or not those who were *not at all confident* tended to avoid driving at night when wet¹. Confidence ratings and avoidance behaviour were significantly related ($\chi^2(1)=148.71$, $p<0.0001$). Those who were very confident were 40 times more likely to say they do not avoid driving at night when wet than say they avoid this driving situation. As shown in Table 35, 55 percent of drivers who said they were not at all confident driving at night when wet also indicated that as a general rule, they do not intentionally avoid driving at night when wet. Appropriate self-regulatory behaviour was observed for 45 percent of drivers who were less confident and also avoided driving at night in the wet.

¹ Due to an oversight, drivers were not asked for difficulty ratings for driving at night or at night in the wet.

Table 35 Drivers' confidence ratings by avoidance of driving at night when wet

Avoidance	Avoidance		Total (%)
	Yes	No	
Very Confident	2	98	100
Mod. / not at all confident	45	55	100
TOTAL	26	74	100

Those who rated their overall health for driving as good, fair or poor (rather than excellent) were also significantly more likely to avoid driving at night when wet ($\chi^2(1)=14.74$, $p<0.0001$) (see Table 36). The odds ratio showed that those with good, fair or poor health ratings were 2.7 times more likely to avoid driving in the rain than those who rated their health as excellent. As with avoidance of night driving, self-rated vision for night driving was also significantly related to avoidance of driving at night when wet, ($\chi^2(1)=48.30$ $p<0.0001$).

Table 36 Avoidance of driving at night when wet by self-reported health

Avoidance	Health rating		Total (%)
	Excellent	Good/Fair/Poor	
Yes	19	33	26
No	81	67	74
TOTAL	100	100	100

Avoidance of driving at night when wet was compared for those with and without vision problems, heart problems and arthritis. No significant relationship was found between avoidance behaviour and vision problems and heart problems (p 's=0.22 and 0.58). A significant relationship was found, however, for arthritis ($\chi^2(1)=4.85$, $p=0.028$) (see Table 37). Those with arthritis were 1.5 times more likely to avoid driving at night when wet than those without arthritis.

Table 37 Avoidance of driving at night when wet by arthritis

Avoidance	Arthritis		Total (%)
	Yes	No	
Yes	31	23	26
No	69	77	74
TOTAL	100	100	100

Driving in busy traffic

Avoidance rates were examined to determine whether or not those who were *not at all confident* or those who found this particular driving situation *very difficult*, tended to avoid driving in busy traffic. A significant relationship was found between ratings of confidence and avoidance behaviour, ($\chi^2(1)=74.74$, $p<0.0001$). As shown in Table 38, those who were very confident were 5.3 times more likely to say they do not avoid busy traffic than say they avoid busy traffic. Also, 56 percent of drivers who said they were only moderately or not at all confident indicated that as a general rule, they do not intentionally avoid driving in busy traffic. However 44 percent of those less confident drivers did intentionally avoid busy traffic, suggesting that they were adopting appropriate self-regulatory behaviours. In addition, difficulty ratings were related to avoidance of busy traffic ($\chi^2(1)=53.58$, $p=0.0001$). Those who said they were very confident were 3.4 times more likely to also report that they do not intentionally avoid busy traffic than to avoid this driving situation. Results also showed that of those who said that driving in busy traffic was a little or very difficult, 58 percent reported that, as a general rule, they did not intentionally avoid this driving situation. Also, of those reporting difficulty 42 percent avoided this driving situation, suggesting appropriate self-regulatory behaviour.

Table 38 Drivers' confidence and difficulty ratings by avoidance of driving in busy traffic

	Avoidance		Total (%)
	Yes	No	
Confidence Level			
Very confident	13	87	100
Mod. / not at all confident	44	56	100
TOTAL	22	78	100
Difficulty Level			
Not difficult	15	85	100
A little / very difficult	42	58	100
TOTAL	22	78	100

No relationship was found between overall health for driving (excellent vs good, fair or poor) and avoidance of busy traffic, $p=0.20$.

A significant relationship was found between avoidance of driving in busy traffic and self-reported vision condition ($\chi^2(1)=6.92$, $p=0.008$) (see Table 39). Twenty-five percent of people who reported having a vision condition also indicated that they intentionally avoided driving in busy traffic compared with 14 percent of participants without vision problems. The analysis of odds ratio for these data showed that those with vision problems were almost two times as likely to avoid driving in busy traffic than those without vision problems (OR=1.92).

Table 39 Avoidance of Driving in Busy Traffic by Vision Problems

Avoidance	Visual Problem		Total (%)
	Yes	No	
Yes	25	14	22
No	75	86	78
TOTAL	100	100	100

No significant relationship was found for avoidance of driving in busy traffic and either heart problems or arthritis (p 's=0.80 and 0.30).

Crash involvement and infringements

Drivers were asked some questions regarding crashes and infringements over the past two years (see Table 40). In relation to crashes, the interviewers emphasised that the study was only interested in the numbers of crashes when they were driving, and when and where they occurred, and was not interested in who was at fault. Over the last two years, 15 percent of drivers had been involved in a crash. Most of these crashes occurred during the day (83%). Seventy-two percent of all crashes occurred on the road, 7 percent occurred on private property and 21 percent in carparks. No gender difference in crash involvement was evident and similarly, only minor differences were observed across age groups. Crash involvement was lower for those living in country towns (12%) compared with rural (18%) and urban dwellers (16%).

Fifteen percent of drivers had incurred a traffic infringement, other than a parking fine, in the past two years. The majority (80%) had incurred only one infringement. A higher proportion of males (18%) reported having at least one infringement compared with females (11%). Urban residents were also more likely to incur an infringement compared with those who live in country towns or rural areas (18%, 12% and 12%, respectively).

Table 40 Frequency of involvement in crashes and infringements in the last 2 years by Gender, Age and Place of Residence

	Overall (%)	Gender		Age (yrs)			Place		
		Female	Male	55-64	65-74	75+	Urb	Cntry Town	Rural
Crashes	15	15	15	15	14	17	16	12	18
Infringe's	15	11	18	15	13	13	18	12	12

Participants were also asked to identify the type of infringement, the time of day it occurred and whether or not there was a crash involved. The most common infringement type was speeding (97%) and the remainder were "red light" infringements.

Relationships between crashes, infringements and self-reported health status and adoption of self-regulatory behaviours

The relationships between self-reported health and medical problems, adoption of self-regulatory behaviours and crash involvement were examined using chi-square analyses. Firstly, crash involvement and infringements for those who reported that their overall health was excellent compared with those who reported good, fair or poor health were examined. No significant differences were found for either crashes or infringements (p 's = 0.83 and 0.74, respectively). This suggests that crash involvement and infringements are unrelated to self-rated health status for this group.

No significant relationships were found between crashes and changes in driving behaviours over the last five years (quality, speed or amount of driving). In addition, involvement in crashes was not related to incursion of infringements.

The relationship between crashes and infringements and driving exposure was also examined using two measures of exposure: (i) those driving daily compared with those driving less than daily; (ii) those who drove more than 100 kilometres per week versus those who drove 100 kilometres or less. No significant relationships were found between crash involvement and exposure on either of these measures (p 's > 0.8). However, there was a significant relationship between incursions of infringements and exposure, for both number of days per week and kilometres per week driven ($\chi^2(1)=4.1$, $p=0.04$, and $\chi^2(1)=5.4$, $p=0.02$, respectively). Those who drove less and less often were less likely to have an infringement (OR: 1.8 and 1.7 respectively).

Interestingly, 69 percent of those who were involved in a crash indicated that they avoided driving situations compared with 59 percent of those who were not involved in a crash. However, the chi-square test just failed to reach significance ($p=0.079$). This relationship was explored further in regression analyses (see following section). No significant relationship was found between infringements and avoidance behaviour ($p=0.98$).

Predictors of self-regulation: The characteristics of self-regulators and non self-regulators

Logistic regression was used to model the self-regulatory behaviour of older drivers. The aim of the modelling was to determine which characteristics are indicative of self-regulatory behaviour in older drivers. It was determined that an appropriate procedure would be to classify drivers using a dichotomous outcome: those that exhibited self-regulatory behaviour and those that did not. Exploratory analyses were conducted with two dependent variables considered exemplary of self-regulatory behaviour:

- Avoidance of *any* of the driving situations (rain; merging; busy traffic; any intersection or roundabout; at night; at night when wet; other situations identified by the driver) (Yes / No);
- Weekly driving distance (≤ 100 km / > 100 km)

Although many other self-regulatory practices were examined in this study, it was not practical or statistically desirable to explore all of these options using regression modelling. For the purpose of the study, it was considered that these two variables would provide some useful insights into characteristics of drivers who reduce their exposure as well as those who engage in any avoidance of driving situations that have been identified in the literature as potentially difficult for older drivers. In preliminary analyses, it was determined that the model for weekly driving distance exposure provided more explanatory power than driving frequency and therefore, the analysis for driving frequency was not included in this report.

Selection of potential predictors of self-regulation

The selection of predictor variables for the regression models considered firstly, those variables that, in initial univariate analyses were found to be related to the self-regulatory behaviours of interest: avoidance behaviours and driving distance. In addition, further selection of potential predictor variables was made on the basis of a priori knowledge (previous literature). A summary of all potential variables and the results (significance levels) for 2-way analyses for prediction of self-regulatory behaviours is shown in Table 41.

Table 41 Potential variables for regression models and results of univariate analyses

Variable	Levels	Reference	Signif c² for <u>Driving Distance</u>	Signif c² for <u>Avoidance</u>
Gender	2	Male	<0.001	<0.001
Age Group	3	75yrs +	<0.001	0.32 NS
Vision Problems	2	No	0.66 NS	0.02
Heart Problems	2	No	0.07 NS	0.89 NS
Arthritis	2	No Arth.	<0.001	0.03
Health Rating	2	Good/fair/poor	0.015	0.05
Ability to make decisions quickly	2	Good/fair/poor	<0.001	0.31 NS
Married or De facto	2	No	<0.001	0.09 NS
Principal Driver	2	No	0.004	0.002
Been involved in a crash	2	No	0.82 NS	0.08 NS
Had infringements	2	No	0.02	0.98 NS
Employment status	3	Retired	<0.001	0.33

Regression models for predicting self-regulation

Tables 42 and 43 provide a summary of the regression model statistics. Together the combination of variables in the models enhanced the probability of predicting self-regulatory behaviour. The logistic regression analyses also provided a measure of the relative contribution of each of the selected variables in predicting self-regulatory behaviour, with all other variables held constant. The size of the contribution is reflected in the proportionate change in the odds ratio when moving from the reference category to the category of interest (e.g., females compared with the reference group of males). These are reported in the summary tables as relative odds ratios (and 95% confidence intervals), which are adjusted for all other variables in the model. Details of the logistic regression modelling procedures and results for driving distance and avoidance behaviours are presented in Appendix C.

Table 42 Summary of model statistics for prediction of ‘weekly driving distance £ 100kms’

Variable	Reference	Sig.	Relative Odds Ratio	95% C.I. for Odds Ratio	
				Lower	Upper
Gender	Male	0.001	2.10	1.37	3.22
Age (55-64 yrs)	75yrs+	0.001	0.39	0.23	0.67
Age (65-74 yrs)	75yrs+	0.001	0.50	0.33	0.76
Arthritis	No Arth.	0.068	1.41	0.98	2.04
Decisions	Good/fair/poor	0.000	0.50	0.33	0.74
Princ. Driver	No	0.005	0.47	0.27	0.80
Marital Status	Not married	0.062	0.66	0.43	1.02
Employment (PT)	Retired	0.002	0.51	0.34	0.77
Employment (FT)	Retired	0.005	0.26	0.10	0.66
Constant		0.059	2.07		

Table 43 Summary of model statistics for prediction of ‘avoidance of any driving situations’

Variable	Reference	Sig.	Relative Odds Ratio	95% C.I. for Odds Ratio	
				Lower	Upper
Gender	Male	0.001	1.80	1.26	2.57
Age (55-64 yrs)	75yrs+	0.076	0.68	0.45	1.04
Age (65-74 yrs)	75yrs+	0.215	0.79	0.54	1.15
Princ. Driver	No	0.011	0.51	0.30	0.86
Vision	No	0.028	1.53	1.05	2.25
Crash	No	0.069	1.54	0.97	2.46
Constant		0.053	1.90		

Characteristics of a self-regulator and non self-regulator

The regression models summarised in the previous section identified some characteristics that may be considered typical of a self-regulating driver, and conversely, a non self-regulating driver.

Driving distance

Females were found to be twice as likely to be self-regulators than males with respect to weekly driving distance. The adjusted odds ratio (see Table 42) for gender (with males as the reference group) was 2.10. Age appeared to be monotonically associated with self-

regulatory behaviour. The odds of a 55-64 year old driver being a self-regulator was only 39 percent that of a driver aged 75 years or older, while the odds of a 65-74 year old driver being a self-regulator was 50 percent that of a driver aged 75 years or older. Thus, as age increased the odds of being a self-regulator increased. Employment was also monotonically associated with self-regulation of driving distance. The odds of a driver who is part-time employed being a self-regulator was 51 percent that of a retiree, while the odds of a driver who is employed full-time being a non self-regulator was 26 percent that of a retiree. Drivers with arthritis were 1.4 times as likely to be self-regulators than those without arthritis. The odds of self-regulating for those who rated their speed of decision-making as excellent was only 50 percent that of drivers who rated their decision-making as good, fair or poor. Those who were the principal driver were less likely to be a self-regulator as those who considered themselves not to be the main driver in the household (OR: 0.47). In addition, the odds of drivers who were married (or in a de facto/common law relationship) being a self-regulator was only 66 percent that of drivers who were not married.

In sum, those who drove shorter distances (100 kilometres or less per week) were more likely to be:

- Female;
- 75 years and older;
- Retired;
- With arthritis;
- Good/fair/poor decision-making for safe driving;
- Not the principal driver in the household;
- Not married.

Avoidance of driving situations

When considering self-regulation in terms of avoidance of specific driving situations, three of the same variables were found to be predictive of self-regulation as were identified for weekly distance travelled: gender, age and principal driver status. Other variables were vision problems and crash involvement.

Females were more likely than males to be self-regulators (OR: 1.8). Age was monotonically associated with self-regulatory behaviour. The odds of a 55-64 year old driver being a self-regulator were 68 percent that of a 75+ year old driver, while the odds of a slightly older 65-74 year old driver being a self-regulator were 79 percent that of a 75+ year old driver. That is, as age increases the odds of being a self-regulator increase. The odds of avoidance self-regulatory behaviours amongst those who were the principal driver was 51 percent that of drivers who considered themselves to not be the main driver in the household. A self-reported vision problem was a significant predictor of avoidance of specific driving situations. Those with vision problems were approximately 1.5 times as likely to be self-regulators as those without vision problems. Interestingly, crash involvement was also a significant predictor of avoidance. Those drivers who reported being involved in a crash in the last two years were approximately 1.5 times as likely to be a self-regulator than those who had not been involved in a crash.

In sum, those who avoid any of the designated driving situations were more likely to be:

- Female;
- 75 years and older;

- With a vision condition;
- Not the principal driver in the household;
- Involved in a crash (in the last two years)

Additional exploratory analyses were conducted to consider confidence rating as a potential predictor variable given that bivariate analyses revealed significant relationships between avoidance and confidence for three specific driving situations. For this model, confidence ratings were categorised dichotomously (very confident versus moderately or not at all confident) in any of the eight situations. This model showed that confidence was highly predictive of avoidance of any of the designated driving situations. Those who were very confident in all of the eight driving situations were four times as likely to be non self-regulators (OR: 4.1, 95% CI: 2.9 and 5.7). Interestingly, the inclusion of the ‘confidence’ variable in the regression model tended to reduce the relative importance of all the other predictor variables (gender, age, vision and crash involvement). This finding warrants further investigation.

Driving cessation

Current drivers were asked a series of questions addressing the issues of driving cessation. First, they were asked if, over the last two years, anyone had suggested that they should limit or stop driving. Only 31 respondents (5%) indicated that this issue had been raised with them. Of these respondents, approximately 60 percent were aged over 75 years, about two-thirds were males and about two-thirds lived in urban areas.

Participants were also asked to indicate who made the suggestion to limit or stop driving (see Table 44). In the majority of cases, family members, including spouse or partners (50%) and son or daughter (45%), were the ones who suggested that drivers should limit or stop driving. Others reported that medical doctors (24%) and vision specialists (15%) had suggested they should limit their driving or give up driving altogether. In addition, 9 percent of drivers indicated that they had approached their family doctor about this issue.

Table 44 Person who suggested drivers should limit or cease driving

Person Making Suggestion	Proportion of Current Drivers (%)
Spouse/partner	50
Son/daughter	45
Doctor	24
Eye doctor	15
Friend	5

An important factor in successfully retiring from driving is planning ahead. Participants were asked some questions about planning for stopping driving. First, they were asked if they had *thought about* the possibility of not driving one day (see Table 45). Seventy-seven percent of respondents indicated that they had given some thought to this. Older drivers were more likely to indicate that they had thought about this issue than younger drivers, and females were more likely than males to do likewise. In addition, more drivers living in urban areas and country towns indicated that they had thought about this issue compared with those living in rural areas.

Table 45 ‘Thought about possibility of not driving one day’ by Gender, Age and Place of Residence

Possibility of not driving one day	Overall (%)	Gender		Age (yrs)			Place		
		Female	Male	55-64	65-74	75+	Urb	Cntry Town	Rural
Yes	77	82	75	76	73	83	80	79	69
No	22	18	24	23	27	17	20	20	30
Not Sure	<1	0	<1	1	0	<1	<1	1	1
TOTAL	100	100	100	100	100	100	100	100	100

Interestingly, while the majority of drivers reported that they had *thought about* the possibility of not driving one day, only 21 percent of drivers indicated that they had actually *planned* for this. As shown in Table 46, of those who indicated that they had made plans, more than half (55%) indicated that they had moved house. Other plans included exploring alternative transport options (43%), becoming familiar with public transport (36%) and moving nearer to family or services (32%).

Table 46 Types of plans for driving cessation

Plan	Proportion of Drivers (%)
Moved house	55
Explored alternative transport	43
Familiar with public transport	36
Moved near family/social/medical	32
Sought advice from doctor	6
Shared driving	3

Past research has identified a number of reasons why drivers think about stopping driving. Participants were asked to indicate whether any of these factors would make them think about stopping driving (see Table 47). The majority of drivers indicated that health-related issues would make them think about stopping driving, for example, declining eyesight (97%) and a decline in health (95%). Most drivers indicated that they would think about giving up driving upon doctor’s advice (96%) or if their family and friends raised concerns (86%) and also out of a sense of responsibility for the safety of other road users (96%). Driving-related concerns, including crashes or close calls (85%) and difficulty in driving (78%) were also cited as factors that would cause drivers to think about stopping driving. Interestingly, only 24 percent of drivers said that they would think about giving up driving if the cost of owning or running a motor car was too high.

Stopping driving has often been described as a ‘devastating’ or ‘life-changing’ event in later life and has been associated with reduced mobility, independence, and social activity. Participants were asked to describe how not being able to drive might affect them personally. The responses are presented in Table 48. The four most important response categories cited by drivers were the loss of freedom and reliance on others (23%), reliance on public transport (20%), loss of mobility and being housebound (19%), and restrictions

on their activities/life (19%). Sixteen percent of drivers indicated that stopping driving would be a devastating or life-changing event.

Table 47 Factors for Driving Cessation

Factor	Proportion of Drivers (%)
Declining eyesight	97
Doctor's advice	96
Responsibility for safety of others	96
Decline in health	95
Loss of confidence	93
Concerns of family & friends	86
Close calls or minor crashes	85
Difficulty in driving situations	78
Cost of running a car	24

Table 48 Description of Effect of Not Driving

Effect	Current Drivers (n=656)	
	Frequency	%
Loss of independence/freedom/being reliant on others	148	23
Have to rely on alternative (usually public) transport	134	20
Loss of mobility/housebound	122	19
Restrict activities/life	122	19
A devastating/life-changing event ²	106	16
Couldn't meet needs/commitments	91	14
Isolation/lose contact with others	88	13
Inconvenience	66	10
Unconcerned/acceptance	51	8
Loss of driving pleasure	40	6
Time-consuming/plan life more	39	6
Change in lifestyle	31	5
Would have to move house	29	4
Other	44	7

Multiple response question – total may exceed 100%

² This category describes responses of individuals who indicated that their life would be devastated by the loss of driving, as distinct from those whose responses were somewhat negative about this possibility.

Participants were also asked to identify the one thing that would *concern them most* about not being able to drive. As shown in Table 49, the issues identified included the loss of independence (42%), a general loss of mobility and the resultant feeling of being housebound (18%), and the inconvenience of not having a car (14%).

“Being dependent on other things and people.”

“Being stuck in the house.”

“Inconvenience of having to get public transport or taxis just for everyday shopping.”

A small percentage (8%) of respondents felt unconcerned by the prospect of no longer driving, with some of these individuals even viewing such a change as positive.

“It wouldn’t concern me. I enjoy walking.”

Table 49 Concerns about not being able to drive

Effect	Current Drivers (n=656)	
	Frequency	%
Loss of independence/freedom/being reliant on others	276	42
Loss of mobility/housebound	116	18
Inconvenience	93	14
Isolation/lose contact with others	49	7
Restrict activities/life	29	4
Unconcerned	24	4
Couldn’t meet needs/commitments	22	3
Loss of driving pleasure	16	2
Change in lifestyle	16	2
Would have to move house	7	1
Other	8	1

Total may not equal 100% due to rounding

Use of Other Transport Options

Past research has also shown that many older people do not like to use forms of transport other than driving themselves. Participants were asked if they felt that using other forms of transport was an option (see Table 50). Seventy-eight percent indicated that they would use other forms of transport and 20 percent said this was not an option. For those who indicated that other forms of transport were not an option for them, reasons included the inaccessibility of other (usually public) transport (37%) and the desire to retain their independence and not become reliant on others (22%). Some drivers said that:

“Public transport service is woeful out here.”

“Don’t want to impinge on others.”

Table 50 Reasons why drivers would not use other forms of transport

Reason	Current Drivers (n=132)	
	Frequency	%
Poor/no public transport/inaccessible	49	37
Wish to retain independence/ don't want to rely on others	29	22
Geographically remote/friends and family not nearby	28	21
Inconvenience	10	8
Other	19	14
No reason given	25	19

Multiple response question – total may exceed 100%

Participants were asked if they currently used other forms of transport apart from driving (see Table 51). Sixty-nine percent of drivers indicated that they were using other transport. Not surprisingly, drivers living in urban areas were more likely to use other forms of transport than those living in country towns or rural areas. Of those who reported using other forms of transport, the most common types were train (71%), tram (31%) and bus (30%) (see Table 52).

Table 51 Current use of other forms of transport by Gender, Age and Place of Residence

Currently use other transport	Overall (%)	Gender		Age (yrs)			Place		
		Female	Male	55-64	65-74	75+	Urb	Cntry Town	Rural
Yes	69	69	69	62	74	68	78	57	53
No	31	31	31	38	26	32	22	43	47
TOTAL	100	100	100	100	100	100	100	100	100

Table 52 Types of transport currently used (other than driving)

Transport	Current Drivers (n=450)	
	Frequency	%
Train	319	71
Tram	141	31
Bus	134	30
Taxi	43	10
Aeroplane	30	7
Pushbike	28	6
Other people	22	5
Public transport (not defined)	11	2
Other	13	3
No response	1	<1

Multiple response question – total may exceed 100%

Poor accessibility of alternative transport options is often raised as a major factor in not wanting to use it. Participants were asked how accessible transport options are to them. As shown in Table 53, buses and taxis were more accessible than other forms of transport. Fewer participants living in country towns (21%) and rural areas (17%) said that trains were accessible compared with those in urban areas (51%). Similarly, fewer participants living in country towns and rural areas had access to taxis and buses compared with urban dwellers (taxis: 62%, 47% and 79%, respectively; and buses: 30%, 36% and 68%, respectively). As expected, trams were accessible almost exclusively to urban residents.

Table 53 Accessibility of transport

Transport Mode	Proportion of Current Drivers (%)		
	Accessible	Somewhat	Inaccessible
Bus	54	23	23
Train	38	32	29
Tram	14	5	80
Taxi	69	22	9

Driver education

Last, current drivers were asked some questions about their involvement in driver education programs for seniors. One-third of drivers indicated that they had attended a driving class or refresher course, other than one they may have taken when first learning to drive. Of those who did attend a course, around 38 percent had taken the course less than five years ago. More males than females took driver education courses (36% vs 27%

respectively). Interestingly, those who participated in driver training courses were more likely to be in the youngest group (40% for the young drivers compared with 34% and 26% for the young old and old-old groups respectively). Types of driving courses attended are described in Figure 16. Seventy-five of the current drivers said that they had attended an advanced driver training or defensive driving course. Around 40 had attended a driving course that was related to their work. Fifty drivers had attended an educational session - either a RACV Years Ahead (or other RACV program) or a VicRoads program (mostly SafeDrive).

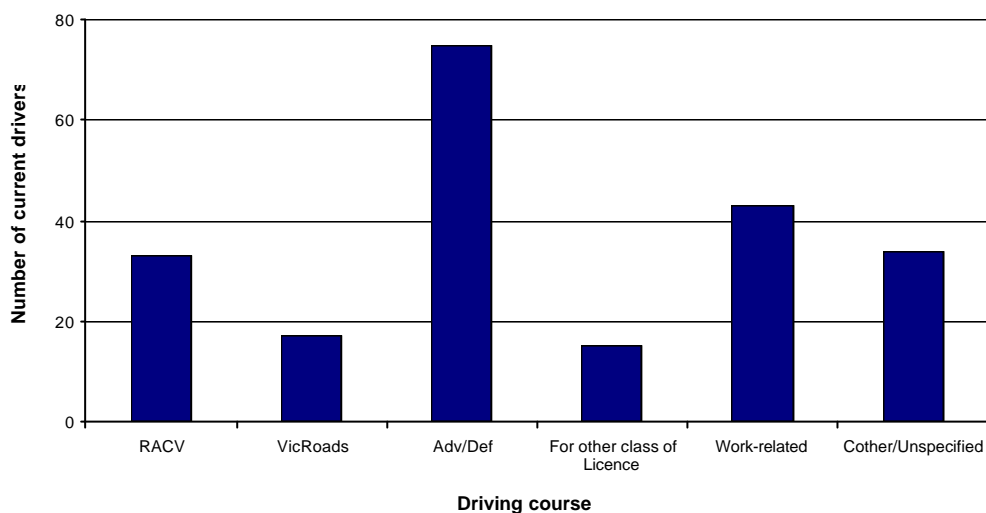


Figure 16 Types of Driving Education Course Attended by Current Drivers

One-third of current drivers also indicated that they had they had obtained information about older drivers. Of those who had used older driver information, the main source was the Victorian Older Drivers' Handbook (VicRoads) (47%).

To examine the effect of driver education on adoption of self-regulatory behaviours, the relationship between avoidance of any driving situations and attendance at driving classes was explored. No effect of driver education was evident.

FORMER DRIVERS

Four percent of seniors who took part in the study considered themselves former drivers (n=29). Approximately one-third of the group still owned a car (34%). Figure 17 shows the duration of time since stopping driving. More than half of the former drivers had stopped driving less than twelve months previously and more than forty percent had stopped between one and two years ago. The median period of time since stopping driving was nine months.

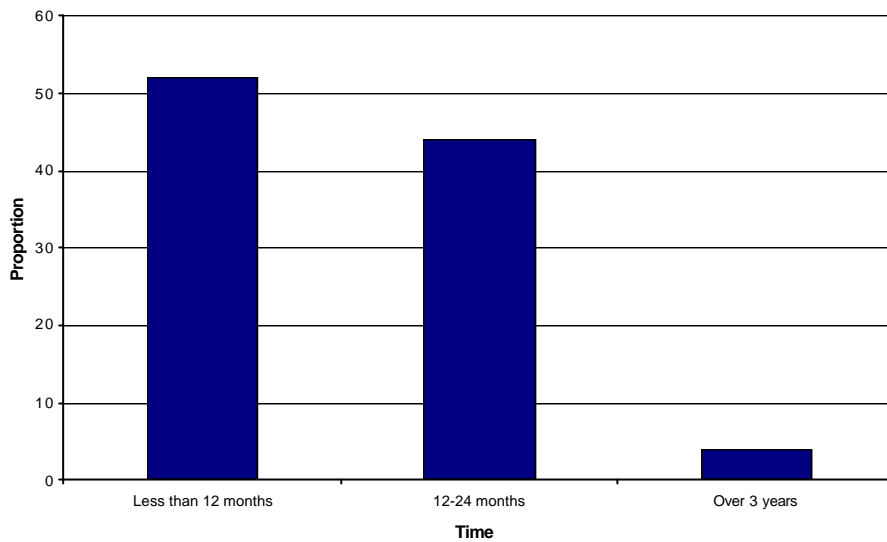


Figure 17 Time since stopping driving

Former drivers were asked general questions relating to their mobility, satisfaction with mobility, transportation options, reasons why they stopped driving, the importance of driving (when they were driving), the likelihood of driving again, and the process of reducing and eventually stopping driving.

Mobility

Former drivers were asked how often they left their home to go places (see Figure 18). Thirty-six percent indicated that they went out once or twice a week and more than half (53%) reported that they went out 3-4 times per week or daily or almost daily.

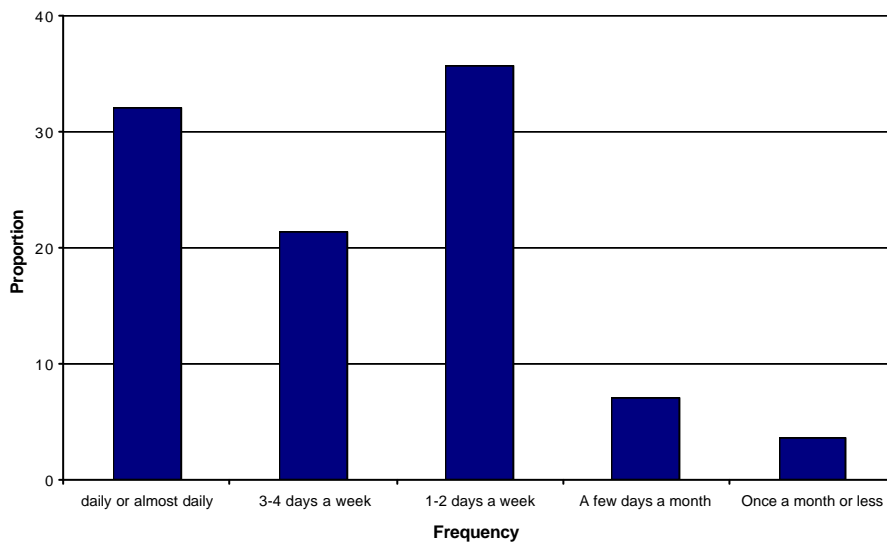


Figure 18 Frequency of going out

Figure 19 shows the level satisfaction of former drivers with their current mobility. Eleven of the 29 former drivers (38%) reported that they were very satisfied with their ability to go places. However, 34 percent were only somewhat satisfied and 28 percent were not very

satisfied with their current mobility. Reasons for dissatisfaction included the paucity and expense of alternative transport and the inconvenience of not having a car.

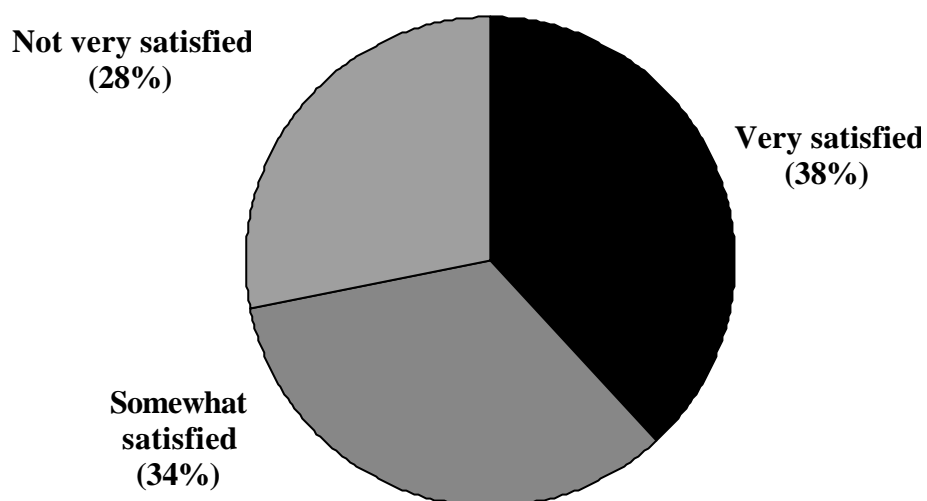


Figure 19 Satisfaction with ability to get to places

The majority of former drivers (66%) indicated that it was very important for them to keep driving as long as they could. Only 17 percent said that this was not very important and a further 17 percent said that it was somewhat important for them to keep driving for as long as possible (see Table 54). Some of the reasons why this was so important for them included the wish to retain their independence and being able to visit family and friends. Another salient reason was the sheer pleasure that driving afforded these seniors.

Table 534 Importance of driving as long as possible

Level of Importance	Proportion of Former Drivers (n=29)
Very important	66
Somewhat important	17
Not very important	17
TOTAL	100

In addition, participants were asked if they thought it was likely that one day they would drive again. As expected, the majority of former drivers 79 percent indicated that it was unlikely that they would drive again (see Figure 20). Interestingly, 13 percent of former drivers indicated that it was very or somewhat likely that they would drive again.

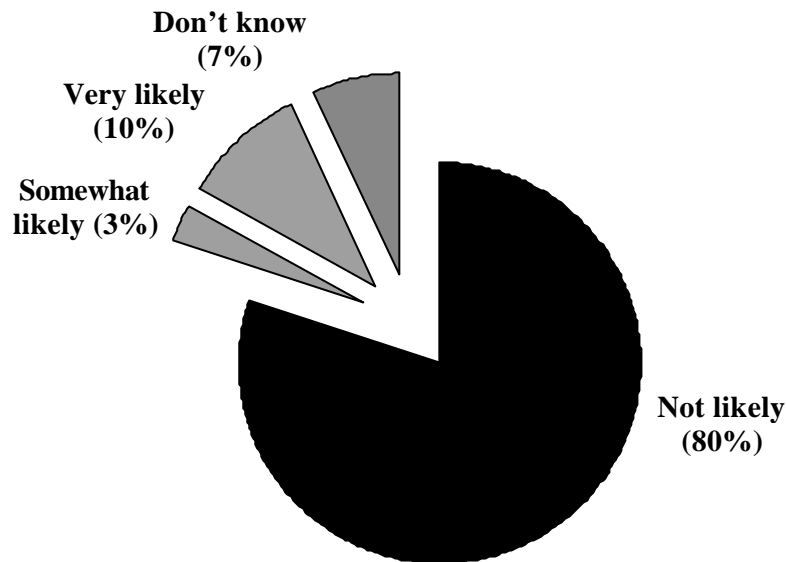


Figure 20 Likelihood of driving again

Alternative transport options

Former drivers were asked a series of questions about the modes of transportation they used to go places. Responses are summarised in Table 55. Overall, 89 percent of former drivers reported that they used a private car, as a passenger, either often (34%) or sometimes (55%). Approximately one-quarter of the group (25%) said they often took taxis to go places and more than half (57%) said they took taxis sometimes. Just under half of the former drivers (46%) reported that they often walked places that were 2 blocks or more away and around one-third (32%) indicated that they often used public transport.

Table 55 Frequency of use of transportation options

Transport Mode	Proportion of Former Drivers (n=29)		
	Often	Sometimes	Never
Passenger in a car	34	55	10
Specialised transportation	7	18	75
Taxi	25	57	18
Public transport	32	21	46
Walk	46	21	32
Bicycle	0	0	100

The decision to stop driving

There are many reasons why people stop driving. Former drivers in this study were asked about their decision to stop driving. First, without prompting for specific pre-determined reasons, participants were asked to describe the *most important* reason why they stopped driving. Responses are summarised in Table 56. The most commonly reported reason given

for stopping driving was ill-health (34%). Other reasons included: safety/apprehension (28%) and crash involvement (21%).

“I got glaucoma so I lost my peripheral vision.”

“I was frightened my reflexes were not going to be fast enough in the event of an emergency.”

“I had an accident by hitting the accelerator instead of the brake.”

Table 56 Most important reason for driving cessation

Reason	Proportion of Former Drivers (n=29)
Ill-health	34
Safety/apprehension	28
Crash involvement	21
Licence removed by Authority	17
Less need (moved/alternative transport)	14
Other	3
No response	3

Common reasons for giving up driving were explored further. A list of commonly cited factors for stopping driving was presented and participants were asked to indicate whether any of these applied to them (see Table 57).

Table 57 Reasons (prompted) for driving cessation

Reason	Proportion of Former Drivers (n=29)
Someone else available to drive you places	21
Other forms of transportation	31
Did not enjoy driving or feel comfortable driving	45
Did not feel a safe driver	41
Concern reactions not fast enough in emergency	28
Advised by doctor	21
Vision problems	31
Dizziness or blackout problem	14
Problems with use of arms or legs or turning head	14
Family or friends encouraged to stop	31
Could not renew licence (when assessed for fitness to drive)	14
Accident or ‘near miss’	21
Cost too high	17

Forty-five percent of former drivers indicated that their decision had to do with not enjoying driving and not feeling comfortable driving. A substantial proportion (41%) also reported that their decision had to do with not feeling that they were a safe driver. About one-third (31%) said that their decision was influenced by the fact that they had other forms of transport available or that they had someone else to drive them places (21%). Fifty-nine percent identified specific medical problems or functional impairments, with vision (31%), dizziness (14%), and use of arms or legs and neck mobility (14%). An additional 28 percent reported that they were afraid their speed of reactions was not fast enough to cope with an emergency situation and 21 percent indicated that they had been involved in a crash or 'near miss' that caused them to stop driving. The influence of doctors' advice (21%) and family advice (31%) was also cited as a factor in the decision to stop driving.

It was also of interest to know whether driving cessation was a gradual process or whether this happened suddenly. The majority of former drivers (62%) indicated that they stopped 'all at once' while 38 percent indicated that they stopped driving gradually. In addition, as shown in Figure 21, the majority of former drivers (69%) thought that they had stopped at about the right time. Interestingly, five of the 29 former drivers (17%) said that they felt they had stopped driving earlier than they should have.

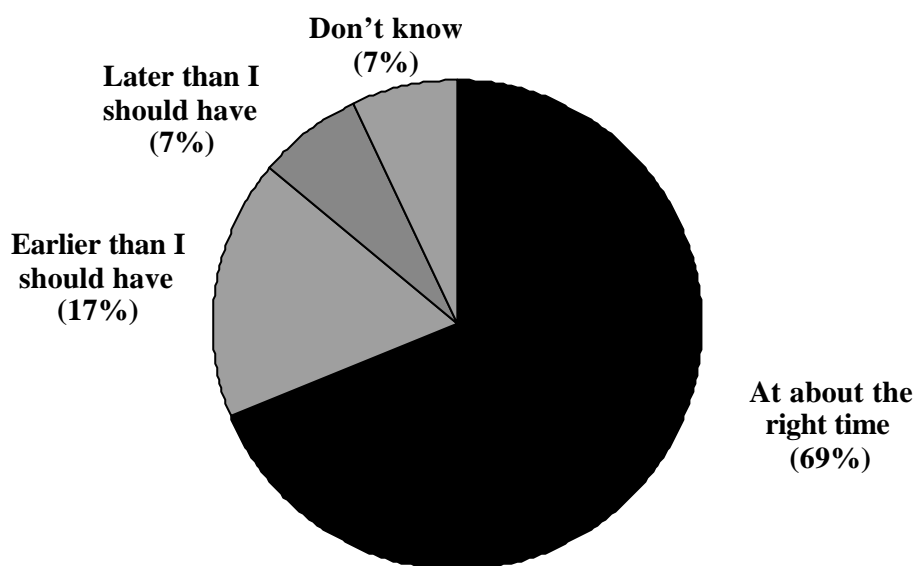


Figure 21 Did driving cessation occur at the right time?

Former drivers in this study were asked if they made the decision to stop driving themselves, or if others were involved in the decision-making process. The majority of former drivers (69%) indicated that the decision was solely theirs. Only five reported that they made the decision along with other people (17%) and four (14%) said that others had made the decision for them.

Crash involvement and infringements

Former drivers were asked a series of questions about their crash involvement and infringements over the last two years, when they were still driving. Only those who had stopped driving within this time frame responded to these questions. (One driver had stopped driving 3 years beforehand and one driver did not indicate when they had stopped driving). Six of the 27 former drivers who met these criteria (22%) indicated that they had

been involved in a crash where they were the driver. All of these crashes occurred during the day. Three occurred on the road and three occurred on private property or in a carpark.

Interestingly, of the six drivers who had been involved in a crash, five said that their involvement in a crash (or near miss) was one of the reasons they gave up driving.

Former drivers were also asked about infringements over the past two years. In this time period, none of the former drivers had incurred a traffic infringement other than a parking fine.

Driver education

Former drivers were asked about their involvement in driver education programs for seniors. Six of former drivers (21%) indicated that they had attended a driving class or refresher course, other than one they may have taken when first learning to drive. Nine former drivers (31%) said that they had obtained information regarding older drivers and five of these were the Victorian Older Drivers' Handbook (VicRoads).

4 SUMMARY AND RECOMMENDATIONS

The broad aim of the study was to gain a detailed understanding of older drivers' self-regulatory practices. Telephone interviews were conducted with 656 current drivers and 29 former drivers. The sample comprised male and female drivers aged 55 years and older from urban areas, country towns and rural areas in the State of Victoria. The study aimed to determine the extent and effectiveness of self-regulation practices of drivers in order to develop road safety initiatives aimed at improving this practice. Key objectives of this study were:

- To gain a better understanding of the extent to which older drivers adopt self-regulatory behaviour while driving;
- To identify the kinds of self-regulatory behaviours that older drivers adopt:
 - Travel patterns;
 - Confidence, difficulty with and avoidance of specific driving situations including complex intersections, driving at night, in the wet, on busy roads etc;
- To describe the reasons for self-regulatory practices;
- To examine whether the pattern of self-regulation differs across age, gender and other demographic variables, and more generally;
- To describe the characteristics of those who are exercising self-regulation;
- To examine the relationship between self-regulatory behaviour and crash risk;
- To identify factors contributing to decisions about driving cessation; and
- To describe other issues relating to transport options and travel satisfaction of current and former drivers.

CURRENT DRIVERS

The current drivers in this study were generally active and experienced drivers. The majority (86%) considered themselves to be the principal driver in the household with males and those 75 years and older more likely to be the main driver. More than two-thirds of all current drivers reported driving daily and the majority were satisfied with the amount of driving they were driving. Males were more likely than females to drive daily and to drive greater weekly distances. Similarly, drivers less than 75 years old were more likely to drive more frequently and greater weekly distances than those older than 75 years. Employment status was also strongly related to weekly travel distance. Contrary to what might be expected, driving frequency and distance were not affected by place of residence.

The most common weekly trips were made to the post office, bank and shops; friends and family; and sports and social clubs. Although it is a popular belief that many older drivers like to have a front seat passenger to assist them when driving, less than 20 percent of current drivers interviewed in this study said that they preferred to have someone with them. More than two-thirds of all drivers indicated that they had no preference for a passenger and a minority said they actually preferred not to have anyone with them when driving. It was also noteworthy that only a little over one-quarter of those who preferred a passenger indicated that this was to assist with driving while the remainder preferred a passenger for company. More than half of those who preferred a passenger were males.

Characteristics of the self-regulating driver and the non-self-regulating driver

Information about changes in driving, confidence in driving and avoidance of driving situations, self-reported health, functional and medical status, and crash risk were examined to identify the kinds of self-regulatory practices that older drivers adopt and to determine the characteristics of those who are exercising self-regulation compared to those who are not.

Changes in driving

The majority of drivers (80%) said that their quality of driving was about the same as it was 5 years ago while only 9% said that their driving was not as good now. Despite the general perception of stability in driving quality, drivers were more likely to say that they were driving less (41%) and slower (40%) now than they were five years ago. Drivers from country towns were more likely to report that they were driving the same amount compared with those from rural and urban areas. Those aged 75 years and older were more likely to report that their amount of driving had decreased over the last five years. Females were more likely than males to drive slower now than five years ago, while age and place of residence did not affect changes in driving speed. Reasons for reductions in the amount of driving included general lifestyle changes, such as moving house and employment changes. About 17 percent said they reduced their amount of driving because of health or general ageing issues. Reasons for driving slower predominantly focussed on safety issues including taking care to adhere to speed restrictions and avoiding speeding infringements.

While it might be reasonable to expect that drivers' recognition of a decline in driving quality could be addressed by driving less and/or by reducing driving speed, the findings revealed only partial support for this. Interestingly, of the relatively few drivers (9%) who said their driving was not as good now, about 60 percent were driving slower, but only about one-quarter reported that they were driving less than they were five years ago. Thus, for the small proportion of drivers who acknowledged a decline in their quality of driving, there was good evidence of self-regulation in reduced amount of driving. In contrast there was little evidence of self-regulation in driving speed.

Confidence, difficulty and avoidance of driving situations

Overall, drivers reported being very confident and had no difficulty in the majority of driving situations. Not unexpectedly, this was particularly evident for making right-hand turns at fully-controlled intersections, but around one-third said they were only moderately or not at all confident driving in busy traffic and through intersections without lights. Similarly, around one-quarter said they found busy traffic and intersections without lights a little difficult. Around half of the drivers said they were moderately or not at all confident when driving at night and at night when wet. Generally, males were more likely than females to report being very confident and were also more likely to say they had no difficulty with the various driving situations. Drivers aged 75 years and older were less likely than younger drivers to be very confident in most driving situations. The oldest group were also less likely to report no difficulty in busy traffic and changing lanes. Few differences were observed for confidence ratings across place of residence. One notable exception was that drivers living in rural areas were less likely than those from urban areas and country towns to report being very confident in busy traffic.

In addition to rating confidence and difficulty in specific driving situations, drivers were asked if they intentionally avoided these situations. Overall, a relatively small proportion of drivers reported avoiding driving situations. Highest avoidance levels were seen for busy traffic, night driving and driving at night when wet. About one-quarter reported avoiding

these three situations. Females were more likely than males to avoid night driving and driving at night when wet. Drivers aged 75 years and older were also more likely than younger groups to avoid night driving and driving at night when wet as well as merging into traffic. Drivers aged 65 and older were more likely than younger drivers to avoid busy traffic. More than half of drivers who avoided night driving or driving at night when wet did so because of problems relating to vision (especially glare from lights) whilst the most common reason (40%) for avoiding busy traffic tended to be personal preference, with many reporting that busy traffic was not enjoyable and made them feel uncomfortable. Other situations frequently reported by drivers to be difficult and/or avoided were freeways and parking.

For the three most commonly avoided situations, a more detailed analysis was conducted to explore the relationship between avoidance behaviour and confidence and difficulty ratings and between avoidance and health status and medical conditions. This was of particular interest because it was thought that drivers' avoidance of situations that they found to be difficult or in which they lacked confidence represented an appropriate self-regulatory practice. Similarly, avoidance of driving situations could be considered an appropriate self-regulatory practice amongst those who rated their health lower or had specific medical conditions (particularly vision, heart problems and arthritis).

A unique finding of this study was that driving confidence was associated with avoidance behaviours. Those who rated themselves as moderately or not at all confident in at least one of the eight driving situations were more likely to be self-regulators. As might be expected, the majority who reported that they were very confident, or had no difficulty with driving at night, at night when wet and in busy traffic also reported that they did not intentionally avoid these situations. It might be proposed that drivers who report being very confident and do not find these driving situations difficult may indeed have a lower risk and therefore have less need to self regulate. In contrast, of those who rated their confidence lower or reported some level of difficulty, around 50-58 percent intentionally avoided these specific situations. Thus, at least half of those who arguably *should* avoid driving situations in which, by their own report, they find difficult and or lack confidence, in fact report that they *do self-regulate*. Conversely, up to half of those who say they have difficulty do not self-regulate.

Moreover, significant relationships were found between health-related factors and avoidance of potentially risky driving situations. Overall health status was strongly related to avoidance of night driving and driving at night when wet. Lower self-ratings of vision for night driving were associated with avoidance of driving at night and at night when wet. Presence of vision problems as well as arthritis were predictive of avoidance of busy traffic. Interestingly, no relationship was found between vision problems and avoidance of driving at night or at night when wet. Further, ratings of speed of decision-making for safe driving did not influence avoidance behaviours. One might expect, for example, that those who rated their decision-making as less than excellent, might also opt to avoid complex intersections or driving in busy traffic which arguably place a load on information processing capacities.

As was reported for confidence and difficulty ratings, the findings suggested that not all drivers with lower health and functional ability ratings and medical conditions were adopting appropriate self-regulatory practices. Only about one-quarter to one-third of those who arguably could be expected to avoid these driving situations (e.g., because they rated their health or functional abilities lower or had vision problems or arthritis) were indeed self-regulating appropriately.

Health and medical status

Of interest was the relationship between self-regulation (the variables considered exemplary of self-regulatory behaviour were reduced driving and avoidance of driving situations) and self-reported medical conditions and functional abilities. Previous studies have identified vision impairment and cognitive impairment as a significant predictor of both amount of driving and avoidance of driving in certain situations (Ball et al., 1998; Stutts, 1998; Lyman et al., 2001). In his study, the majority of drivers rated their overall health for driving as good, rather than excellent. Overall health ratings were affected by age so that those aged 75 years and older were much more likely to rate their health lower than younger drivers. The same pattern of age differences was also found for each of the areas of functional ability related to driving: vision for day driving, vision for night driving, speed of decision-making, upper and lower body strength and head and neck mobility. In addition, females were more likely than males to rate their vision for night driving lower. Amongst this group of drivers, the three most commonly reported medical conditions were vision problems (77%), arthritis (41%) and heart problems (21%). Of those with vision problems, the majority were presbyopia (longsightedness) and myopia (shortsightedness). Only a small minority (3-4%) had cataracts or glaucoma.

Not unexpectedly, significant relationships were found between weekly driving distance and health-related factors. Those with poorer health ratings tended to drive less frequently and shorter weekly distances. Those with arthritis and who took prescribed medications were also more likely to drive shorter distances per week. Only one of the self-reported functional abilities assessed in this study, speed of decision-making for safe driving, was associated with reduced driving. Those who rated their decision-making as only good, fair or poor, (rather than excellent) were more likely to drive fewer kilometres per week. In addition, those who took prescribed medications reported avoiding driving while on medications.

These patterns are suggestive of appropriate self-regulatory practices amongst those who were aware of declines in health, changes in functional abilities, those with arthritis and vision problems, and those who take medications.

Crash and infringement history

Reduction in driving exposure (driving distance and frequency) was related to infringements but not crash involvement. Avoidance of driving situations was marginally related to crash involvement but not to infringements. Somewhat surprisingly, crashes were more prevalent amongst those who self-regulated by avoiding risky driving situations. Those who had been involved in a crash were slightly more likely to avoid at least one of the eight specific driving situations than those who were not involved in crashes. Thus, rather than self-regulation being associated with a lower crash risk, evidence was found to the contrary. It is important to note that the survey did not provide information about the relative timing of crashes and adoption of self-regulatory behaviour. However, it is plausible that older drivers were likely to avoid potentially risky driving situations following their involvement in a crash. While few current drivers attributed avoidance of situations to crash involvement, interestingly 21 percent of former drivers said that at least one of the reasons they gave up driving was because of a crash or a near miss.

Overall, there was no evidence that self-regulation was an effective means of reducing crash risk in this group of drivers. This finding may be due to the fact that crashes are a relatively rare event and so a much larger sample size may be required to have sufficient power to detect a true effect. Alternatively, it may be that many of those who are self-regulating do not need to. That is, they do not have medical conditions or any serious

declines in functional abilities that are associated with higher crash involvement. It is important that future studies be designed to further explore the relationship between crash risk and self-regulation.

Other factors

A number of other factors were examined in relation to adoption of self-regulatory behaviours.

Interestingly, the presence of another driver in the household was associated with reduced driving and avoidance of driving situations. Those who were not the principal driver in the household were more likely to be self-regulators than those who were the principal driver. This is an intuitive result since the presence of another driver would provide an opportunity for sharing the amount of driving and possibly when and where trips were taken. Curiously, those who were not married (or in a defacto or common law relationship) were also more likely to be self-regulators in terms of limiting the weekly travel distance. It is possible that having a partner creates a greater need for travel and possibly leads to longer and/or more frequent trips.

About one-third of drivers had attended a driving education course and about the same proportion had obtained information about older drivers, predominantly from VicRoads' Victorian Older Drivers' Handbook. However, attendance at driver education courses appeared to have no influence on drivers' avoidance of any driving situations, nor with any measures of exposure.

Key characteristics of self-regulators

Regression modelling was used to identify key characteristics of self-regulators amongst older drivers. Together the combination of variables in the models enhanced the probability of predicting self-regulatory behaviour. The logistic regression analyses also provided a measure of the relative contribution of each of the selected variables in predicting self-regulatory behaviour, with all other variables held constant. Two variables describing driving patterns were selected to exemplify self-regulation: weekly driving distance (km) and avoidance of potentially difficult and risky driving situations.

Those who drive no more than 100 kilometres per week were more likely to:

- be female;
- be 75 years and older;
- be retired;
- have arthritis;
- rate decision-making for safe driving as good/fair/poor (rather than excellent);
- not be the principal driver in the household;
- be not married (or in a de facto relationship).

Those who avoid *any* of the specific driving situations (rain; merging; busy traffic; roundabouts/intersections; at night; at night when wet; changing lanes; other driver-specified problem situations) were more likely to:

- be female;
- be 75 years and older;

- have a vision problem;
- not be the principal driver in the household;
- have had a crash in the last two years.

Additional exploratory modelling of predictors of avoidance also showed that confidence ratings were highly predictive of avoiding driving situations. Those who rated their confidence in every one of the eight driving situations as excellent were four times more likely to be non self-regulators.

Driving cessation: the experience of current drivers

Approximately three-quarters of drivers indicated that they had thought about the possibility of not driving one day. These were more likely to be female, aged 75 years and older and living in either an urban area or a country town. Very few current drivers (5%) said that someone had suggested they should limit their driving or stop driving altogether. The majority of drivers said they had thought about stopping driving one day. However, of some concern was the finding that only around 20 percent said they had actually made some plans for this. The most common ways of planning were moving house, exploring alternative transport options and moving closer to family and services.

Predominantly drivers said that the one thing that would concern them most about not being able to drive was a loss of independence. About 16 percent said that this would have a devastating effect on them. Others described a general loss of mobility, restricted activities, reliance on alternative (usually public) transport and the general inconvenience of not having a car.

Interestingly, more than two-thirds of drivers reported using alternative forms of transport, other than driving. Amongst those who use alternative transport about two-thirds used trains, while trams and buses were also used by about one-third. Taxis were used by relatively few as was being driven by other people. Buses and taxis were generally reported to be the most accessible forms of transport, although less so in country towns and rural areas. For example, only about one-third of people in country towns and rural areas said they had access to buses.

Not unexpectedly, drivers placed a very great importance on their ability to drive. This was reflected in their concern that stopping driving would represent a major loss of independence and would, for some, have a devastating effect on their life.

FORMER DRIVERS

A secondary aim of this study was to explore issues relating to the decision to stop driving, factors that contributed to driving cessation, use of alternative transport options and the impact of driving cessation on various life areas for former drivers.

A small sample of 29 former drivers was interviewed. The majority (approximately 80%) were aged 75 years or older; about half were males and half were females. A little more than half had stopped driving in the previous year and the majority of the remainder had stopped between 12 months and 2 years prior to the study. About two-thirds said they stopped driving abruptly while the remainder said that stopping driving was a gradual process.

Two-thirds of former drivers indicated that it was important for them to keep driving for as long as they could. Reasons for this primarily were related to a desire to remain

independent; to be able to visit family and friends; and because of the pleasure that driving afforded them.

Twenty former drivers said they made the decision to stop driving themselves, five indicated they made the decision together with others, while only four said that others made the decision for them. Most said they stopped driving at about the right time, however, five reported that they felt they gave up driving too soon.

About half of former drivers went out either daily or 3-4 times per week, however, more than one-third said they went out only one or two days per week. More than one-quarter said they were not very satisfied with their ability to get to places that they wanted to go to. Reasons for this were predominantly related to paucity and expense of alternative transport and the inconvenience of not driving.

About one-third of former drivers said they often travelled to places as a car passenger and a similar number reported often using public transport. Just under half said they often walked places. Taxis were used often by about a quarter of former drivers while about a half said they used taxis sometimes.

Ill-health, safety concerns and crash involvement were the three most important reasons given for stopping driving. Many also reported that their decision was influenced by the fact that they no longer enjoyed driving or no longer felt comfortable when driving. The option of having access to other forms of transport was influential in the decision to stop driving for about one-third of the group. The influence of doctors' advice and family and friends' advice was also a factor for some. On face value, these reasons for stopping driving would appear to be generally appropriate self-regulatory behaviour.

Related to this finding, it has been proposed elsewhere (see Oxley et al., 2003) that mandatory age-based licensing in the state of Queensland may have a powerful effect on drivers' decisions about giving up driving, particularly amongst older women. It would be interesting to explore self-regulatory practices as well as voluntary driving cessation patterns across different jurisdictions where licensing requirements differ.

LIMITATIONS OF THE STUDY

Ideally, changes in self-regulatory behaviours are best studied using longitudinal studies, following a cohort of drivers across. Constraints on time and budget precluded this approach in the present study. Notwithstanding this limitation, this study was able to identify some important differences in self-regulatory behaviours across the three age groups studied. What is more difficult to ascertain is whether these effects are cohort-specific or whether they are truly reflective of changes that occur with the ageing process.

While some survey questions addressed the issue of *changes* in driving behaviour across the previous five years, this issue is much more appropriately explored using a longitudinal study design. It was not possible, simply because of constraints on interview time, to explore changes in self-regulatory practice for all driving behaviours. For example, we do not know whether those who avoided certain driving situations had done so only recently or whether they had avoided these situations all their driving life. A comparison of age-group differences suggested that drivers aged 75 years and older were much more likely to avoid certain driving situations than younger drivers. However, ideally, this should be studied using a longitudinal study design. Alternatively, a more in-depth evaluation of this issue could be undertaken using a focus group approach.

In this study, it was not possible to assess directly the various functional abilities related to driving. Rather, vision, decision-making and other abilities required for safe driving were

assessed by self-report. Ideally, functional impairment should be measured by performance on standardised assessments tests of cognition, vision, perception, attention and physical abilities related to driving. However, one could also argue that if drivers perceive their abilities in these areas to be less than optimal for safe driving, then this indeed may be sufficient justification for self-regulation. One of the major problems with self-ratings of this kind is that people with poor cognitive capacity or memory impairment are unlikely to provide accurate information about health status or driving patterns. Moreover, those who lack insight cannot, by definition, provide reliable information about their functional abilities.

The data provided in this survey made it difficult to ascertain the relationship between crash risk and self-regulation and in particular, whether self-regulatory practices were effective in reducing crash risk. Part of the reason for this may have to do with the fact that crashes are a relatively rare event amongst older drivers. Future research is needed to better identify the effectiveness of self-regulatory driving practices in reducing crash risk.

Last, despite numerous efforts to recruit former drivers only a very small number of people volunteered for this study. It is reasonable to expect that many of those who have recently given up driving will have serious health problems and medical conditions which might result in their hospitalisation or placement in residential care. Moreover, the likelihood that former drivers with such severe health problems would volunteer for this study is relatively low. More research is needed on issues relating to former drivers with a larger sample. Interestingly, several adult children of older people contacted the researchers to provide information about their parents. Interviews with adult children of former drivers may provide a useful additional source of information about former drivers.

CONCLUSION

The results of this study confirmed for a sample of Australian drivers many of the findings from previous research with drivers in other western countries (e.g., see Benekohal et al., 1994; Hakamies-Blomqvist, 1994; Land Transport Safety Authority, 2000; Rosenbloom, 1999). In general, this study found evidence for age-related changes in reduced driving distances and reduced frequency of driving as well as avoidance of specific driving situations. In addition, a major contribution of this study has been to explore characteristics, other than age, that are associated with self-regulatory driving practices. Self-regulators tended to be female, aged 75 years or older, with vision problems, with arthritis, lower ratings of speed of decision-making for safe driving, not the principal driver and not married. Of interest was the finding that crash risk was not necessarily related to lower crash involvement. As noted above, the relationship between crash risk reduction and reduction of driving in potentially risky situations needs to be explored further.

RECOMMENDATIONS

This study has provided a rich source of information about drivers' self-regulatory practices. Based on the findings of this study a number of recommendations are made for future research and for strategies to enhance the awareness of self-regulatory practices and to encourage older people to drive for as long as it is safe for them to do so.

Recommendations include:

- Promote amongst older people better awareness of health and medical conditions and functional abilities that affect driving; and related to this

- Promote through educational materials and programs the adoption of self-regulatory practices consistent with declines in functional ability and presence of medical conditions known to be associated with crash risk;
- Promote early planning for retiring from driving amongst older drivers, general practitioners, local council aged care workers, senior citizens and other relevant community groups and families of older drivers; and
- Explore strategies to provide better mobility options for former drivers to help them maintain their independence after driving cessation including access to alternative transport options, proximity to services, family and friends, and improved community infrastructure.

It is also recommended that further research be conducted to address some of the constraints of this study and explore further some of the current findings. Future research should:

- Explore the relationship between self-regulation and functional impairment, using standardised tests of cognition, attention, visual perception etc to assess functional abilities;
- Examine the relationship between crash risk and self-regulation using a case control study method with two groups of older drivers: crash-free and those with crash history;
- Examine changes in self-regulatory practices in a cohort of drivers using a longitudinal study method (e.g., over 5 years);
- Consider the influence of mandatory age-based licensing requirements in determining self-regulatory driving practices as well as voluntary cessation of driving; and
- Explore further the effect of mandatory age-based licensing on the decision to stop driving and consequent mobility restrictions, particularly amongst older women.

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APPENDIX A

NEWSPAPER AND MAGAZINE ARTICLES AND FLYERS

(example: Royal Auto, November 2001)

Monash University studies how seniors keep themselves safe on the roads

Cars and driving play an important role in our lives. Cars provide the mobility that is important to our sense of independence, general health and well-being. There are over 800,000 licensed drivers in Victoria over age 55 years. People continue to rely on the car to get around for many years after the customary age of retirement.

Mobility needs have changed. Motor vehicle use by today's seniors is vastly different from those of previous generations. Recent figures show that Australians aged between 65 and 75 years spend an average of 67 minutes per day in a car. Under the direction of Professor Brian Fildes, RACV Chair of Road safety, researchers at the Monash University Accident Research Centre are studying the travel needs and safety of seniors. Dr Charlton, a Senior Research Fellow at the Centre, describes a new study that will look at the driving strategies that seniors use to keep themselves safe on the roads

Statistics show that older drivers are involved in a relatively small number of car crashes. However, Dr Charlton, explains that these figures do not take account of the fact that older drivers don't travel as far or as frequently as younger drivers. "When crash figures are adjusted for this reduced exposure of older drivers on the roads, and their greater frailty, we find that they are at a higher risk for crashes that cause serious injury than any other age group".

The proportion of older people in the community will increase, and tomorrow's seniors are more likely to hold a licence, travel greater distances and live longer. Researchers estimate that the road safety problem will grow up to threefold by 2031. However, it is also reasonable to expect that there will be many advances that could lessen this problem to some extent, such as improvements in the traffic environment and safer cars. Nevertheless, improving older driver safety is a major challenge for all those who have an interest in road safety.

Recently, the Accident Research Centre in conjunction with its baseline sponsors (including RACV) and Austroads initiated a major study to find out how older drivers themselves can help to solve the road safety problem. This unique approach will study the kinds of safe practices that older drivers adopt to adjust for their changing abilities across their senior years. "We hear about lots of ways that seniors change their driving habits to keep themselves safe", says Dr Charlton. "One important change is that many people are aware of their declining eyesight especially when faced with the glare of oncoming vehicle lights at night, and so they choose not to drive at night".

Currently in most States except Victoria and NT, there is compulsory re-licence testing for drivers when they reach a specified age. However, this system does not recognize that individuals of the same age can vary considerably in physical, sensory and mental capacities. Dr Charlton explains "it is important to find out whether the same people who are most at risk of crashes are the ones who do adjust their driving practices to fit their changing abilities." If we can show this is true, then there will be less need for compulsory re-licence testing for all older drivers.

Dr Charlton says that generally, older drivers are experienced and responsible on the roads. Many choose to modify their driving habits to match their lifestyle in retirement as well as fit their changing capabilities. They may choose to make trips at times other than in peak traffic and avoid

driving at night. The Monash University study will focus on why *some* drivers adjust their driving habits and why others do not.

“The important aim of all of our research on older drivers, is to point to ways to make our roads safer for everyone. A major challenge for the future is to find ways to keep drivers mobile for as long as possible but at the same time, ensure the safety of all road users”.

The Monash University study will start in October 2001 and will run for a number of months. People aged 55 years or older, including those who are currently driving and those who are former drivers, are invited to participate. The study involves a survey on driving history, driving and travel patterns and general health.

If you would like to volunteer for the Monash University Accident Research Centre study, please send your details on the form provided to the address below. For more information, call 03-99051879.

DETACH HERE

 I WOULD LIKE TO KNOW MORE ABOUT THE MONASH UNIVERSITY ACCIDENT RESEARCH STUDY. PLEASE SEND ME SOME INFORMATION ABOUT THE STUDY AND A SURVEY. *Please note that if you decide later that you do not wish to complete the survey, there is no obligation to do so.*

Name Mr / Mrs _____

Postal Address

Telephone Number _____

Email Address: _____

Please Forward To:

**Dr Judith Charlton
Senior Research Fellow
Accident Research Centre
PO Box 70A
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VIC 3800
Australia**

OR

Fax + 61 3 9905 4363

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APPENDIX B

EXPLANATORY LETTER FOR PARTICIPANTS

MONASH UNIVERSITY ACCIDENT RESEARCH CENTRE

OLDER DRIVER STUDY

Recently you expressed an interest in a research project on older drivers conducted by the Monash University Accident Research Centre. The study was featured in the RACV RoyalAuto and several seniors' newspapers. The project will look at the travel patterns of older road users and the reasons why older drivers may change their behaviour on the road. This research will identify important issues for the mobility of older people in Australia and also will go some way towards developing effective road safety initiatives for older road users in the future.

The study will be conducted by telephone interview. The interview will ask some questions about your health, driving performance, changes in driving and reasons for such changes. This should take approximately 20-30 minutes to complete and this would be at a time that suits you. Some volunteers may have already participated in the interview. However, if you have not yet received a call, our research team will contact you sometime in the next few months to check that you still wish to participate in the study and to arrange a suitable time for the interview.

The information we collect is for research purposes only and will be treated in the strictest confidence. No information that identifies an individual will be reported, published or passed on to the road authorities, Police or any other agency, organisation or person. Participation in this research project is entirely voluntary, and if you agree to participate, you may withdraw your consent at any time.

If you have any queries about the study, please contact Dr Judith Charlton on 3 9905 1903; by email at Judith.Charlton@general.monash.edu.au; or by mail at the Accident Research Centre, PO Box 70A, Monash University, VIC 3800 Australia. A summary of the overall research findings will be sent to all participants at the completion of the study.

Thank you.

Dr Judith Charlton

Senior Research Fellow

Should you have any complaint concerning the manner in which this research is conducted, please do not hesitate to contact The Standing Committee on Ethics in Research on Humans at the following address:
The Secretary

The Standing Committee on Ethics in Research on Humans

Monash University

Wellington Road

Clayton Victoria 3168

Telephone 61 4 3 9905 2052 Fax 61 4 3 9905 1420

APPENDIX C

LOGISTIC REGRESSION MODEL FOR SELF-REGULATORS

Step 1 Procedure for preliminary selection of predictor variables

Those variables that demonstrated univariate associations with the variables of interest (driving distance and avoidance behaviour) (p values of 0.25 or less), as shown in Table 41, were selected for the stepwise regression procedure. This relatively high cut-off point was selected because while the variable may not have a large association individually, when used in conjunction with other variables, it may have a significant additional effect. If shown to be not significant, these variables were filtered out during the second step of the stepwise selection procedure.

Step 2 Stepwise selection procedure

The significant predictor variables were determined using a backwards-stepwise variable selection procedure. That is, all of the significant variables were initially included in the model (full model) and individually removed (reduced model). The relevance of the removed variable was assessed by comparing the difference of the log-likelihood ratios of the reduced model to the full model, and compared to a chi-square distribution to determine the additional explanatory power of the variable to the model. If not significant, the variable was discarded and another iteration was considered. The significance cut-off used was 0.1. Variables with a marginal significance between 0.05 and 0.1 were individually tested for contributory significance using the difference in log-likelihood ratios as stated above, and discarded from the model where not required.³

Logistic Regression Model

The variables and general logistic regression equation used in the analysis was:

$$\text{Logit pr (SR=1)} = a + \beta_1 * \text{Sex} + \beta_2 * \text{Age1} + \beta_3 * \text{Age2} + \beta_4 * \text{Arthritis} + \beta_5 * \text{Decision} + \beta_6 * \text{Principal} + \beta_7 * \text{Marital} + \beta_8 * \text{Employ 1} + \beta_9 * \text{Employ 2}$$

Where, SR	= Binary outcome of Self Regulator	1 = Self-Reg.	0 = Non-Reg.
Sex	= Gender	1 = Female	0 = Male
Age 1	= Age group 55-64	1 = 55 – 64	0 = 75+
Age 2	= Age group 65-74	1 = 65 – 74	0 = 75+
Arthritis	= Has Arthritis	1 = Yes	0 = No
Decision	= Ability to make decisions	1 = Excellent	0 = Fair
Principal	= Principal Driver	1 = Yes	0 = No
Marital	= Married or De Facto	1 = Yes	0 = No
Employ 1	= Employed part-time	1 = Part-time	0 = Retired
Employ 2	= Employed full-time	1 = Full-time	0 = Retired

³ However, it should be noted, that not all variables were discarded where not significant. In one instance, age group was not significant. One specific example was the variable Age. Univariate comparisons (and previous literature) suggest that age is associated with self-regulatory behaviour.

The variable Age group (and Employment) had 3 levels and therefore 2 dummy variables are used to represent each independent level. The remaining variables were coded as dummy variables to represent their binary outcome.

Logistic regression was performed on the above variables. The resulting coefficients, standard errors, significance, odds ratios and confidence intervals are given in Tables D1 and D2.

Table D1 Summary of model statistics for prediction of ‘driving distance’

Variable	Reference	Beta	S.E.	Sig.	Odds Ratio	95% C.I. for Odds Ratio	
						Lower	Upper
Gender	Female	0.74	0.22	0.001	2.10	1.37	3.22
Age1	55-64 years	-0.93	0.27	0.001	0.39	0.23	0.67
Age2	65-74 years	-0.70	0.21	0.001	0.50	0.33	0.76
Arthritis	Yes	0.34	0.19	0.068	1.41	0.98	2.04
Decisions	Excellent	-0.70	0.20	0.000	0.50	0.33	0.74
Principal Driver	Yes	-0.76	0.27	0.005	0.47	0.27	0.80
Marital	Yes	-0.42	0.22	0.062	0.66	0.43	1.02
Employed1	Part-time	-0.67	0.21	0.002	0.51	0.34	0.77
Employed2	Full-time	-1.34	0.47	0.005	0.26	0.10	0.66
Constant		0.73	0.39	0.059	2.07		

Table D1 Summary of model statistics for prediction of ‘avoidance of driving situations’

Variable	Reference	Beta	S.E.	Sig.	Odds Ratio	95% C.I. for Odds Ratio	
						Lower	Upper
Gender	Female	0.59	0.18	0.001	1.8	1.26	2.57
Age1	55-64 years	-0.38	0.21	0.076	0.68	0.45	1.04
Age2	65-74 years	-0.24	0.19	0.215	0.79	0.54	1.15
Principal Driver	Yes	-0.68	0.27	0.011	0.51	0.30	0.86
Vision	Yes	0.43	0.19	0.028	1.53	1.05	2.25
Accident	Yes	0.43	0.24	0.069	1.54	0.97	2.46
Constant		0.64	0.33	0.053	1.90		

Interpretation of the beta coefficients are in terms of the log odds (column 'Beta'). By taking the exponent of the equation, interpretation is in terms of an odds ratio (column 'Odds Ratio'), in relation to a reference level of 1. A ratio greater than one suggests the effect has higher odds of being a self-regulator, whereas a ratio less than one suggests the effect has lower odds of being a self-regulator, or conversely higher odds of being a non self-regulator. The 95% confidence intervals are interpreted in the same way. The significance level gives the *marginal significance* of each variable, that is, its significance after adjusting for all other variables.

The Hosmer and Lemeshow test (1989) was used to test the hypothesis that there is no difference between the observed and predicted values of the dependent variable, self-regulatory behaviour. Results for both driving distance and avoidance behaviour showed that the models provided an adequate fit (p values were 0.658 and 0.332, respectively).