

Seniors driving Longer, Smarter, Safer:  
Enhancement of an innovative educational and   
training package for the safe mobility of seniors

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Summary

Older road user safe mobility continues to be a significant road safety and public health issue. The ‘older road user problem’ can be addressed using the Safe System approach, and a particular emphasis is on safer road users through adoption of safe road use practices.

A new education and training package for older drivers, the ‘Seniors Driving Longer, Smarter, Safer’ has been developed in Australia. This is an innovative program aimed to improve the adoption of safe driving practices amongst older drivers in Australia and it is envisaged that this package will supplement and support current initiatives addressing the safe mobility of seniors. The new package incorporates three complementary components i) a one-day workshop/group presentation, ii) a supporting educational booklet, and iii) computer-based self-assessment and/or training tools for older drivers. These components, collectively, are designed to:

* raise awareness amongst older drivers of the issues surrounding older driver safe mobility;
* provide information on the effects of ageing on driving performance and crash risk;
* inform older drivers about ways that they can maintain safe driving (addressing issues specific to both male and female drivers);
* utilise self-assessment tools to demonstrate functional abilities and impact on driving ability; and,
* provide information on successful reduction and cessation of driving and alternative transport options.

An evaluation of the program revealed positive outcomes of the program, including high ratings of usefulness, content, format and delivery style. Moreover, a comparison of questionnaire responses before and after program participation showed improvements in knowledge of road safety issues, awareness of functional changes and impact on driving ability, and attitudes towards adoption of safer driving practices.

Education and training to improve the driving practices of older drivers is central to current international thinking about this group’s safe mobility and there is increasing international recognition of the benefits of these programs. It is claimed, for instance, that if older people are able to adopt safer driving practices, then this will have a protective effect on crash risk and there will be less need for them to have to submit to periodic testing. The current program offers a targeted and potentially powerful strategy to reduce crash and injury risk and maintain safe mobility.

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**Chapter 1: Background**

**1.1 Mobility**

Mobility is essential for general independence as well as ensuring good health and quality of life, and one of the most relevant and important activities of daily living for maintaining independence is the ability to drive. To most older people driving represents not only a means of transportation, but a symbol of freedom, independence, and self-reliance, and having some control of their life. A wide body of research shows that many older adults in motorised countries rely heavily on driving for most of their transportation needs and that older drivers are strongly interested in keeping their cars and licenses after retirement (OECD, 2001; TRB, 1988). It is suggested that older people who are mobile and drive have fewer health problems such as osteoporosis, hip fractures, and use fewer prescription drugs compared with those who do not drive (Waller, 1991). In addition, driving one’s own vehicle is associated with higher levels of life satisfaction, higher adjustment, less loneliness and better perceived control.

In contrast, forfeiture of driving privileges is considered a major loss by many older adults in terms of social identification, control and independence. There is no doubt that many older people report strong feelings about the importance of driving and the prospect of reduction and more particularly cessation of driving evokes a level of fear. For many, particularly those with a decline in health status, driving cessation is likely to lead to poor psychological outlook, life satisfaction, community engagement and quality of life, and increase in depressive symptoms, feelings of isolation, loss of self-consciousness, and a decline in out-of-home activity levels and community mobility (Harper & Schatz, 1998; Marottoli, Mendes de Leon, Glass, Williams, Cooney & Berkman, 2000; Harrison & Ragland, 2003). Further, for at least some people, the same health conditions and functional impairments that cause a change in driving patterns will also limit access to other transport options (walking, cycling, public transport), thereby further contributing to restricted community mobility and its consequences. Driving status thus plays a critical role in the complex interactions between ageing, physical and psychological health, community mobility and use of health services.

Unfortunately, as skills and abilities decline with age, it is inevitable that at some point, it becomes necessary for many individuals to consider reducing driving or retiring from driving. How and when this decision is made is likely to have an important influence on the driver’s experience and adjustment to life without driving. Cessation of driving may follow a gradual reduction in the amount and frequency of driving or suddenly when the consequences of some event leaves a person unable to drive. A person’s decision to stop driving may be voluntary (e.g., recognition of the situation or influence by others) or involuntary (e.g., loss of licence, sudden onset of medical conditions) and forfeiture of driving privileges, whether voluntary or involuntary, is considered a major loss for many adults in terms of social identification, control and independence. Even curtailment of driving usually means relying on others for transportation, incurring potential inconveniences of public transport, or reducing the number of trips.

A number of studies have examined the factors that are associated with reduction and cessation of driving and generally conclude that health problems, little reason to drive, concern about crash involvement, licence cancellation, availability of others to drive and other transportation options, influence from family and doctors, and dislike for driving are major factors involved in the decision to cease driving (Stutts et al., 2001; Ragland, Satariano & MacLeod, 2004). Gender differences are also associated with the timing of driving reduction and cessation, and there is general consensus internationally that there is a higher likelihood of driving reduction particularly driving in stressful conditions (Gallo, Rebok & Lesikar, 1999; Charlton et al., 2004), and voluntary cessation at a younger age, for less pressing reasons and in better health by older women compared with older men (Hakamies-Blomqvist & Sirén, 2003; Rosenbloom, 2006). There is also evidence that women are more likely than men to give up driving prematurely even though they may still be capable of driving safely (Stutts, Wilkins & Schatz, 1999; Oxley, Charlton, Fildes, Koppel & Scully, 2004).

Despite the apparent perception by older drivers that stopping driving would be devastating, it is possible that if the process of retiring from driving is properly managed and planned, and drivers (and their families) are given guidance, information and strategies to make the transition from driver to non-driver smoothly, it should be a less stressful experience for older drivers. Indeed, some research suggests that there is a great difference in quality of life between voluntarily giving up a license and having it revoked by the authorities. Those who make the decision themselves and give up their license voluntarily are less likely to experience depression, loss of self-confidence and status to the same extent as those who have lost their license involuntarily (Oxley & Fildes, 2004). It is also reported that such life changes that are often associated with driving cessation may not be as severe for some and this may be linked with a range of demographic and other factors. Moreover, some have found that the recollection of loss amongst ex-drivers was more neutral compared with current drivers (Oxley & Charlton, 2009).

**1.2 The older driver safe mobility problem**

Given that driving affords the greatest mobility, it is important that we ensure that older drivers and their passengers remain safe while using the transport system. In terms of absolute numbers, older drivers are currently involved in fewer crashes compared with young drivers in Australia. However, when figures are adjusted for any exposure measure (e.g., population, number of licensed drivers, distance travelled), older drivers represent one of the highest risk categories for crashes involving serious injury and death in most western societies (OECD, 2001). In Australia, too, crash rates reveal that drivers aged 75 years and older are at higher risk of death and serious injury compared with middle-aged drivers aged 25-60 years, even when such rates are adjusted for vulnerability and driving exposure.

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 (Charlton, Koppel, O’Hare, Andrea, Smith, Khodr, Langford, Odell & Fildes, 2004; Marottoli et al., 1998). 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 deteriorations of several relevant functional 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). An attempt to show the relationship between age-related impairments and driving performance is shown in Table 1.

Many researchers now contend that the older driver ‘problem’ is mainly restricted to certain sub-groups of older people, rather than encompassing all older people and much of the recent research, therefore, has shifted from a general approach of ***why*** older drivers have high crash risk to focussing on identifying ***which*** older drivers are most at risk (OECD, 2001).

Table 1: Age-related impairments and driving problems

|  |  |
| --- | --- |
| **Age-related Impairments** | **Driving Problems** |
| Increased reaction time. Difficulty dividing attention between tasks | Difficulty driving in unfamiliar or congested areas |
| Deteriorating vision, particularly at night | Difficulty seeing pedestrians and other objects at night, reading signs |
| Difficulty judging speed and distance | Failure to perceive conflicting vehicles. Accidents at junctions |
| Difficulty perceiving and analysing situations | Failure to comply with yield signs, traffic signals and rail crossings. Slow to appreciate hazards |
| Difficulty turning head, reduced peripheral vision | Failure to notice obstacles while manoeuvring. Merging and lane changes |
| More prone to fatigue | Get tired on long journeys |
| General effects of aging | Worries over inability to cope with a breakdown, driving to unfamiliar places, at night, in heavy traffic. |
| Some impairments vary in severity from day to day. Tiredness | Concern over fitness to drive |

SOURCE: Suen and Mitchell (1998).

The full impact of the association between ageing, medical conditions, functional decline and reduced driving skills upon crash involvement is mitigated by older drivers themselves. Janke (1994) argued that reductions in skills do not necessarily translate into a higher crash rate over any given period of time for elderly drivers as a group, because of the group’s characteristic compensatory behaviours and voluntary limitations of their driving.

Indeed, many older drivers are aware of some functional decline and accordingly adjust their driving patterns to avoid travel under conditions which are perceived to be threatening or which otherwise cause discomfort (Eberhard, 1996; Smiley, 1999; Charlton, Oxley, Fildes, Oxley, Newstead, Koppel & O’Hare, 2006). As examples of self-regulation, older adults typically regulate when, where, and how they drive and choose to reduce their exposure by driving fewer annual kilometres, making shorter trips and making fewer trips by linking different trips. Older drivers have also been found to limit their peak hour and night driving, restrict long distance travel, take more frequent breaks and drive only on familiar and well lit roads (together (OECD, 2001; Benekohal, Michaels, Shim & Resende, 1994; Charlton et al., 2006).

While self-regulation may contribute to a reduction of older drivers’ crashes below expected levels, there is evidence that at least some older drivers are not regulating or adopting appropriate self-regulatory behaviours. For example, Stalvey and Owsley (2000) found that over three-quarters of a visually-impaired, high-risk group of older drivers did not self-regulate and did not see themselves as particularly susceptible to crashing.

Others, too, demonstrate that not all older drivers self-regulate their driving. For example, Charlton and her colleagues (2006) identified the characteristics of those who self-regulate and those who do not. Amongst their sample of drivers aged 65 years and older, those who were less likely to adopt self-regulatory behaviours (defined as driving less than 100 kilometres per week and avoiding specific driving situations) were more likely to be younger (<65 years), male, married, without a vision condition, and the principal driver of the household.

**1.3 Managing the ‘older driver problem’**

Older drivers as a group have a heightened casualty crash involvement per distance travelled – and in such crashes are more likely than other participants to be injured or killed. Older drivers as a group are more likely to have some level of functional impairment and, at least intuitively, a reduction in some driving skills. However this latter factor is considered to have only a modest role in all older driver crashes, due to older drivers’ propensity to self-regulate, thereby reducing driving exposure (particularly to difficult or otherwise uncomfortable driving situations).

In explaining older drivers’ heightened casualty crash involvement per distance travelled, the research suggests that in addition to many of the usual factors affecting drivers of all ages, the following have a particular role:

* for almost all, physical frailty;
* for many, a high level of urban driving; and,
* for some, reduced fitness to drive.

Moreover, over the next few decades, increases in the number and proportion of older people in the population, increases in licensing rates, increased car use and dependency on the car, will have implications for future crash levels amongst older drivers. In the US, Hu, Jones, Reuscher, Schmoyer and Truett (2000) attempted to project the crash risk for future generations of older road users, taking into account predicted driving behaviour, population migration, personal wealth and health, infrastructure and technological impacts. They predicted an overall 286 percent increase in fatalities from 1995 to 2025. Similar projections have recently been established in Australia (Fildes, Fitzharris, Charlton & Pronk, 2001). An overall three-fold increase in fatal crashes involving older drivers without active intervention was predicted.

The Safe System framework was adopted in Australasia in 2003, in response to the recognition that any significant gains in road safety would best be achieved by the introduction of a new approach. Within the common framework of safer roads, vehicles, speeds and road users, Safe System approaches present a different view of road users than has traditionally been the case. The Netherlands’ *Sustainable Safety* describes the road user as the weakest link in the transport chain: the individual road user is largely unpredictable and cannot be relied upon to behave safely over the long term, all best intentions notwithstanding (Langford & Oxley, 2006). However this view does not excuse road users from behaving responsibly. They are expected to obey road rules, demonstrate adequate skills and can expect fines and even loss of licence if they behave inappropriately (for example, by speeding or drink-driving).

Older road users pose a specific challenge for the Safe System framework, and, in their analysis of the ‘older road user problem’ from within a Safe System framework, Langford and Oxley (2006) recommended the following interventions targeting older drivers:

* Safer roads, through a series of design improvements particularly governing urban intersections;
* Safer vehicles, through both the promotion of crashworthiness as a critical consideration when purchasing a vehicle and the wide use of developed and developing ITS technologies;
* Safer speeds especially at intersections; and
* Safer road users, through both improved assessment procedures to identify the minority of older drivers with reduced fitness to drive and educational efforts to encourage safer driving behaviours.

With regard to ensuring safe road users, there has been much focus on re-licensing procedures for older drivers, with many countries and jurisdictions imposing age-based license renewal procedures, with a range of screening tests to determine fitness to drive. However, many of these licensing procedures have been called into question with respect to their efficacy in reducing crash risk and implications of reduced mobility (Langford, Fitzharris, Koppel, & Newstead, 2004; Langford, Fitzharris, Newstead, & Koppel, 2004). More recently there has been a call for more targeted identification of those older drivers who are most at risk (OECD, 2001; Stutts, Wilkins, Reinfurt, Rodgman & van Heusen-Causey, 2001; Fildes, Charlton, Langford, Frith, Pronk, Newstead, Oxley, Oxley, & Koppel, 2004).

It is also acknowledged that many older drivers adopt safe driving practices, in the form of ‘self-regulation’, and a major focus of initiatives has been on assisting older drivers to self-regulate appropriately. Indeed, there are promising strategies have focused on improving the driving practices of older drivers through education and training programs and resources. One of the reasons this appears to be the result of some evidence that indicates that driving errors related to lack of knowledge/or driving experience can be overcome through training and/or education (McKnight, 1988). This may be especially true for the current cohort of older drivers, many of whom had little formal driving education (Goggin & Keller, 1996).

In addition, in cases where training is not able to correct or diminish the impairment (for example, a medical condition), there is some evidence suggesting that education can assist older drivers compensate for the effects of the impairment identifying or promoting adaptive or self-regulatory strategies such as minimising the amount of driving done under conditions that impose a heavy perceptual and cognitive load (e.g., avoiding extensive driving or driving in unfamiliar: Kostyniuk, Streff & Eby, 1998; Persson, 1993); enlisting the cooperation of others to help share the driving load (e.g., having a passenger navigate or read the road signs: Kostyniuk, et al., 1998; Persson, 1993); and exercising alternatives to reduce perceptual and cognitive load (e.g., using less-travelled roads: McKnight, 1988).

Previous research conducted at MUARC has identified some behavioural and travel factors that may contribute to increased crash risk, and concerns about those drivers who arguably should be self-regulating because of declining abilities, but who fail to adapt their driving behaviour accordingly, and those drivers (particularly women) who may lack up to-date driving experience and confidence, and give up driving at an unnecessarily early stage (Charlton, Oxley, Fildes, Scully, Koppel, Congiu, & Muir, 2006; Oxley, Charlton, Fildes, Koppel, Scully, Congiu, & Moore, 2006). These studies have identified a need for awareness, education and training programs, with a particular focus on the sub-groups of older drivers who may benefit greatly from driver education and training programs.

Education and training to improve the driving practices of older drivers is central to current international thinking about this group’s safe mobility and there is increasing international recognition of the benefits of these programs. It is claimed, for instance, that if older people are able to adopt safer driving practices, then this will have a protective effect on crash risk and there will be less need for them to have to submit to periodic testing.

In 2008-09, with the support of the NRMA ACT Road Safety Trust, MUARC developed a new and innovative education and training program, *‘Seniors Driving Longer, Smarter, Safer’*, taking into account an understanding of the issues surrounding the safe mobility of older road users, previous literature and international ‘best-practice’ in road safety education programs, general international ‘best-practice’ in adult education strategies, and feedback from groups of older road users (Whelan, Devlin, Oxley & Charlton, 2010). The program aimed to provide ‘at risk’ groups of older road users with information about driving. The program was structured within a Safe System approach and designed to address four major areas addressing the safe mobility of older road users, including i) a general awareness of crash and injury risk, ii) the impact of age-related functional changes on driving ability and safety, iii) use of alternative transport options, and iv) strategies to maintain safe driving.

During the development of the program, a small process evaluation was conducted amongst three groups of older drivers to assess the program’s effectiveness in changing/improving overall knowledge of safe mobility and adoption of safe driving practices, and its acceptability amongst older drivers. The findings revealed a significant change, as a result of the program, in the extent to which participants had considered ways in which their abilities affected their driving. Participants (87%) indicated that they thought ‘*somewhat to a lot*’ about these issues after attending the program (compared with 51% prior to attending the program). Other changes, while not statistically significant, included a higher likelihood of self-regulation by avoiding some difficult driving situations (such as driving at night, in the rain, on freeways, and driving through intersections without traffic lights) after attending the program compared with prior to attendance. In addition, there was some suggestion that attendance at the program resulted in some changed attitudes to important road safety messages and changes in driving behaviour and patterns. Encouragingly, positive acceptability ratings were found, particularly regarding the program’s usefulness and information dissemination. While the group generally felt that the length of the program session was appropriate, additional feedback from community groups suggested that shorter programs, either a two-hour or one-day session may be better received by seniors and seniors groups and more practical.

Key recommendations from the study and subsequent discussions with interested community groups in the ACT suggested further refinement of the program package, particularly to reduce the program to a one-day event, and a more rigorous evaluation of the effectiveness and acceptability of the program amongst a larger group of older road users. Undertaking these tasks will result in an enhanced and effective program and good opportunities for widespread use of the package in the community.

**1.4 Aims of the project**

The main objective of this project was to translate the research already undertaken in developing an effective education/training program for older road users into action. The specific aims of the study were to:

* Enhance and refine the ‘Seniors Driving Longer, Smarter, Safer’ program into a comprehensive and updated shorter event; and
* Pilot the revised program addressing effectiveness in achieving behaviour change and older drivers’ acceptability of the program.

The study was conducted in two stages. First a review of current international literature on ‘best-practice’ behavioural and educational measures for older drivers was undertaken. Second, based on the evidence, an enhanced one-day educational/training program was developed and evaluated.

**1.5 Outline of report**

The remainder of this report provides a detailed description of the development, trial and evaluation of the educational/training package. Chapter 2 provides the results from the review of current international literature on ‘best-practice’ behavioural and educational measures for older drivers.

Chapter 3 provides an outline of the educational and training package, the process undertaken to develop the contents of the workshop and booklet, and the results of the trial and evaluation.

Chapter 4 brings together the findings and discusses the overall effectiveness of the program, and implications for distribution and promotion of the resource for widespread use in the Australian community and further research opportunities.

**Chapter 2: Review of Literature**

A review of the most recent research literature evaluating older driver training and education programs was undertaken to summarise program effectiveness in producing safer road users. Key search terms included: Old\* /elder\*/ age\*/ senior\*/ mature/ driver/ education train\*/ program\*/ workshop/ strategy tool/ risk/ countermeasure/ evaluation/ assessment /metric/ effectiveness/ analysis. The search was restricted to publications for the period 2000-2011 which appeared in the following data bases: ATRI, TRID, TRANSPORT and ERIC.

The subsequent publications were reviewed by the project team and reduced to those considered to be of direct relevance to the stated purpose of this report. Only publications detailing training or education programs explicitly developed for older drivers were retained for further review. As a general rule, only publications which evaluated the effectiveness of these programs using variables directly related to either driving or safety performance were considered. As noted by Eby et al. (2009, p. 97):

Most educational programs gather feedback from participants about how much they liked the programs and how to improve it. These data are useful for program developers but do not provide objective data for program effectiveness. They fail to address the core outcomes of programs: amount learned, changes in behaviours due to the program, and changes in motor vehicle crash/injury/risk. These changes should be addressed in a formal evaluation.

As a further restriction, the range of changes attributed to a program needed to have been demonstrated through some form of robust outcome measurement, directly related to safety – mainly on-road driving performance or changes in crash involvement. However pertinent program evaluations based on self-reports or other less-than-robust measures have been noted, usually as footnotes.

The range of training and education programs covered by the selection of publications were categorised into four groups:

* programs which have as the main function, the provision of knowledge about the general association between ageing, changes in functional performance and safe driving practices;
* programs which have as a main function, the provision of practical driver training or behavioural skills directly associated with driving;
* programs which have as the main function, increased self-awareness of fitness to drive (perhaps but not necessarily accompanied by knowledge of compensatory driving practices); and
* programs which have as the main function, improvements in functional areas considered to be necessary pre-conditions for safe driving.

The publications have been reviewed to identify recent programs in each category and to provide a summary of their effectiveness in producing safer older drivers. The report does not attempt to provide an exhaustive listing of the various older driver training and education programs in use in Australia and overseas but deals only with those programs for which there is recently published evidence of effectiveness. The report does not cover programs which have older driver safety and mobility as their primary concern but which are aimed at community and professional groups rather than the older drivers themselves (for example, family and friends of older drivers, medical and health professionals). For a useful overview of all programs relating to older drivers in Australia and overseas, see Anderson (2009) and Frith and Langford (2010).

While the report is concerned primarily with presenting the evaluation evidence relating to the effectiveness of training and education programs, it also aims to provide recommendations for designing and implementing effective older driver training and education programs.

Many behavioural interventions have been introduced to address safer road users, with the assumption that they are effective in reducing crash risk, while maintaining a level of mobility, however, many lack scientific evaluations and/or are not based on scientific evidence. Recently, Preusser and colleagues (Preusser, Williams, Nichols, Tison & Chaudhary, 2008) reviewed over 100 behavioural highway safety interventions and ranked them in terms of their effectiveness along a four-point scale. The list contained seven interventions targeting older drivers, which were ranked thus:

* Proven effective
  + none;
* Likely to be effective
  + licence renewal policies for elderly drivers requiring in-person licence renewal;
* Effectiveness is unknown/uncertain/unlikely

- public information and education programs for elderly drivers;

- formal driver education courses for elderly drivers;

- Medical Advisory Boards for elderly drivers;

- referring elderly drivers to licensing agencies;

- licensing screening and testing for elderly drivers;

- licensing restrictions for elderly drivers;

* Proven not to work

- none.

These interventions are consistent with ‘safe-mobility interventions’ argued by Hennessey and Janke (2009) as rightful responsibilities of licensing authorities in their management of older driver safety. The identified interventions are:

* referring functionally limited drivers for physician-based evaluation and (where appropriate) treatment;
* educating functionally limited drivers about the safety implications of their condition and providing advice about compensatory strategies;
* encouraging functionally limited drivers to get behind-the-wheel training, particularly to develop compensatory driving skills; and
* the use of restricted licences for those functionally limited drivers able to drive safely especially in less hazardous driving environments.

While all three studies have identified training and education programs[[1]](#footnote-1) as possible interventions of value to at least some older drivers, Preusser et al. (2008) have estimated the effectiveness of these programs as ‘unknown/uncertain/unlikely’. However the programs vary greatly in regard to their target audiences, their objectives, their format and content – and it might be expected, their effectiveness. The purpose of this report is to review the most recent research literature to describe the main older driver training and education programs and to summarise their effectiveness in producing safer road users.

**2.1 Programs that provide knowledge about the general association between ageing, changes in functional performance and safe driving practices**

### 2.1.1 The 55-Alive/Mature Driving Program

The 55-Alive/Mature Driving program[[2]](#footnote-2) is a widespread education program introduced in 1979 by the American Association of Retired Persons (AARP) to address the special needs of drivers aged 50 years or older, Currently, 36 US states and the District of Columbia have passed laws that mandate automobile insurance discounts for course participants, thereby contributing greatly to its spread (ARRP, 2011). The program has also been adapted for Canadian drivers by the Canadian Safety Council (Bédard et al., 2004).

In brief, the program is a classroom-based or on-line driver improvement course. The online version was introduced in 2006 and presents the same information as the traditional classroom course. The course provides information about the effects of ageing on driving, compensation techniques, rules of the road, hazard recognition and defensive driving techniques. In the US the program is given in two four-hour sessions run over two days and consists of eleven chapters covering: getting started, judging yourself, physical changes, potential trouble spots, aggressive driving/road rage, safety considerations, driver guidance, your vehicle, intersections, the freeway and driving retirement (AARP, undated). The Canadian adaptation consists of two half-day sessions of three hours each (Bédard et al., 2004).

Only three evaluations of program effectiveness using strong outcome measures were found for the period 2000-2011. Skulfa (2008) used a web-based survey to obtain self-reported driving changes from a sample of US DSP participants who completed the course in late 2007. The results included:

* The majority of respondents (87%) reported that they had changed at least one key driving behaviours as a result of the course. The most commonly cited behaviour changes were ‘always checking blind spots’, maintaining ‘following distance and space cushion’ and ‘keeping eyes moving/scanning traffic’; and
* When the on-line participants were compared to classroom participants (the method for making the comparison was not specified), classroom participants were more likely than on-line participants to report changed driving behaviours.

Another evaluation was conducted by Nasvadi (2007), based on driving changes reported via a telephone survey of 367 older drivers who attended Canada’s 55 Alive/Mature Driving program one-and-a-half to four years earlier. Three-quarters of respondents reported that they adopted numerous safer driving habits as a result of course participation.

Bédard et al. (2004) used a randomised case-control design to evaluate the impact of Canada’s version of the program on driving behaviour. A convenience sample of 72 urban drivers aged 55 year or older initially completed a driving evaluation on a standardised circuit and was then block-randomised to either a control or intervention group. The intervention group attended a re-training session in the form of the 55-Alive program. Both groups then underwent a second driving evaluation using the standardised circuit – the time between the two evaluations being approximately two months. By the time of the second evaluation, seven participants had withdrawn from the study.

The control and intervention groups were equivalent in age, gender and base-line driving scores. Both groups showed an improvement in driving scores by the time of the second evaluation – and while the improvement was higher for the intervention group, the difference was not statistically significant. The authors hypothesised several reasons for the apparent ineffectiveness of the program – including the possibility that the course was not sufficiently intense, with more hours of training and possibly on-road training being required[[3]](#footnote-3). Improved quality of instruction and possible contamination between the two groups were other possible factors.

Bao and Boyle (2009) also used driving behaviour as the outcome measure of program effectiveness – this time with a more specific focus on driving behaviour at intersections. Thirty-five drivers aged 65 years of older in the US state of Iowa – 18 of whom had completed AARP’s DSP, 17 of whom had not – were asked to drive an instrumented vehicle along a route containing two two-way, stop-controlled intersections. The researchers concluded that DSP drivers were more likely to respond to the driving situation and more likely to obey traffic regulations than non-DSP drivers. Safer behaviours by DSP drivers included: earlier braking approaching the intersection, greater likelihood of coming to a complete stop (as required) and more head movements to check for possible hazards and conflicts. However it was also cautioned that these findings may have been influenced by possible sample bias: because Iowa provided no insurance incentive to attend the DSP, perhaps course participants were already safer and more conscientious than non-participants.

Nasvadi and Vavrik (2007) stepped beyond the focus on safe driving habits to consider whether the 55-Alive program resulted in reduced crashes involving aging drivers. They noted that evaluating the program’s effectiveness especially in terms of changes in crash levels was not straightforward – especially because of likely self-selection bias amongst drivers who attend the courses. Where attendance was prompted by an increased safety consciousness, it was likely that post-course crash levels would be relatively low. Where attendance was prompted by previous higher numbers of crashes and violations, it was likely that post-course crash levels would be relatively high. It was therefore argued that any case-control design in evaluating the safety benefits of older driver education programs needs to take these possibilities into account in the selection and categorisation of subjects.

Nasvadi and Vavrik subsequently used a matched-pairs cohort design to:

* determine whether there is a self-selection bias amongst older drivers attending the 55-Alive program program in British Columbia,
* determine whether there were changes in crash rates after attending the course, through an analysis of records before and after the crash; and
* use focus groups to identify those components of the course that affect the driving behaviour of participants.

All participants in the 55-Alive program for the period 1 January 2000 to July 31 2003 were identified: for the initial group of 1186 drivers, adequate background data were obtained for 889 participants. Their crash involvement for the two years preceding course attendance was then compared to the crash involvement of a matched set of controls, based on insurance claims and police records. Course participants were significantly more likely to have been involved in prior crashes for which they were judged to be at least 25 percent responsible by insurance assessors and also in police-attended crashes. Looking just at those in crashes and for both insurance and police records, course participants were also significantly more likely to have been involved in multiple prior crashes.

Given these findings, Nasvadi and Vavrik therefore reasoned that a valid evaluation of program effectiveness needed to compare course participants to drivers also with equally elevated prior crash rates who had not experienced the intervention. When this comparison was made using an appropriate control group, the results were mixed:

* for the overall sample, participation in the 55 Alive driving program was associated with an increase in post-course crash involvement. However the difference was both slight and not statistically significant;
* for younger (55-74 years) and for older (75-94 years) female drivers, course participation had no meaningful impact on subsequent crash levels;
* younger male participants had lower crash rates than controls but the difference was not statistically significant; and
* older male participants had higher post-course crash rates than controls (almost four times higher) and the difference was statistically significant.

The authors sought to explain the elevated crash rates of the older male drivers by a series of focus group sessions restricted to male drivers aged 63 to 90 years. They hypothesised that the older male drivers – and particularly those involved in post-course crashes – failed to implement the knowledge presented in the course and continued to have a relatively high driving exposure. The failure to respond to the course may have been due to reduced self-awareness of any decline in driving skills, perhaps coupled with a stronger emotional attachment to the driving task.

The overall conclusion reached by Nasvadi and Vavrik (2007, p. 1079):

This study is the first to demonstrate that attendance at a mature driver education program is associated with higher post-course crash rates for a particular sub-set of mature drivers, namely men aged 75 years and older. In addition, this study is consistent with previous evidence[[4]](#footnote-4) that driver education does not have a positive effect on the crashes of most participants.

### 2.1.2 Other Education Programs

Owsley et al. (2003) evaluated the effectiveness of a two-session educational program designed to alert visually at-risk older drivers (aged 60 years or older) to the driving risks posed by their impairment and to encourage eight self-regulatory driving practices intended to counter the impairments. All drivers in the study had been involved in at least one crash during the previous twelve months. The intervention was conducted on a one-on-one basis. Drivers identified as having specified visual impairments were randomly assigned to two groups – one group receiving usual medical treatment (n=171), the other receiving the medical care plus the educational intervention (n=194). The outcome measures – attitudes towards driver safety and adoption of self-regulatory practices – were gathered by questionnaire administered by an interviewer before and six months after assignment to the two groups.

After the educational intervention, drivers were more likely to acknowledge their visual impairments and to report difficulties in driving situations requiring high visual standards. While there were no differences in regard to other basic driver safety attitudes, drivers who participated in the educational intervention were more likely to report a range of self-regulatory practices, including: day rather than night driving, avoiding left-turns, and avoiding rush-hour driving. They were also more likely to report reduced driving exposure - driving fewer days per week and making fewer trips to fewer locations after the intervention. In claiming program effectiveness however, the authors recognised that a crucial next step was to determine whether these self-reported changes resulted in crash reduction.

Subsequently Owsley et al. (2004) – using essentially the same sample and the same educational intervention – investigated whether the intervention group had a reduced crash rate over the two years after the intervention. The intervention group did not differ significantly from the usual care group in terms of police-reported crash rates, whether expressed in terms of person-years of follow-up or person-miles of travel. Their conclusion:

This study agrees with earlier work indicating that there is no empiric support that educational programs enhance older driver safety (i.e. reduce crash rates) despite their widespread popularity. Given the convergence of findings here and from earlier studies … future public health initiatives should focus resources on identifying and implementing evidence-based strategies to improve older driver safety (Owsley et al., 2004, p. 228).

Kelsey and Janke (2005) also took a group of at-risk older drivers as their primary target – drivers aged 70 years or older who had ‘moderately unclean’ crash or conviction records: that is, they could be classified as negligent drivers but not to the extent that they needed to discontinue driving. Their reasoning was that age was associated with a range of functional impairments: if drivers in the early stages of functional decline could be identified through their moderate involvement in crashes and violations, an educational intervention might reduce subsequent crashes for this group. They used California’s driver licensing database to identify a sample of 57,776 drivers meeting the study criteria and then allocated subjects to one of four groups:

* Group A received a set of educational materials (pamphlets and brochures relating to older driver safety), a resource list of internet addresses and telephone numbers relating for driving- or elder-oriented organisations, a questionnaire coverings aspects of driving and safety knowledge, and a covering letter;
* Group B received only the resource list of internet addresses and telephone numbers, the questionnaire and the covering letter;
* Group C received only the questionnaire and covering letter;
* Group D was not contacted.

The outcome variables used to evaluate the effectiveness of the two education options were crash involvement six months after the mail-out and then twelve months after the mail-out, violations six months after the mail-out, and then twelve months after the mail-out and driving and safety knowledge based on the returned questionnaires (Groups A,B and C only). The conclusions:

* there were highly statistically significant differences between the three contacted groups regarding driving and safety knowledge – overall, Group A outperforming Group B who in turn outperformed Group C;
* however there were no significant traffic safety benefits associated with the various educational strategies, whether considered in terms of crashes or violations.

No evaluations of Australian education programs for older drivers were found for the study period[[5]](#footnote-5).

**2.2 Practical driver training programs**

The provision of behind-the-wheel on-road driving training represents the most direct approach to improving older drivers’ skills.

Marottoli et al. (2007b) used an eventual sample of 126 active drivers aged 70 years or older initially to assess a total of 36 variables measured in an on-road assessment, the variables including parking lot manoeuvres, driving in low, medium and high traffic density environments and highway driving. As well as the on-road assessment, participants also completed a written road knowledge test. Drivers who performed either below or above specified scoring thresholds for the driving assessment were excluded from the study. The remaining participants were then assigned to one of two groups: the intervention group, which received eight hours of classroom instruction (based on the Driver Improvement Program developed by the American Automobile Association) and two hours of on-road instruction which targeted errors made by participants in their baseline driving assessment; and the control group, which received an education module covering home safety and a second module covering basic vehicle maintenance and safety. All participants repeated the on-road assessment and the knowledge test at eight weeks.

When the performance of the two groups was compared, the intervention group returned higher scores on both the driving test and the knowledge test and the differences were statistically significant. Based on previous research, Marottoli et al. estimated that the difference in driving performance was equivalent to a 9.5 percent decrease in crash risk. The conclusion:

The current findings offer encouragement to a broad spectrum of drivers that a relatively easy to implement intervention can enhance their driving performance and potentially prolong their safe driving years, thereby maintaining their activity level and mobility (Marottoli et al., 2007b, p. 1118).

As discussed in the previous section, Bédard and colleagues (2004) in their evaluation of the 55-Alive/Mature Driving program hypothesised that to be effective, the program might require an on-road training component. Bédard et al. (2008) subsequently undertook a second study, to evaluate the effectiveness of the in-class education program in combination with two 30- to 40-minute on-road practice sessions with a qualified instructor. Participants aged 65 years or older (and meeting other basic criteria, especially relating to adequate functional performance in areas considered critical to safe driving) were recruited at a number of sites in Canada. All recruits completed a baseline safe driving knowledge questionnaire and a 35-minute on-road driving evaluation. They were then randomly assigned to either an intervention group (who received the 55-Alive/Mature Driving program and the two on-road sessions, n=38) or to a control group (no actions, n=37)[[6]](#footnote-6). Approximately four to eight weeks after completion of the intervention, all participants completed a second on-road evaluation. The second knowledge test was completed as part of the education intervention and therefore not completed by the control group.

The intervention group showed a statistically significant improvement on the road knowledge test after the intervention. When ‘before-and-after’ on-road driving performance of the intervention and control groups was compared, the intervention group showed statistically significant improvement on some aspects of driving (especially ‘moving in roadway’) but not on other aspects. The authors’ conclusions:

The results of this study demonstrate that education programs (incorporating behind-the-wheel training) focused on the needs of older drivers may help improve their knowledge of safe driving practices and actual driving performance. Further research is required to determine if these changes will affect other variables such as driver confidence and crash rates (Bédard et al., 2008).

The use of driving simulators as a training device to improve driving skills represents a safer option for managing older driver safety, especially when dealing with drivers already considered to be at heightened crash risk. The literature search for 2000-2011 identified two studies using a driving simulator for training purposes.

Lavalliere et al. (2009) examined the impact of a simulator-based driving training program on on-road driving performance. Twenty-two older drivers without known impairments were given a baseline driving evaluation using a dual-controlled instrumented car driven on a 12-kilomtere driving circuit. A structured and standardised scoring system was used for the evaluation, covering key aspects of driving performance (including turning manoeuvres at intersections, turning manoeuvres and frequency of blind spot verifications). Participants were then assigned to one of two groups. Those in the control group received the 55-Alive/Mature Driving program with instruction being on a one-to-one basis over three sessions each lasting about 40 minutes. They also drove through a 16-kilomtre scenario in the simulator after each session but received no feedback on their performance. The ‘feedback group’ went through the same procedures - except that they received on-going individualised feedback during the simulator sessions covering key aspects of their driving performance. Finally both groups were again evaluated on-road.

Both groups performed similarly on the baseline driving evaluation[[7]](#footnote-7). While the control participants showed no modification of their performance in the second on-road evaluation, participants from the feedback group improved their driving performance for all manoeuvres that were evaluated. ‘The present study confirms observations from Bédard et al. (2008) that classroom training only are not effective to modify and improve driving skills’ (Lavalliere et al, 2009, p. 225).

Romoser and Fisher (2009) took as their main concern, older drivers’ well-documented difficulties in negotiating intersections. They attributed these difficulties at least partly to older drivers’ inadequate ‘secondary’ scanning behaviour: that is, the scanning that occurs while the turn is being made (as distinct from the scanning before making the turn). The researchers then conducted two experiments to determine whether a program can be designed to train older drivers to improve their secondary scanning.

The first experiment was set up using a simulator to determine whether: (1) older drivers (70 years or older, n=18)) performed worse than younger drivers (25-55 years of age, n=18) when negotiating intersections; (2) older drivers changed their perceptions of their own skills in response to feedback based on simulator performance; and (3) the simulator-based evaluation was seen by participants as face valid. Ten simulator scenarios were used related to intersections where hazards emerged outside of the driver’s field of view thereby requiring head and scanning movements. To summarise the experiment outcomes: older drivers committed more errors at intersections, including the failure to execute secondary looks; and customised feedback to older drivers was effective in altering participants’ attitudes about their driving ability, according to participants’ self-reports.

The researchers considered that these findings justified a second, more ambitious experiment which had three objectives, to:

* determine whether older drivers were as unlikely to take secondary looks on the road as they were in the driving simulator;
* design an active training program based on feedback covering participants driving errors both in the simulator and on the road, and provide simulator-based intersection training; and
* determine whether this active training program would prove more impact on intersection scanning than would a passive, classroom-based program without individualised feedback.

Fifty-four healthy participants were divided into three age groups: 70-74, 75-79 and 80-89 years. The eighteen participants in each age group were then allocated to one of three treatment groups (active learning, passive learning and control), balanced for gender. A six-part procedure was then implemented:

Session 1 the administration of various physical and cognitive tests to assess overall performance levels, and a practice drive on the simulator;

Session 2 a simulator evaluation consisting of the ten intersection scenarios with peripheral hazards used in the first experiment;

Session 3 an on-road driving evaluation, starting from the participant’s home[[8]](#footnote-8). The participant used his or her own vehicle and chose a 30-minute route. They were unaccompanied and recording of head movements was done via a mobile four-camera installation;

Session 4 the active learning group received individualised feedback based on their simulator and on-road performances. Training in secondary scanning skills was provided by again using the ten simulated driving scenarios. The passive learning group received traditional classroom-based instruction based on a power-point presentation, text and figures. The control group did not participate in this session – but were offered training after the experiment concluded;

Session 5 for all three groups, a simulator evaluation identical to Session 2; and

Session 6 for all three groups, an on-road driving evaluation identical to Session 3 and with the same route.

In the baseline evaluations 34 percent and 45 percent of all participants took secondary looks at intersections, suggesting a reasonable degree of correspondence between simulator and behind-the-wheel driving - with the majority of older driver sin both instances driving unsafely on this measurement. However when post-training performance was considered:

* for simulator performance, those who received active training demonstrated a 35 percentage point increase in secondary looks– with the increase greatest for the 80-89 year-olds (48 percentage points). Those who received passive training demonstrated a 14 percentage point increase – which was significantly different from the active learning group but not from the control group;
* for on-road performance, those with active training demonstrated a 38 percentage point increase in secondary looks, whereas there was effectively no change for the passive learning and control groups.

Consistent with this improvement in performance, participants from the active learning group rated the effectiveness of their training as significantly higher than did participants in the passive learning group. The researchers concluded:

The findings that 70- to 89-year-old drivers in the active learning group nearly doubled the amount of side-to-side scanning during turns on the driving simulator and that 70- to 70-year-old drivers in the same learning group saw similar gains in the field, whereas those in the passive learning group saw no significant gains, were … promising results. … The implications are clear – training programs made available for older driversshould move beyond passive, classroom-style instruction techniques and provide drivers with more immersive, active practice of target skill sets (Romoser and Fisher, 2009, pp. 11-12).

A final evaluation to complete this section used neither on-road nor simulator training.

Horswill et al. (2010) looked at the impact of training on a sub-domain of driving: older drivers’ hazard perception ability, or the quickness of response to hazards and other cues that indicate a dangerous situation. They advanced the possibility that older drivers – perhaps because of imperfectly developed search strategies, perhaps in combination with reduced capacity to respond to perceived hazards as a result of cognitive, sensory or motor declines – have slow hazard perception times that could be improved with specialised training. Twenty-four community-dwelling drivers aged 65 years or older were given a baseline hazard perception test where they were shown video footage of a series of traffic situations and were required to identify road users who were likely to be at risk of collision with a vehicle. Response time was the time required to identify at-risk road users from the time of their first appearance in the footage. Participants were then allocated to either a trained group or control group, each group consisting of twelve drivers.

The trained group was then shown a seventeen-minute video depicting a series of hazardous traffic situations, while listening to an expert driving instructor giving a running commentary on the situations, indicating what he was searching for and giving general advice about anticipating hazards. Those in the control group also viewed the video but did not receive any commentary. Both groups re-sat the initial hazard perception test – with the results showing that trained drivers responded to hazardous situations around half a second earlier compared to their initial test performance. In contrast, drivers with no training showed no change in hazard perception performance. ‘The time difference as a result of the training would equate to a distance of approximately 8.9 metres on the road if one was travelling at 60 kph, which could plausibly be the difference between having and not having a crash (Horswill et al., 2010, p. 468).

**2.3 Programs which promote self-awareness of fitness to drive**

Some education programs seek to alert older drivers to possible changes in driving performance and crash risk as a result of age-related changes. These programs often include a checklist of medical conditions, functional limitations and safe-versus-unsafe driving practices, accompanied by advice for developing safer driving. These programs often but not always take the form of handbooks, distributed to older drivers through a variety of means – with many jurisdictions in western countries having localised versions of these programs. Anderson (2009) and Eby et al. (2003) provide comprehensive listings of these programs in Australia and the US, respectively.

The literature survey conducted for this report covering the period 2000-2011 identified evaluation studies of three self-awareness instruments: the *Driving Decisions Workbook* and the *SAFER Driving: Enhanced Driving Decisions Workbook*, both produced by the University of Michigan’s Transportation Research Institute (UMTRI) and the AAA *Roadwise Review*.

### 2.3.1 The UMTRI Instruments

The *Driving Decisions Workbook* represents a self-screening instrument for older drivers in the form of a questionnaire, built around three domains: health conditions and medications; driving abilities (including vision, cognition and psychomotor performance); and driving-related experiences, attitudes and behaviours (including crashes and citations, any family and friends’ concerns and current driving practices). Within each domain, assessment items appropriate to a pencil-and-paper questionnaire were developed for a total of 37 individual assessment areas. For each assessment area, feedback was provided consisting (where possible and appropriate) of information to increase self-awareness and general knowledge, suggestions for further evaluation and recommendation of compensatory driving strategies (Eby et al., 2003).

Eby et al. (2003) used a convenience sample of 99 Michigan drivers aged 65 to 90 years to assess whether: (a) the workbook increased self-awareness and general knowledge related to health and safe driving; (b) the workbook was perceived as useful, especially for facilitating discussions within older drivers’ families; and (c) performance on the workbook correlated with driving performance. The first two objectives relied upon a 27-item questionnaire and the third objective upon driving assessment over a standardised seven-mile on-road course. For various reasons, driving data were collected only for 92 of the 99 participants in the study.

Questionnaire responses showed that about three-quarters of participants considered that they were more aware of changes that could affect their driving and all participants considered the workbook to be at least a little useful in facilitating family discussions. Based on scoring systems developed for workbook responses (reflecting the numbers of self-reported problems in eight sub-areas) and driving performance (reflecting the errors made on 17 specified performance tasks), there was an overall statistically significant correlation of 0.3 between workbook responses and driving performance. ‘This finding indicates that as the number of potential problem areas identified by the workbook increased, the number of performance tasks with problems observed during the road test also tended to increase (Eby et al., 2003, p. 378)’.

Positive and statistically significant correlations were also found between on-road driving performance and five of the eight sub-areas assessed in the workbook – with the sub-scores for health and medication use having the lowest correlation coefficients. In retrospect, this result did not surprise as properly treated medical conditions and at least some medications may not produce any change in driving ability. ‘Thus, a diagnosis of a certain medical condition, or treatment with a certain medication, will not necessarily affect driving adversely, as is assumed in the *Driving Decisions Workbook* (Molnar et al., 2010, p. 368)’. Accordingly, the UMTRI research team sought to develop an improved instrument by shifting the focus from identifying medical conditions and medications to the symptoms arsing from these conditions and medications (Molnar et al., 2010).

The *SAFER Driving: Enhanced Driving Decisions Workbook* represents a self-screening instrument for older drivers in the form of a questionnaire, built around a set of 27 health concerns and 15 critical driving skills (Molnar et al., 2010). Participants are required to answer questions about each health concern, indicating the level of severity they were experiencing (ranging from none to severe). By linking each self-reported health concern to a subset of driving skills considered likely to be affected by that health condition, the instrument is able to provide participants with feedback which includes possible impact of the health problems and functional impairments on safe driving, recommendations (when appropriate) for behavioural changes and safety tips, follow-up with a professional and vehicle modifications. Unlike the earlier, *Driving Decisions Workbook*, the new instrument was provided in electronic format – mainly because of the greater control that format afforded in preparing individualised feedback.

Molnar et al. (2010) conducted an evaluation along similar lines to that conducted for the *Driving Decisions Workbook*: to assess whether the instrument resulted in increased self-awareness about any age-related decline in fitness to drive, whether it was perceived as useful especially in facilitating discussion with families and whether it accurately identified health concerns and potential driving difficulties. A convenience sample of 68 drivers aged 65 years or older:

* completed the web-based self-screening instrument (either independently or with assistance);
* completed a series of questions relating to self-awareness and usefulness of the instrument;
* were clinically assessed especially for functional performance and health issues by an occupational therapist/certified driving rehabilitation specialist; and
* underwent a 45-minute on-road driving assessment by a different occupational therapist/certified driving instructor.

As with the *Driving Decisions Workbook*, the large majority of participants endorsed the *SAFER Driving: Enhanced Driving Decisions Workbook* as valuable in enhancing self-awareness of how functional declines can affect driving. Sizeable numbers also reported plans to engage in safer driving practices, including undertaking refresher training courses. Nearly all participants reported that the instrument was useful in promoting discussion of driving concerns with family members.

After assigning scores for issues identified by the instrument, at the clinical evaluation and during the driving assessment, correlations were found between the instrument and the clinical evaluation (+0.25) and the on-road assessment (-0.26). Both correlations were modest but statistically significant and in the expected direction. These correlations were greater for drivers aged 75 years or older - +.54 and -.44 for the clinical evaluation and on-road assessment, respectively.

**2.3.2 AAA’s *Roadwise Review***

The *Roadwise Review* has been developed as a CD-ROM tool distributed by the American and Canadian Automobile Associations to assist older drivers in reaching a judgement about their driving fitness[[9]](#footnote-9). The instrument aims to assess eight different functional abilities necessary for safe driving: leg strength and general mobility; head and neck flexibility; high contrast visual acuity; low contrast visual acuity; capacity to visualize missing information; visual information processing speed; capacity for visual search; and working memory. Each test and its relevance to driving are briefly described, with instructions presented by a ‘host’ who guides the individual through the assessment process. Upon completion, a rating is provided for each performance area (no impairment, mild impairment and serious impairment) and advice is given to the driver on safe driving strategies and options for further information and testing, if appropriate. The individual’s results are also shown on a graph that compares his or her score with that of the general older driving population (Staplin & Dinh-Zarr, 2006).

The instrument has been evaluated for acceptability to older drivers (Myers et al., 2008) and the sub-tests which comprise *Roadwise Review* have in different contexts been evaluated for accuracy in distinguishing between safe and unsafe drivers. (Sherrets and Staplin (2006) for example have reported that drivers with a significant loss in the functional capabilities tested by *Roadwise Review* are 2 to 5 times more likely to cause a motor vehicle crash than unimpaired drivers. However these associations have been derived from studies using the eight tests in different contexts, often as pen-and paper instruments. It remains to be determined whether the results are applicable to the *Roadwise Review* in its self-administered electronic format.

Scialfa et al. (2010) administered what they called the *Roadwise Review[[10]](#footnote-10)* to a convenience sample of 73 community-dwelling drivers aged between 50 and 88 years and also gathered data on self-reported driving difficulties and any crashes and moving violations over the previous two years. The researchers found that the instrument did not predict self-reported driving quality – nor was any association found between test performance and retrospective at-fault collisions. The researchers concluded:

Although the Roadwise Review may be valuable in providing drivers with information on skills related to driving performance, in its current form it does not appear to be useful in the prediction of self-reported driving difficulties or risk in older adults (Scialfa et al., 2010, p. 436).

Bédard et al. (2011) used a convenience sample of drivers aged 51-86 years (the sample size for most analyses being 51) to compare performance on *Roadwise Review* with both laboratory measures of driving fitness and an on-road driving assessment. The on-road evaluation was conducted in the participant’s own vehicle and lasted 30 to 40 minutes over a circuit comparable to that used for the jurisdiction’s licensing examination. The driving assessment score reflected the frequency and the severity of driving errors made over the course. The authors evaluated the validity of *Roadwise Review* performance at two levels:

* the correlation between appropriate components of *Roadwise Review* with the clinical tests Trail Making Tests A and B and Useful Field of View sub-test 2;
* for a convenience sub-sample of 30 participants, the correlation between *Roadwise Review* performance (measured from several different bases) and on-road driving performance – the latter based on both the number of demerit points accumulated and the overall pass/fail outcome.

Despite calculating 75 different correlation coefficients, it was concluded that there was little concordance between *Roadwise Review* results and other measures of driving performance. (Bédard et. al., 2011) commented thus:

A valid (read predictive) self-assessment tool would have great benefit in allowing drivers to seek remediation before becoming unsafe and risk losing their licenses. This remains a worthy goal: we encourage researchers to continue pursuing it. However, drivers using a tool that lacks validity may endure some negative consequences. … drivers may worry where there is no reason to or they may not worry when they should … They may become cynical of self-assessments if they sense a major discordance between their perceived overall abilities and assessment results.

**2.4 Programs to promote pre-conditions for safer driving**

Marottoli et al. (2007a) argued that improved physical ability would be a valuable early step in extending the safe mobility of older drivers.

A convenience sample of 744 active older drivers was initially screened to identify those whose driving safety was potentially threatened by some form of physical impairment: measured factors included neck and trunk rotation, shoulder abduction, hip flexion, manual dexterity and gait speed. Based on specified threshold scores and exclusion criteria (including the presence of cognitive and visual impairments), the remaining 259 drivers were requested to take a baseline driving performance assessment. After excluding those who declined the assessment and those who returned extreme low or high scores on the assessment, participants were then randomly allocated to either an intervention group (final n=90) or a control group (final n=88). Those in the intervention group received weekly visits for 12 weeks by a physical therapist who supervised a daily graduated exercise program directed at physical abilities considered relevant to safe driving. The following domains and abilities were targeted: axial and extremity conditioning, upper extremity coordination/dexterity and hand strength, gait and foot abnormalities. The control group received monthly in-home education modules relating to home safety, falls prevention and vehicle care. Both groups received a second on-road assessment three months after the baseline assessment.

Based on the driving performance scores, the intervention group maintained its driving performance over the three months, in contrast to the control group whose performance declined – and the benefit of physical training was most evident amongst those who had the lowest baseline driving performance. Group difference in trends over the three months was statistically significant. Participants from the intervention group committed fewer critical driving errors after three months relative to controls and the difference had borderline statistical significance. However there were no significant differences between the two groups in evaluators’ ratings of driving performance. Marottoli et al. (2007a, p. 590) concluded:

This safe, well-tolerated intervention maintained driving performance, while controls declined during the study period. Having interventions that can maintain or enhance driving performance may allow clinician-patient discussions about driving to adopt a more positive tone, rather than focusing on driving limitation or cessation.

From a different perspective, in mid-2009 the AAA Foundation for Traffic Safety recommended for older drivers ‘a new, ground-breaking safety program called DriveSharp’ (AAA Foundation for Traffic Safety, 2009). DriveSharp consists of two computer-based exercises with over ten hours of play that aim to improve reaction time, visual processing speed, useful field of view and driving ability. The instrument represents a development of the Useful Field of View (UFOV) test battery which has been used in many studies as a screening test for assessing fitness to drive.

There are numerous evaluation studies to support DriveSharp, in the main conducted by researchers involved in the development of the original UFOV[[11]](#footnote-11). The two studies which use outcome measures directly related to safety (one measuring driving performance, the other changes in crash involvement) have been summarised below.

Roenker et al. (2003) investigated the association between two types of training and possible changes in driving performance. Participants aged 48-94 years who had a minimum 30 percent ‘field of view’ reduction as shown by the UFOV were assigned to either speed-of-processing (n=48) or simulator training groups (n=22). Participants with no measured decline in field of view’ formed the low-risk reference group (n=25). The speed-of-processing group received around 4.5 hours of training on an adapted version of the UFOV test (the basis for what became DriveSharp), to achieve specified processing thresholds. The simulator training group received two two-hour simulator sessions in safe driving and crash prevention practices, ending with a one-hour on-road demonstration of the practised skills by a driving instructor. The low-risk reference group did not receive any training in any form or context.

Participants from all three groups underwent baseline measures of driving performance, first using a simulator in simple and choice braking reaction times and then using a specially equipped vehicle over a seven-mile on-road driving route to score eight composite driving factors. These two assessment procedures were completed for all three groups after approximately two weeks when all training had been completed, and again after 18 months. A comparison of performance across the 18 months showed:

* for most baseline measures the low-risk reference group (unimpaired field of view) performed better than either of the two training groups (impaired field of view);
* for simple braking reaction time as measured on a simulator, all three groups showed stable performance. In other words, neither speed-of-processing nor simulator training had any impact on performance;
* for choice braking reaction time as measured on a simulator, all three groups showed improvement after two-weeks and after 18 months – with the extent of improvement being greatest for the speed-of-processing group, followed by the simulator group. The reference group at all three stages had superior performance to the two training groups;
* for the on-road performance, the results were mixed. Simulator training was associated with an immediate improvement in the behaviours directly practised during training (turning and signal useage) – with the improvement largely lost after 18 months. Speed-of-processing training was associated with significantly fewer dangerous manoeuvres and faster reaction time after 18 months – despite the reference group having fewer errors at baseline.

The authors concluded that:

In summary, these data add further weight to the accumulating research linking processing speed deficits to driving performance failures by older adults. Furthermore, the current data suggest that these processing deficits can be ameliorated through speed-of-processing training and that this improvement results in safer driving behaviours that are durable for at least 18 months (Roenker et al., 2003)

However this may be overly optimistic. When the analyses are considered in detail, the benefits of speed-of-processing training to direct driving behaviours were evident for only one of the eight composite measures made, with seven of the measures showing no or minimal changes (sometimes in an unwelcome direction).

Ball et al. (2010) recruited a sample of 908 active drivers aged 65 years or older, with other inclusion criteria including no evidence of substantial functional, cognitive, visual or overall health decline. Participants were then randomly assigned to one of four groups: a no-contact control group, (n=409); those receiving memory training (n=175); those receiving reasoning training (n=145); and those receiving speed-of-processing training (n=179). Participants completed individual and group assessments at baseline, immediately after training (or after an equivalent delay for the control group) and annually over the following five years. In addition, Department of Motor Vehicles crash records were used to determine whether participants had been involved in crashes and in at-fault crashes up to six years after enrolment in the study.

For each intervention group, ten initial training sessions were given by trainers to small groups of two to four participants over five to six weeks. Two sessions per week were given, each session lasting just over an hour. On average, participants completed nine training sessions. Although not made explicit in the formal report, it can be assumed from the descriptions given (and from the research team’s professional declarations of conflict of interest) that the speed-of-processing training was in the form of DriveSharp.

Considering the total sample of 908 drivers, about 85 percent remained crash-free, 12 percent experienced one crash (and perhaps surprisingly, nearly all were judged to be at fault), and three percent experienced two or more crashes. After adjusting for age, gender, education and a range of health measures (based largely on self-reports) participants who had received either reasoning or speed-of-processing training had statistically significant reduced crash involvement - especially at-fault crash involvement. This association was strongest for at-fault crashes per person mile driven: both intervention groups had approximately a 50 percent lower crash rate than the control group.

The authors concluded:

Although many physicians, scientists, and policy makers focus efforts on the identification of unsafe older drivers, the … results presented here raise the issue as to whether or not all older drivers might benefit from cognitive training. Scarce resources to identify “high risk” drivers might be better spent in providing interventions to postpone cognitive decline to begin with (Ball et al., 2010).

Table 6.1 summarises the evaluation studies reviewed in this report.

Table 1: Evaluation studies of older driver training and education programs published 2000-early 2011.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Authors** | | **Nature of participants** | **Age of key participants** | **Program** | **Effectiveness** | |
| **1. Education only** | | | | | | |
| Bédard et al. (2004)\* | | ‘normal’ active drivers | 55 yrs+ | 55-Alive/Mature Driving | Ineffective – no driving improvements | |
| Bao and Boyle (2009) | | ‘normal’ active drivers | 65 yrs+ | 55-Alive/Mature Driving | Effective – improved driving at intersections | |
| Nasvadi & Vavrik (2007)\* | | ‘normal’ active drivers | 55 yrs+ | 55-Alive/Mature Driving | Ineffective – increased crash rates for some participants | |
| Owsley et al. (2003)\* | | visually impaired, crash-involved drivers | 60 yrs+ | tailored program | Effective – self-reported improved safety attitudes, self-regulatory practices | |
| Owsley et al. (2004)\* | | visually impaired, crash-involved drivers | 60 yrs+ | tailored program | Ineffective – no crash reductions | |
| Kelsey and Janke (2005) | | drivers with ‘unclean’ records | 70 yrs+ | education publications and/or resources list | Ineffective - no crash, violation reductions (although increased driving, safety knowledge) | |
| **2. Practical driver training programs** | | | | | | |
| Marottoli et al. (2007b)\* | | ‘normal’ active drivers | 70 yrs+ | 55-Alive/Mature Driving + on-road training | Effective – improved driving knowledge, performance | |
| Bedard et al. (2008)\* | | ‘normal’ active drivers | 65 yrs+ | 55-Alive/Mature Driving + on-road training | Effective – improved driving knowledge, performance | |
| Lavalliere et al. (2009) | | ‘normal’ active drivers | ? | 55-Alive/Mature Driving + simulator training | Effective – improved driving performance | |
| Romoser & Fisher (2009) | | ‘normal’ active drivers | 70 yrs+ | ‘active ‘ simulator training, ‘passive’ education | Effective only for active group – improved simulator and driving performance at intersections | |
| Horswill et al. (2010) | | ‘normal’ active drivers | 65 yrs+ | hazard perception training (video) | Effective – improved hazard perception | |
| **3. Self-awareness of fitness to drive** | | | | | | |
| Eby et al. (2003)\* | | ‘normal’ active drivers | 65 yrs+ | self-awareness/knowledge workbook | Effective – self-reported improved awareness;  Valid – self-reported difficulties associated with driving performance | |
| Molnar et al. (2010) | | ‘normal’ active drivers | 65 yrs+ | self-awareness/knowledge computer program | Effective – self-reported improved awareness;  Valid – self-reported difficulties associated with driving performance | |
| Scialfa et al. (2010) | | ‘normal’ active drivers | 50 yrs+ | Roadwise Review | Not valid – no association between test performance and self-reported driving quality, at-fault collisions | |
| Bedard et al. (2011) | | ‘normal’ active drivers | 50 yrs+ | Roadwise Review | Not valid – no association between test performance and related clinical measures, driving performance | |
| **4. Pre-conditions for safer driving** | | | | | | |
| Marottoli et al. (2007a)\* | active drivers with specified physical impairments | | 70 yrs+ | daily exercise program | | Effective – better driving performance than a control group |
| Roenker et al. (2003)\* | visually impaired drivers | | 48 yrs+ | speed-of-processing or simulator training | | Mixed results |
| Ball et al. (2010) | ‘normal’ active drivers | | 65 yrs+ | speed-of-processing, reasoning or memory training | | Effective for speed-of-processing, reasoning training – reduced at-fault crash involvement |

Note: “‘normal’ active drivers” in the main relates to convenience samples of active older drivers NOT selected on the basis of specified   
medical or performance criteria. However selection and other biases may have influenced the final samples.

\* indicates also reviewed by Korner-Bitensky et al. (2009).

Kua et al. (2007) undertook a systematic review of the English-language scientific literature to identify articles published up to and including 2004, relating to skill-specific older driver training programs. Korner-Bitensky et al. (2009) updated the review to include appropriate articles published since 2004 and found a total of twelve articles, nine of which appear in Table 6.1 above[[12]](#footnote-12). It was concluded that “the emerging evidence that intervention can change knowledge and on-road driving behaviours of older drivers is highly encouraging (Korner-Bitensky et al., 2009, p. 110).

If accepted at face value, the expanded list of studies summarised in Table 6.1 supports this conclusion. Of the 18 evaluation studies:

* eleven programs showed effectiveness at some level, including changes in driving performance and most impressively, in at-fault crash levels;
* all five programs which provided practical driving training showed improvements in at least some driving skills;
* two of the three evaluations of programs which sought to improve pre-conditions for driving (physical activity, speed-of-processing and reasoning) showed either driving improvements or crash reductions – with a third study showing mixed results;
* in contrast, of the six classroom-based education programs, four were unable to show either driving or crash improvements, with a fifth evaluation showing an increase in crashes for some drivers;
* programs which sought to increase older drivers’ awareness had mixed results. The two related programs from UMTRI had positive responses from participants, with driver ratings holding up against on-road performance. In contrast the two evaluations of *Roadwise Review* were unable to provide any validation evidence.

While the evidence is considered sufficiently positive to warrant further development of older driver training and education in expectation of safety benefits, there are several key issues that need to be further investigated.

First, there is the need for empirically-improved evaluation designs. Many of the studies cited in this report relied upon convenience samples of older drivers who customarily, were then randomly assigned to either intervention or control groups. Other studies used older drivers who voluntarily attended training or education programs to serve as ‘cases’. For both ethical and practical reasons, the use of convenience or volunteer samples is readily understandable. However it remains that important selection biases may have unduly influenced the results. Practical difficulties notwithstanding, there is the need for more truly randomised case-control studies to test program effectiveness.

Secondly, in the development of training and education programs there is the need to clearly identify the target group(s) of older drivers. So far as could be judged, most of the programs in this report used ‘normal’ samples of active older drivers. However some programs targeted impaired older drivers with a history of crash involvement, with another program selecting only drivers with a ‘moderate’ history of crashes or violations. It may be that the normal or safest older drivers are most likely to benefit from training or education, given their relative lack of impairments: conversely however, it may also be that these drivers are already close to maximum driving performance and can expect a ceiling effect for any improvements. It may also be argued that impaired drivers are most in need of improvement and that there are obvious training and education strategies for them.

In identifying appropriate target groups, attention needs also to be given to the age parameters (if any) to be used. Many of the programs reviewed in this report used relatively low age thresholds - around 50 years of age in several cases and in one instance, lower. With the evidence suggesting that the risk of impairing medical conditions and over-representation in serious casualty crashes become most noticeable for the oldest old drivers, it may be that education and training programs are best reserved for this neediest group. Alternatively, programs may be most effective if they are proactive rather than reactive, by targeting drivers yet to enter their riskiest periods.

As a third issue to be considered, there is the need to consider the criteria to be used in evaluating program effectiveness. The focus in this report has been on evaluation studies using some form of robust outcome measurement, especially either on-road driving performance or changes in crash involvement. However for some programs, other evaluation criteria might be more appropriate.

For example, for programs which promote increased self-awareness of driving skills and practices, there is the initial need to establish whether the program serves the purpose of self-assessment or self-screening. At the risk of overly simplifying a range of considerations, self-assessment instruments seek to allow reasonably categorical ‘stand-alone’ decisions about driving performance and safety to be made. Self-screening instruments seek to serve as only one of several information sources to be used in reaching a decision about driving performance and safety. If the purpose of a self-screening instrument is to serve as an early prompt to a subsequent range of assessments (perhaps by a medical practitioner, perhaps entailing an on-road assessment), any evaluation of its safety benefits can be confounded by the effectiveness of other assessment procedures triggered by the initial instrument.

In the final analysis, if self-awareness instruments claim to have safety benefits, it will be necessary to show that they contribute to reducing older driver crashes – or at the very least, assist in distinguishing between safe and unsafe drivers. However the effectiveness of self-screening instruments might be more meaningfully evaluated using interim criteria – including older drivers’ acceptance of the screening process, their possible progression to further more sophisticated assessment and/or their undertaking remedial actions, including but not restricted to the adoption of safer driving practices.

As part of the need to select appropriate effectiveness criteria, there is also the need to determine the longevity of safety benefits. Some welcome exceptions aside, many of the studies cited in this report have analysed outcome measures almost immediately after completion of the education or training program: were any identified benefits to diminish shortly thereafter, the value of the program becomes questionable[[13]](#footnote-13).

Fourthly, the effectiveness of any program is likely to be strongly influenced by the program’s structure - especially its content, the underlying training or educational processes and the intensity/duration of the program. The reviews undertaken in this report suggest that little confidence can be placed in programs which consist exclusively of passive, classroom-based learning procedures – whereas direct driver training programs (perhaps accompanied by more passive education components) are more likely to lead to safety benefits. As noted by Korner-Bitensky et al. (2009, p.110):

Interestingly, what has as yet not been explored fully is the benefit of a multi-faceted intervention that includes education, motor, sensory, cognitive, and behavioural aspects, all of which have been shown to be important components of safe driving. Given that the task of driving involves a complex interplay of all of these, the need for such studies is clear.

Bedard et al. (2004, p. 297) note another factor in this context:

… a crucial issue is the potential variability in effectiveness across instructors. … the optimal effectiveness of the intervention may depend on the training of the instructors to deliver the program and their adherence to best practices for adult education.

As part of this issue, the delivery format of the training or education program needs to be carefully considered. Training older drivers to improve their on-road skills can occur through various means – a driving simulator or on-road driving being the two most obvious examples. Both forms of training have their advantages and limitations and in all likelihood, may vary in effectiveness. Programs which seek to improve participants’ self-awareness of driving and health issues can be delivered via guided tutorials, ‘stand-alone’ handbooks or via either guided or unassisted computer-based materials. Again, each method has advantages and limitations and again, may vary in effectiveness.

A fifth issue when judging the effectiveness of a training or education program, relates to participants’ extent of program participation. As an illustration, the DriveSharp program which offers speed-of-processing training consists of around ten training sessions, each lasting just over an hour: if participants decline to complete all or much of the program, any subsequent evaluation may substantially understate potential program effectiveness. Participants’ willingness to comply with program requirements in turn will depend on the intensity, duration, perceived relevance and convenience of the program.

As a final issue and from a wider perspective, the likelihood of a program making a meaningful impact on a jurisdiction’s overall road toll also needs to be considered. Training and education programs often require substantial resources from the organisations conducting them and from the participants recruited to attend them. If it is not feasible to provide sufficient programs to reach a sufficient spread of older drivers, even the most effective programs are unlikely to make much of a dent upon a jurisdiction’s total road safety performance –possible safety benefits to individual participants notwithstanding. In addition, while a program may be associated with safety benefits, the extent of these benefits even though statistically significant, may still be very modest in terms of real driving improvements or crash reductions – and may or may not justify the resources necessary to run the program.

There are no simple answers to these issues. The stance taken in regard to each issue is likely to vary from program to program and from audience to audience. There seems little point in running a self-awareness education program for drivers with moderate or advanced dementia, just as it may be pointless to conduct a driving training course for drivers already performing with high levels of capability. However if resources are to be expended effectively, it is critical that deliberate decisions be made regarding these key issues – informed by the research wherever possible, based on considered judgement in the absence of evidence.

**2.5 Recommendations for the design and delivery of training and education programs**

The older driver training and education evaluations identified as being published 2000-2011 and reviewed in this report, were not pitched at a sufficiently detailed level to allow empirically-based recommendations for future program design and development. The strongest conclusion that could be drawn from the evidence is that programs that include practical training in driving skills or in capabilities considered necessary for safe driving, are most likely to have safety benefits – whereas programs that rely upon passive classroom-based learning are likely to be ineffective. However even here, depending upon individual program characteristics and qualities, it is feasible that at least some driver training programs will be ineffective and some classroom-based programs may have benefits. In other words, the ‘conclusion’ relating to practical training versus classroom learning is best viewed as a broad indication rather than a hard and fast finding.

In the absence of empirically-based findings to guide the details of program development, the following steps are recommended:

1. Determine the program objectives and target group. Is the program intended to promote self-awareness of the possible impact of ageing upon health and driving performance for active, ‘normal’ drivers? Is the program intended to refresh the driving skills of active, ‘normal’ drivers? Is the program intended to provide driving and perhaps other forms of remediation to older drivers showing evidence of heightened crash risk?
2. Determine the key program processes. In particular, determine: whether practical training in driving-related skills is to be included; the context for providing any driving training (for example, simulator versus on-road); the context for providing any educational components (for example, classroom versus written material versus computer-based); nature of the training and/or education (for example, individualised versus group, guided versus self-paced); trainer or instructor qualifications and experience; program content; and duration and intensity of the program;
3. Design an appropriate evaluation strategy, including a pilot evaluation. Ensure that the evaluation will meet both formative and summative purposes – and that the key outcome measures are appropriate to the program objectives and feasible to implement;
4. Identify the likely resources available to allow program development, implementation and evaluation and if necessary, adjust the program design (including evaluation) accordingly;
5. Identify an effective recruitment strategy, to ensure that maximum numbers of the target group are reached and recruited into the program.
6. Pilot the program, using a pilot evaluation especially to gather participants’ and trainer/instructor responses.

**Chapter 3: Development and evaluation of enhanced program**

The initial training program was designed to be run in a classroom setting, with speakers presenting information with the aid of PowerPoint slides and group activities. It was designed to be conducted over a two-day period, providing groups of older road users with detailed knowledge about crash and injury risk, to raise their awareness of the effects of ageing on driving performance and crash risk, and to provide tips and strategies on how to maintain safe driving practices for as long as possible. In addition, strategies for successful reduction and cessation of driving and alternative transport options were provided (see Scully et al., 2008 for details of the program). Briefly, the program consisted of four sessions, as follows:

Session 1: Overall introduction and presentation of crash and injury risk

Session 2: Functional assessments

Session 3: Alternative transport and mobility options

Session 4: Other strategies to manage successful mobility and reduce risk

**3.1 The enhanced program**

While the evaluation of the initial program suggested that the program was successful in raising awareness of the importance of maintaining skills for as long as possible and successful reduction/cessation of driving, there were some opportunities that were identified that may improve revised versions of the program, specifically the inclusion of more practical training components in addition to transfer of knowledge. Moreover, given the feedback from seniors groups and older drivers as well as recent evidence regarding ‘best-practice’ in delivering effective educational and training programs, the enhanced program was designed to be a shorter and more concise program, with the inclusion of a more practical ‘training’ component.

The enhanced program provides key messages to older road users regarding the adoption of safe driving practices and information on maintaining safe driving for as long as possible and strategies to reduce and cease driving successfully, based on current evidence of older driver safe mobility. The information is provided to groups of older road users and is structured within a Safe System approach. It is designed to provide groups of older road users with knowledge about crash and injury risk, raise their awareness of the effects of ageing and medical conditions on driving performance and crash risk, and provide tips and strategies on how to maintain safe driving practices for as long as possible. In addition, strategies for successful reduction and cessation of driving and alternative transport options are provided.

Importantly, the revised program incorporated practical driving-simulator-based components within a classroom-based course, and a validated self-assessment tool to inform decisions on driving and driving reduction/cessation. In addition, two versions of the program are available: a one-day event, the other, a shorter version that can be conducted during a shorter 2-hour session. Both present the same important key messages, however, the activities, are either unavailable (the hazard detection activity using the driving simulator), or included as a full group activity (e.g., Trails Tests) or in a shortened form (e.g., examples of the Working Decisions Workbook activity are undertaken with the option of participants completing the online self-assessment after attending the program).

A detailed description of program components and key messages is provided in the facilitator’s manual. Briefly, here, the revised program consists of the following four discrete components:

Session 1: Discussion of risk situations and crash types;

This first session sets the scene for the program, methods of introducing presenters and participants, and discussed the aims of the program and provided a schedule of the workshops. Following this, a presentation of crash and injury risk to older drivers is given, focussing on the importance of mobility, future demographic changes, crash statistics, challenging driving situations and crash types.

Session 2: Awareness of functional abilities;

The second session aims to raise the awareness of the impact of age-related changes in functional abilities on driving behaviour and performance. Here, practical tasks are undertaken and include:

* Driving simulator training activities (hazard perception tasks)
* *SAFER Driving: Enhanced Driving Decisions Workbook* (Molnar et al., 2010)
* Trails Test Parts A and B (Reitan, 1958) with and without props to demonstrate visual, attentional and memory changes, including glasses with simulated visual impairments and various secondary (distraction) tasks, and
* A working memory task.

Session 3: Alternative transport and mobility options;

This session discusses the importance of maintaining mobility, through adoption of appropriate self-regulatory driving practices, reduction and cessation of driving. This session provides some strategies to plan ahead for driving reduction and cessation, particularly the use of alternative transport options.

Session 4: Strategies for managing and decreasing risk.

This session provides further ways to maintain safe driving practices including improved driving patterns and practices, and ensuring comfort and safety in vehicles. This session provided details of vehicle safety features (crash protection), choice of vehicles and vehicle safety resources. It also discusses ways to adapt vehicles to increase comfort and therefore improve safety.

**3.2 Process evaluation**

An important component of the development of any behavioural program is to assess the acceptability of the program amongst target audiences, and evaluate the effectiveness in improving the behaviours that the program addresses. To achieve these objectives, a pilot evaluation was included as part of the development of the program.

The evaluation focussed on the acceptability of format, delivery and content, and effectiveness in raising awareness of issues surrounding the safe mobility of older drivers and promoting adoption of safe driving practices.

**3.2.1 Method**

A total of 37 participants who were active drivers, aged between 70 and 86 years (11 males, 26 females, mean age = 77.8 years, SD = 4.3) took part in the process evaluation study. Participants were recruited with the assistance of the Australian Capital Territory Council on the Ageing (ACT-COTA). Five hundred information flyers were distributed during Seniors’ Week in the ACT at participating COTA venues. In addition, members and associates of COTA and affiliated organisations assisted with recruitment.

Prior to attending a training session, participants were mailed a pre-session survey, and requested to complete it and bring it with them to the session. All pre-session surveys were collected by instructors before sessions commenced. The pre-intervention surveys were designed to elicit a range of responses addressing knowledge of road safety issues, travel patterns, attitudes toward driving and mobility, strategies adopted to maintain safe driving, use of alternative transport options, reduction and cessation of driving, etc.

Three one-day sessions were organised and participants were invited to choose which session they wished to attend. Fourteen participants attended the first session, 14 attended the second, and 9 attended the third. Sessions were held from 9.30am to 3pm over three consecutive days.

At the conclusion of each training session, post-session surveys were administered to each participant to complete in their own time. Participants were requested to return their survey to the researchers within one week using a reply-paid envelope provided, although most participants returned the survey immediately after completing the session.

The post-intervention survey was designed to ask similar questions as in the pre-intervention survey, to determine the effectiveness of the program on driver behaviour, with additional questions addressing the acceptability of the program (e.g., content, delivery, etc).

Survey responses were utilised to make further refinements to the program.

**3.2.2 Results**

Survey data from all training sessions were combined. Therefore all data analyses are based on an overall sample size of thirty-seven. Table 2 provides an overview of the demographics of the sample.

Table 2: Participants’ demographic characteristics by gender

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Males (%) (n=11)** | | **Females (%) (n=26)** | | | **Total (%) (n=37)** |
| **Age:** 70-79 year olds 80+ year olds | 50.0 50.0 | | 56.0 44.0 | | | 54.3 45.7 |
| **Living Arrangements:** Living alone Living with partner/spouse Living with others (family/friends) | 36.4 63.6 0 | | 53.8 42.4 3.8 | | | 48.6 48.6 2.8 |
| **Amount of driving per week (km):** Less than 50km 51-100km 101-200km More than 200km | | 9.1 54.5 27.3 9.1 | | 19.2 46.2 26.9 7.7 | 16.2 48.6 27.0 8.1 | | |
| **Change in amount of driving (5 years):** Reduced Stayed the same Increased | | 27.3 72.7 0 | | 38.5 57.7 3.8 | 35.1 62.2 2.7 | | |

Participants who volunteered to attend the training session were all aged 70 years and over. Overall, there was a higher proportion of younger participants aged between 70 and 79 years (54.3%), compared with the older group (45.7%), and there was a tendency for female participants to be in the younger age group. These differences were not statistically significant. In addition, the majority of participants (68.8%) lived with their partner or spouse. Approximately half the participants lived alone, while half lived with a partner or spouse. There were gender differences in living arrangements: the majority of male participants reported that they lived with a partner or spouse (64%). In comparison, only 42 percent of females lived with a partner or spouse, and a higher proportion (54%) lived alone. These differences did not reach significance, however, χ2(3) = 1.76, p=0.62. This higher proportion of males living with a spouse/partner than females is reflected in the Australian population (Australian Bureau of Statistics, 2011).

There were some expected differences in amount of weekly driving. While females tended to report a lower amount of driving each week, with 19 percent of them reporting driving less than 50km, only 9 percent of males reported doing so. Fifty five percent of males reported driving 51-100km per week, while 46 percent of females reported driving this amount.

In order to examine the ability of the program on improving awareness of road safety issues and driving behaviour, participants were asked a series of questions in both the pre- and post-training surveys. First, participants were asked to indicate whether they avoided some hazardous driving situations using a 5-point scale (always, usually, sometimes, rarely or never). Of most interest here were responses where participants always or usually avoided driving situations (Figure 1).

Overall, small proportions of participants (less than 20%) reported always or usually avoiding most of the listed driving situations. The most commonly avoided driving situations were driving at night (especially when wet), driving in busy traffic and driving in rain. While proportions of responses were low, there were some interesting and mixed results in reported avoidance after attending the workshop, compared with before. For example, post-workshop responses showed that more participants indicated that they always or usually avoided driving in busy traffic and in the rain compared with reported pre-workshop behaviours. However, there were also fewer participants who indicated that they always or usually avoided changing lanes, making right-hand turns at intersections with and without traffic lights after attending the workshop. None of these differences reached statistical significance.



Figure 1: Avoidance of driving situations by survey session

In addition, participants were asked to rate various functional abilities for safe driving. Table 3 summarises these ratings. Overall, participants rated their abilities for safe driving highly, many reporting very good to excellent abilities and this was particularly so for vision for safe driving through the night.

For other abilities, a substantial proportion also rated their abilities as fair to good (e.g., vision for safe driving at night, ability to respond quickly for safe driving). No significant changes were noted for rating responses between pre-workshop responses and post-workshop.

There was some suggestion, however, that ratings for safe driving during the day decreased, with fewer reporting very good to excellent abilities and more reporting fair to good abilities after attending the workshop.

Table 3: Ratings of abilities for safe driving by survey training session

|  |  |  |
| --- | --- | --- |
| Rating for safe driving | Pre-training (%) | Post-training (%) |
| **Vision for safe driving during the day:** Very good to excellent Fair to good Very poor to poor | 68.6 31.4 0.0 | 67.6 32.4 0.0 |
| **Vision for safe driving at night:** Very good to excellent Fair to good Very poor to poor | 34.3 57.1 8.6 | 38.2 52.9 8.8 |
| **Ability to respond quickly:** Very good to excellent Fair to good Very poor to poor | 40.0 54.3 5.7 | 35.3 58.8 5.8 |
| **Upper body strength and flexibility:** Very good to excellent Fair to good Very poor to poor | 51.4 45.7 2.9 | 55.9 41.2 2.9 |
| **Lower body strength and flexibility:** Very good to excellent Fair to good Very poor to poor | 54.3 42.8 2.9 | 50.0 47.1 2.9 |

Participants were asked to respond to a series of general statements about older driver safety (Table 4). Generally, participants were aware of important road safety issues prior to attending the training session, with the majority agreeing with statements on self-regulation amongst older drivers, driving at safe speeds and safety features of vehicles. There was less knowledge on injury risk among older drivers and difficulties in making right hand turns (indicated by higher proportions of ‘false’ and ‘don’t know’ responses).

Knowledge of these issues appeared to change after attending the workshop, with a higher proportion of ‘true’ responses compared to pre-workshop responses. Moreover, the proportions of ‘don’t know’ responses decreased.

In order to assess the program’s acceptability, participants were asked a series of questions regarding the program. Participants provided feedback on their overall thoughts on the program, their likes and dislikes of each session, and difficulties they experienced with any of the session components, as well as suggestions for improvement.

First, participants were asked to indicate overall how informative they thought the program was. Encouragingly, 49 percent of participants found the workshop to be very informative. A further 49 percent reported the workshop to be informative, while only 3 percent found it to be very uninformative. In terms of overall acceptability, the program was well received, with 56 percent and 38 percent reporting it to be very acceptable and acceptable, respectively. Only one ‘very unacceptable’ response was received.

Table 4: Responses to statements on general road safety

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Statement | Pre-Training (%) | | | Post-Training (%) | | |
|  | True | False | Don’t Know | True | False | Don’t Know |
| People aged 65+ years have more crashes resulting in injuries compared with those aged 40-65 years | 22.2 | 69.4 | 8.3 | 50.0 | 46.9 | 3.1 |
| Many older drivers tend to adjust their driving to allow for the effects of ageing | 86.5 | 5.4 | 8.1 | 97.1 | 0.0 | 2.9 |
| One of the most difficult manoeuvres for older drivers is making right hand turns across traffic | 45.9 | 40.5 | 13.5 | 82.4 | 14.7 | 2.9 \*\* |
| Older drivers usually drive at safer speeds compared with young drivers | 81.1 | 8.1 | 10.8 | 91.2 | 5.9 | 2.9 |
| Safety features of a car are a very important factor in protecting the driver | 97.3 | 0.0 | 2.7 | 97.1 | 2.9 | 0.0 |

\*\* p<0.01

Participants were also asked to rate ease of understanding and how informative they thought the workshop sessions and components were. Generally, the results were positive, with the majority of participants (97%) rating the workshop and sessions (both in terms of presentation and group discussion) as very easy or easy to understand, and provided adequate information. Acceptability of the practical tasks, especially the introduction of a desk-top driving simulator was high. However, while the majority found this session to be acceptable (21% very acceptable and 56% acceptable), there were some noted difficulties. Participants reported that the simulator task was hard to complete, there were technical difficulties, difficulty in seeing the screens, poor pedal placement, etc. There were also some positive responses regarding these sessions, including comments about the ‘real life experience’ of the simulator, ‘a helpful reminder of what we should do’, ‘made me focus more’, etc.

Last, participants were given the opportunity to provide any feedback on how the program might be improved. Suggestions focussed on three main themes, including i) ensuring all individuals have time to undertake practical tasks and more interaction, ii) a shorter overall session, and iii) improved technical running of the simulator tasks.

**Chapter 4: Discussion and Summary**

This report describes the development of an educational/training program for older drivers in Australia and includes a review of the literature on effectiveness of educational/training programs as well as a process evaluation of the program.

While safe travel remains an essential goal for any society, recognition of the benefits of continued mobility and, conversely, serious consequences of loss of mobility must also be considered. Mobility is critical to carry out life’s activities, and to maintain independence, a good psychological outlook and well-being. In contrast, poor mobility places a substantial burden on the individual, family, community and society. Given that many older drivers will, at some point, need to consider driving cessation, there is a real need to ensure that this transition is a smooth as possible and that means raising the awareness of the benefits of planning ahead for retiring from driving and providing new and different kinds of transport options and mobility services that are viable, affordable, accessible, safe and co-ordinated.

Education and training to improve the driving experiences and practices of older drivers is central to current international thinking about this group’s safe mobility and there is increasing international recognition of the benefits of educational/training programs aimed to maintain safe driving as long as possible and to assist a smooth transition from driver to non-driver. It is claimed, for instance, that if older people are able to adopt safer driving practices, then this will have a protective effect on crash risk and subsequently there would be less need for them to have to submit to periodic licence testing. Furthermore, a well-managed process from driver to non-driver will result in overall improved health of the older population through maintenance of mobility, independence, self-esteem and quality of life. This would represent a substantial community saving.

The overall aim of the project, therefore, was to develop an informative, useful and effective training program for older drivers that will raise the awareness of older driver safe mobility, and promote the use of strategies to maintain safe driving practices for as long as possible and planning for mobility options beyond the car.

A number of tasks were undertaken in the development of this program including:

* A review of the literature, including identification of other previous or existing educational and training programs nationally and internationally, and identification of key ‘best-practice’ initiatives;
* Re-development of an educational/training program for seniors using current literature on issues pertaining to older driver safe mobility, incorporating current ‘best-practice’ in adult education, and feedback from community groups regarding length of sessions and feasibility of running community-based sessions; and,
* Evaluation of the program to assess its effectiveness in improving knowledge, attitudes to and adoption of safe driving practices amongst older adults, and acceptability of the program in terms of presentation style, delivery, content and use of computer-based activities.

The process evaluation of the program revealed a positive position toward the program amongst the sample of older drivers, and included high ratings of usefulness, content, format and delivery style. Moreover, a comparison of questionnaire responses before and after program participation showed some improvements in knowledge of road safety issues, awareness of functional changes and impact on driving ability, and attitudes towards adoption of safer driving practices.

In addition, the review of the literature addressing the effectiveness of education/training initiatives revealed:

* four of the six classroom-based education programs were unable to show either driving or crash improvements, with a fifth evaluation showing an increase in crashes for some drivers;
* all five programs which provided practical driving training showed improvements in at least some driving skills;
* programs which sought to increase older drivers’ awareness had mixed results. The two related programs from UMTRI had positive responses from participants, with driver ratings holding up against on-road performance. In contrast the two evaluations of *Roadwise Review* were unable to provide any validation evidence;
* two of the three evaluations of programs which sought to improve pre-conditions for driving (physical activity, speed-of-processing and reasoning) showed either driving improvements or crash reductions, with one third showing mixed results.

Overall, eleven programs showed effectiveness at some level, including changes in driving performance and most impressively, in at-fault crash levels. These findings are consistent with the conclusion reached by Korner-Bitensky et al. (2009).

While this evidence is positive, there are several key issues that need further discussion.

First, there is a clear need for empirically-improved evaluation designs. The evaluation of the current program as well as many of the other evaluations cited relied upon convenience samples of older drivers who, in some cases, were then randomly assigned to either intervention or control groups. Other studies used older drivers who voluntarily attended training or education programs to serve as ‘cases’. For both ethical and practical reasons, the use of convenience or volunteer samples is readily understandable. However it remains that important selection biases may have unduly influenced the results. Practical difficulties notwithstanding, there is the need for more truly randomised case-control studies to test program effectiveness.

Second, in the development of training and education programs there is the need to clearly identify the target group(s) of older drivers. So far as could be judged, most of the programs, including the ‘*Seniors Driving Longer, Smarter, Safer’*, used ‘normal’ samples of active older drivers. However some programs targeted impaired older drivers with a history of crash involvement, with another program selecting only drivers with a ‘moderate’ history of crashes or violations. It may be that the normal or safest older drivers are most likely to benefit from training or education, given their relative lack of impairments: conversely however, it may also be that these drivers are already close to their best driving performance and might therefore expect a ceiling effect on improvements. It may also be argued that impaired drivers are most in need of improvement and that there are obvious training and education strategies for them.

In identifying appropriate target groups, attention needs also to be given to the age parameters (if any) to be used. Many of the programs reviewed used relatively low age thresholds – around 50 years of age in several cases and in one instance, lower. With the evidence suggesting that the risk of impairing medical conditions and over-representation in serious casualty crashes become most noticeable for the oldest old drivers, it may be that education and training programs are best reserved for this neediest group. Alternatively, programs may be most effective if they are proactive rather than reactive, by targeting drivers yet to enter their riskiest periods.

As a third issue to be considered, there is the need to consider the criteria to be used in evaluating program effectiveness. The focus of the literature review was on evaluation studies using some form of robust outcome measurement, especially on-road driving performance or changes in crash involvement. However for some programs, other evaluation criteria might be more appropriate.

For example, for programs which promote increased self-awareness of driving skills and practices, there is the initial need to establish whether the program serves the purpose of self-assessment or self-screening. If the purpose of a self-screening instrument is to serve as an early prompt to a subsequent range of assessments (perhaps by a medical practitioner, perhaps entailing an on-road assessment), any evaluation of its safety benefits can be confounded by the effectiveness of other assessment procedures triggered by the initial instrument.

Fourth, the effectiveness of any program is likely to be strongly influenced by the program’s structure – especially its content, the underlying training or educational processes and the intensity/duration of the program. The review suggested that little confidence can be placed in programs which consist exclusively of passive, classroom-based learning procedures – whereas a program in combination with driver training programs are more likely to lead to safety benefits. As noted by Korner-Bitensky et al. (2009, p.110):

Interestingly, what has as yet not been explored fully is the benefit of a multi-faceted intervention that includes education, motor, sensory, cognitive, and behavioural aspects, all of which have been shown to be important components of safe driving. Given that the task of driving involves a complex interplay of all of these, the need for such studies is clear.

As part of this issue, the delivery format of the training or education program needs to be carefully considered. Training older drivers to improve their on-road skills can occur through various means – a driving simulator or on-road driving being the two most obvious examples. Both forms of training have their advantages and limitations and in all likelihood, may vary in effectiveness. Programs which seek to improve participants’ self-awareness of driving and health issues can be delivered via guided tutorials, ‘stand-alone’ handbooks or via either guided or unassisted computer-based materials. Again, each method has advantages and limitations and again, may vary in effectiveness.

As a final issue and from a wider perspective, the likelihood of a program making a meaningful impact on a jurisdiction’s overall road toll also needs to be considered. Training and education programs often require substantial resources from the organisations conducting them and from the participants recruited to attend them. If it is not feasible to provide sufficient programs to reach a sufficient spread of older drivers, even the most effective programs are unlikely to make much of a dent upon a jurisdiction’s total road safety performance – possible safety benefits to individual participants notwithstanding. In addition, while a program may be associated with safety benefits, the extent of these benefits even though statistically significant, may still be very modest in terms of real driving improvements or crash reductions – and may or may not justify the resources necessary to run the program.

There are no simple answers to these issues. The stance taken in regard to each issue is likely to vary from program to program and from audience to audience. If resources are to be expended effectively, it is critical that deliberate decisions be made regarding these key issues – informed by the research wherever possible, based on considered judgement in the absence of evidence.

The final product is a ‘ready-to-deliver’ classroom-based program package. The enhanced resource is designed for local governments, non-government organisations, community groups, practitioners and volunteers who either provide services to or work with older populations. The package provides the materials for interested organisations to run workshops for seniors whom they work with, either as a one-day event or a shorter 2-hour session, and includes a facilitator’s manual, powerpoint presentation, and materials for practical activities. The instructors manual sets out clearly the set up of classes and activities, strategies on effective teaching amongst older adults, and step-by-step messages to be delivered for each powerpoint slide as well as detailed procedures for activities.

**4.1 Recommendations and conclusions**

There are good opportunities for widespread use of the package in the community, however, a number of steps are required for this to occur, particularly to ensure that the package is delivered in an appropriate manner.

* It is envisaged that the resource can be implemented by relevant community groups and organisations including motoring clubs with oversight of the resource by a coordinating body to ensure quality, consistency and relevance of the product and its delivery.
* While the package is designed for immediate use by organisations and community groups to deliver to older drivers, it is important that a consistent message is conveyed. It would be of overall benefit for any organisation or group interested in promoting and presenting program workshops to undertake training sessions. It is therefore recommended that MUARC develop a ‘train-the-trainers’ course to ensure the integrity of the program, that potential presenters understand the importance of delivery style, the information being conveyed to participants is current and still relevant, and to provide them with training on activity procedures.
* It is important that potential users of the program are aware of its existence and have the opportunity to request training sessions for them to take the program to their communities. This will require a media campaign, perhaps through development and promotion of a series of presentations and flyers targeting government and non-government organisations and community groups.

**4.1.1 Conclusions**

Managing the safe mobility of older drivers within the Safe System approach requires an integrated approach including initiatives addressing improvements to behaviour, road design and vehicles (crashworthiness and occupant protection). Behavioural interventions are central to current international thinking about this group’s safe mobility and thought to play a significant role in raising awareness of the issues, and promoting the adoption of safe driving practices. The ‘*Seniors Driving Longer, Smarter, Safer’* program therefore addresses an important component of the Safe System approach, i.e., ensuring that older adults remain safe road users.

The program was developed to address the issues surrounding self-regulation, awareness of changing abilities and how they relate to the driving task, and to provide drivers with strategies to keep them safe and mobile. These strategies include making appropriate changes to driving behaviours and patterns, as well as planning ahead for the transition from driver to non-driver. A small evaluation of the program demonstrated its effectiveness in raising the awareness of the issues surrounding older driver crash and injury risk, and the factors that may increase this risk, as well as adoption of some safe driving practices. Furthermore, the evaluation showed high acceptability of the program amongst groups of older adults.

It is an effective training program aimed to inform drivers about steps they can take to ensure their safety and others while they are driving. The package produced is a ‘ready-to-use’ resource (along with liaison with MUARC developers) for organisations and community groups working with older populations and includes all materials, instructions, activities and brochures for implementation.

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1. For the purposes of this report, ‘training’ has been used to describe those programs which include as a component, the acquisition or improvement of aspects of functional performance – including but not restricted to driving skills. ‘Education’ has been used to classify programs which aim to provide a range of (usually) driving-related knowledge, often but not always classroom-based. For purposes of convenience, programs which combine both educational and training components have been classified as training programs. [↑](#footnote-ref-1)
2. In the latest AARP publications, the program is referred to as the ARRP Driver Safety Program (DSP). The terminology used throughout this report reflects the program title used in each evaluation. [↑](#footnote-ref-2)
3. Bedard et al. (2008) conducted a further evaluation of the 55-Alive program, this time in conjunction with an on-road driving component. This paper is discussed in the following section. [↑](#footnote-ref-3)
4. The authors did not specify the basis of this ‘previous evidence’. It is possible that they were referring to an extensive body of research literature relating to driver education programs designed usually for young novice drivers. If this were true, the application of this evidence to cover older driver education programs may not be justified as there are distinct differences between the youngest and oldest drivers’ education needs – as well as possible differences in their responsiveness to any education programs. [↑](#footnote-ref-4)
5. A before-and-after evaluation of the ‘Years Ahead – road safety for seniors’ conducted by the Royal Automobile Club of Victoria and based on a survey of participants and a control group, suggested that course attendance was associated with an increase in road safety awareness (Seymour and Harris, 2002). However as noted by the authors, there was no evaluation of actual changes in driver behaviour. [↑](#footnote-ref-5)
6. Some variations in this procedure occurred across the three sites: for example, at one site, only the safe driving knowledge was captured, at another site only the on-road evaluation took place. [↑](#footnote-ref-6)
7. Numerical results from the baseline and post-intervention evaluations were not included in the published report. [↑](#footnote-ref-7)
8. For ethical reasons, drivers aged 80 years or older did not participate in this session. [↑](#footnote-ref-8)
9. Whether the instrument is for self-assessment or self-screening is unclear. The studies cited in this report have effectively evaluated it as a self-assessment tool. [↑](#footnote-ref-9)
10. In actuality, they used the ‘research-friendly’ DrivingHealth Inventory – a battery of eleven sub-tests from which the Roadwise Review was developed. [↑](#footnote-ref-10)
11. These include:

    Edwards et al., (2002) – analysing the association between speed-of-processing training and performance of instrumental activities of daily living;

    Edwards et al., (2005) – analysing the impact of speed-of-processing training on cognitive and everyday performance;

    Wadley et al., (2006) – analysing the impact of speed-of-processing training on subsequent speed-of processing;

    Ball et al., (2007) – a further analysis of the impact of speed-of-processing training on cognitive and everyday functions;

    Edwards et al., (2009a) – analysing the impact of speed-of-processing training on continuation of driving; and

    Edwards et al., (2009b) – further analysing the impact of speed-of-processing training on driving mobility. [↑](#footnote-ref-11)
12. Three articles, out of scope so far as this report is concerned, were: Ostrow et al. (1992), McCoy et al. (1993) and Janke (1994). [↑](#footnote-ref-12)
13. In recognising the value of enduring safety benefits, it is not intended to overlook the practical and empirical difficulties in using an extended time scale for evaluation. [↑](#footnote-ref-13)