Assessment of computer-based training packages that may improve the safety older people's driver behaviour

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Abstract

There will be an increase in older drivers on the road over at least the next 20-30 years. On the whole older drivers are not a particular risk to road safety. However, they are over represented in crashes resulting in injury and death that involve junctions, in merging traffic, with turns across the road and in busy traffic and when navigating unfamiliar routes. They have greater difficulty in maintaining consistent speeds and are more likely to be distracted. They are more likely to have problems with poor lighting (glare, darkness, luminance) and have slower reaction times. Cognitive tests can be used to predict driver performance including being involved in a crash. Training has been shown to improve performance on the many of these tests and, in two cases (the Useful Field of View (UFOV) and Dual N task), can translate into improved driver behaviour. There are some promising examples of bringing together these cognitive tests currently run at local driver assessment centres and also some at-home self-assessment style programmes. These are always very positively received by older people and there is tentative evidence they improve driver behaviour yet little evidence that crashes are reduced. There is also a tendency for drivers to disengage with learning after an initial intervention, so effects tend to be short-lived. More research is needed about the best combination of training and tests and how to lock-in training benefits that translate to driver behaviour.

Introduction

Society across the globe is rapidly ageing due to a combination of falling fertility rates and substantial increases in life expectancy (UN, 2013). In 1950, there were 384,704,000 people aged over 60 across the world, representing only 8.6 per cent of the global population, now there are 840,628,000 people over 60, representing 11.7 per cent of the population (UN, 2013). Projections suggest there will be 2,020,359,000 people aged over 60, representing 21.2 per cent of the global population by 2050 (UN, 2013). Increases in ageing are happening across the world but the rate of increase is faster in wealthier countries. For example, the UK will reach 25% of the population being over 60 by around 2030 (ONS, 2013).

In the UK, as in many western societies, older people are more fit and active than previous generations. Ageing does not change the engagement people have with a hypermobile society, wanting and needing to travel large distances, more frequently than previous generations. They may still be working, have caring responsibilities (for other older people, for children or grandchildren, for example) and social and recreational networks that span over wide geographical distances. However, those aged over 70 are the group most likely to cite difficulties in accessing shops, banks and hospitals and to stay connected to local communities, especially when no longer driving) and state transport as being a barrier to engaging in social activities (see Ormerod et al., 2015 and Musselwhite, 2011 for an overview). Recent figures from Great Britain suggest around 342,000 over 75 year olds 'feel trapped' in their own homes through lack of suitable transport (WRVS, 2013).

Older people are more likely to give-up driving due to health, finance or confidence issues; yet giving up driving has repeatedly been shown to related to a decrease in wellbeing and an increase in depression and related health problems, including feelings of stress and isolation and also increased mortality (Edwards et al., 2009b;Fonda et al., 2001; Ling and Mannion, 1995; Marottoli, 2000; Marottoli et al., 1997; Musselwhite and Haddad, 2010a; Musselwhite and Shergold, 2013; Peel et al., 2001; Ragland et al., 2005 Windsor et al. 2007; Zieglar and Schwannen. 2013). Hence, there is a substantial amount of research, policy and practice examining how to keep older people mobile, especially in terms of driving.

Casualty rates for older drivers per miles driven is at its lowest at 70 years of age and begins to increase from around 75 years (see figure 1), most of this increase is almost certainly due to frailty as suggested by the number of deaths and Killed and Seriously Injured rising faster than all casualties. That said, older drivers from the age of 70 become more likely than not to be "at blame" for collisions they are involved in, according to official police records (Clarke et al., 2009; Mitchell, 2013). Clarke et al. (2009) reviewed STATS19 data (police on-scene incident record in Great Britain) and found older drivers are over represented as a casualty at fault in collisions at junctions, in merging traffic, with turns across the road and in busy traffic. Van Elsande and Dominque (2000) estimated that 19% of older driver crashes are due to their cognitive abilities being overwhelmed and that if eyesight issues are added the figure rises to 40% (Staplin et al., 2003a,b). Langford et al. (2006) suggest that low mileage drivers entirely make-up the increase in numbers in this category post 75 years of age, maybe as a result of self-selection; safer drivers are driving a higher number of miles.

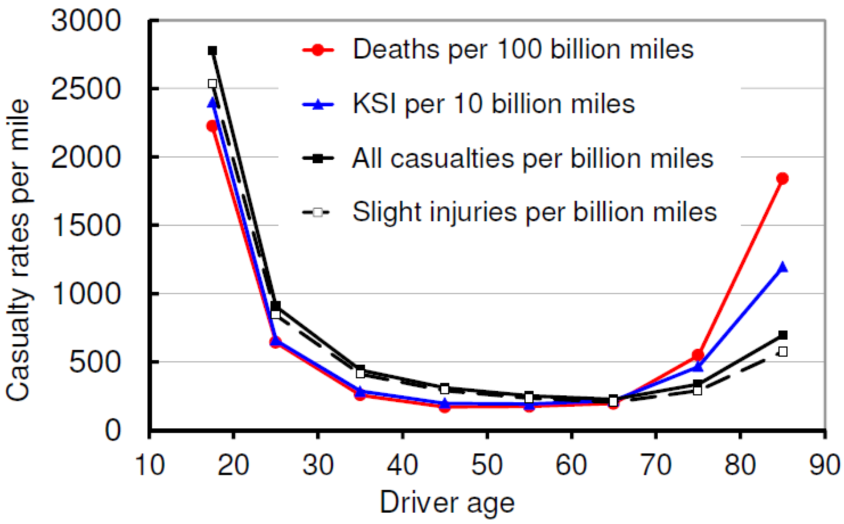

Figure 1: Casualty rates for drivers by age and types of casualty (Mitchell, 2013).

This research undertaken for this paper sought to investigate how far training can be undertaken that might help overcome some of the cognitive changes associated with ageing in later life. Specifically computer-based training packages were examined, with a view that they are easy and flexible to administer, being able to be completed at home or with a trained driving instructor at a driver training centre.

Methodology

Design

A desk based research project was supplemented by the meeting of an expert advisory group of people with expertise in driving in later life, comprising of 14 individuals: 5 gerontology academics, 2 geriatric-medicine academics, 2 geriatric-medicine practitioners and 5 older-age specialist qualified driver instructors. The project examined how far computer based training packages could improve older people's driving behaviour. This involved three stages (1) trawling STATS19 databases and examination of previous literature to identify contributory factors associated with older people's collisions; (2) identifying age related physiological and cognitive changes that might explain the contributory factors in the collisions and; (3) identifying computer based programmes which have been purported to be related to driver behaviour and therefore could form the basis of improving older people's driver behaviour.

Stage one: trawling STATS19 databases and other literature

STATS19 is a standardised database of information collected by police in attendance at a Road Traffic Collision (RTC) where there has been a casualty. Data collected includes location, vehicles involved, gender, and crucially age and contributory factors. The validity and reliability of the dataset is, however, open for debate. The database is an official document, completed by trained individuals at the scene of every injury-RTC across Great Britain. However, the dataset only links to 33% of hospital records collected on RTCs (DFT, 2012) and the contributory factors are recorded at the discretion of the police in attendance and although well trained no research exists to assess validity and consistency of such data. The STATS19 dataset was examined for Wales between the years of 2003 and 2011.

Differences between the findings for drivers aged 70 years and over with those aged under 70 were examined. This was supplemented by a literature review by the author.

***Stage two: Identifying age related physiological and cognitive changes that might explain the contributory factors involved in the collision*.**

The findings from stage one were presented to the expert advisory group. These people met in person in an hour long focus group and were presented the findings from stage one. They discussed the findings and concluded the key physiological and cognitive changes associated with ageing that could be responsible for the contributory factors identified in stage one.

Stage three: Identifying computer based programmes which may help older drivers improve road user safety.

The expert group, in the second half of the focus group, were then tasked to identify a list of computer programmes or tasks purported to be related to driver behaviour that older people could complete that matched three criteria: (i) that performance on the computer programme is related to driver performance; (ii) training can improve performance on the computer task and; (iii) improvement in performance on the computer task is synonymous with an improvement in driver performance. Recommendations for future computer based tests are then discussed. Again, this was supplemented by the author with a literature review.

Analysis

STATS19 data was entered into Excel and collisions and casualty datasets matched. Data for Wales between 2003 and 2011 were extracted. Data was further coded into two categories, those aged over 70 and those aged under the age of 70 for comparison. Where no age was given then data was omitted. In terms of the expert advisory focus group, key findings for the project were extracted and agreed upon with the participants at the focus group using sticky-notes and charts which were photographed for recording purposes.

Findings

Stage one: trawling STATS19 datasets and other literature.

Compared to other age groups older people over the age of 70 are more involved in collisions that involve failures of attention and judgement, 46% failed to look properly, compared to 42% across all age groups, 25% failed to judge the other vehicle or person's path, compared to 21% across all age groups and 17% performed a poor manoeuvre compared to 13% of all ages. Although loss of control involving older drivers was a contributory factor in around the same percentage of collisions as a younger driver, it was 15 percentage points higher that it would lead to a death than found for the general population, perhaps showing a more severe loss of control for older people. Older drivers are also over represented in RTCs that involve turning right (across traffic), moving off from stationary or reversing. In terms of turning right, this represented 12% of all cases (2003-11) for older drivers and only 7% for drivers under 70. In 13 per cent of cases they were described as 'turning right'; and over the whole period from 2003 to 2011, this represented 12 per cent of cases for older drivers, as compared with 7 per cent of cases for drivers aged under 70.

Literature suggests older people are over represented in collisions at junctions, in merging traffic, with turns across the road and in busy traffic (Clarke et al., 2009) esp. judgements of relative speed, time gap judgements (Oxley et al., 2006; Preusser et al., 1998), which broadly correlates with the STATS19 data of turning across traffic and failure to look properly and judge other people's speed. They are also more likely to have difficulties in navigating unfamiliar routes (Holland, 2001), something not investigated on a STATS19 form. Research also suggests older people have difficulty maintaining speed and tracking (Brendemuhl, Schmidt and Schenk, 1988; Mussewhite and Haddad, 2008, 2010b; Schlag, 2003). They may also have attentional difficulties in being distracted by radio, passengers, outside (Holland, 2001; Musselwhite and Haddad, 2008, 2010) and perceptual difficulties in inability to see very well under poor lighting (glare, darkness, luminance) (Janke, 2004; Musselwhite and Haddad, 2008, 2010b). There is also literature on poorer reaction times (Musselwhite and Haddad, 2008, 2010b).

***Stage two: Identifying age related physiological and cognitive changes that might explain the contributory factors involved in the collision*.**

The findings from stage one were presented to the expert advisory group and were then mapped to specific physiological and cognitive difficulties faced by older people (table 1).

The expert advisory group identified five cognitive issues and one cognitive/physiological issue:
(1) Attention. The literature suggests that older age is synonymous with deficits in selective and sustained attention (Zanto and Gazzaley, 2014).

Driving issue pertinent to older drivers	Failed to look properly (STATS19 databse)	Failed to judge others' path (STATS19 databse)	Performed a poor manoeuvre (STATS19 database)	over represented in collisions at junctions, in merging traffic, with turns across the road and in busy traffic (Clarke et al., 2009) esp. judgements of relative speed, time gap judgements (Oxley et al., 2006;	Difficulties in navigating unfamiliar routes (Holland, 2001)	Maintaining speed and tracking (Brendemuhl, Schmidt and Schenk, 1988; Musselwhite and Haddad, 2008, 2010b; Schlag, 2003)	Being distracted by radio, passengers, outside (Holland, 2001; Musselwhite and Haddad, 2008, 2010)	Inability to see under poor lighting (glare, darkness, luminance) (Janke, 2004; Musselwhite and Haddad, 2008, 2010b)	Reaction times (Musselwhite and Haddad, 2008, 2010)
Attention	×	×	×	×	×	×	×		×
Cognitive Overload	×			×	×		×		
Cognitive processing speed	×			×					×
Perceptual speed	×	×		×		×			
Working memory	×		×	×			×		×
Task switching	×	×	×		×		×		×
Eyesight	×	×	×	×	×	×		×	×

Table 1: Mapping errors on the road in which older drivers are overrepresented to changes in cognition and eyesight in later life

(2) Cognitive Overload. Older people reach maximum task difficulty of increased processing of multiple-tasks quicker than younger people. That is they are unable to process as much

information simultaneously than younger people (Zanto and Gazzaley, 2014). Switching between tasks can also pose more problems than younger people (Zanto and Gazzaley, 2014). This may be due to the brain already using compensatory pathways where direct routes have diminished over time

(3)Cognitive processing speed. How quickly a person can process changes in the environment tends to deteriorate over time. This is often measured in terms of reaction time, for example, It is well documented that reaction time shortens from infancy to around 20 years of age, then increases slowly to around 70 years of age and beyond (Der and Deary, 2006; Jevas and Yan, 2001; Welford, 1977). A person over the age of 65 can have reactions times up to 22 times slower than that of someone of 30 (years of age, though it is noted many factors contribute to this, not just cognition (for example being able to move feet onto correct pedals or alter course through moving steering wheel) (see Holland, 2001).

(4) Perceptual speed. Difficulty in judging relative speeds of self and others often becomes more problematic with age (Maloula, et al., 2004)

(5)Working memory. Ageing is associated with reduced storage capacity and processing efficiency of the working memory (the memory used to perform immediate tasks). Hence, the ability to store new information and processing other information at the same time is diminished (Maloula et al.2004).

(6)Task switching. Ability to switch between different tasks, competently, efficiently and smoothly with minimal delay is diminished as people age (Maloula et al.2004)

(7) Eyesight. Between 15 and 65 years of age, not only does susceptibility to glare increase, the recovery time from glare increases from two to nine seconds' (Holland, 2001). Research suggests that by the age of 75 years old drivers may require 32 times the brightness than a 25 year old does in order to be able to see effectively.

These were then mapped to the errors older people make on the road identified in stage one. Once an agreement was reached among the expert focus group, a matrix was created (see table 1). Failed to look properly could have been a result of all of the cognitive changes associated with ageing. Attention and eyesight effect the majority of different errors made on the road and hence are crucially important to driving in later life.

Stage three: Identifying computer based p[programmes which may help older drivers improve road user safety.

This section examines a variety of cognitive computer-based training programmes that have been shown to be related to driver safety and that can be trained for. Such training is often referred to as brain training or brain fitness programmes. Brain training is "the engagement with a specific program or activity that aims to enhance cognitive skill or general cognitive ability as a result of repetition over a circumscribed timeframe" (Rabipour and Raz, 2012, page 159).Brain training is related to neuroplasticity, that the brain is malleable can change or even grow in relation to stimuli (Calero and Navarro, 2007).

(1) The Useful Field of View (UFOV) Test and Training. The Useful Field of View (UFOV) (figure 2) test is a computer based measure of cognitive processing speed and attention. The test consists of 3 sub-tests: (1) Processing Speed: Determines a person's threshold for discriminating stimuli presented in central vision. Participants are required to identify a silhouetted shape in a central fixation box; (2) Divided Attention: Builds on sub-test 1 by adding a peripheral target simultaneously and; (3) Selective Attention: Requires central and peripheral target identification (as in sub-tasks 1 and 2) but with additional distractor shapes.

Poor results on UFOV relate to increased crash involvement and poorer driver performance (Ball and Owsley, 1992; Ball et al., 1991, 1993; Clay et al., 2005; Goode et al., 1998; Horswill et al., 2011; Mathias and Lucas, 2009; Staplin et al., 2003a,b). On specific driver ability tests there is still a relationship between poor UFOV performance and driver behaviour but relationship tends to be quite weak (Selander et al., 2011) and in populations with mild cognitive impairments, the relationship is non-existent (Bohensky et al., 2007). Computer based training can improve results on UFOV which then translates to improving driver behaviour, for example, Ball et al. (2010) found ten 70 minute training sessions for older people led by an instructor over five weeks (two per week) reduced at-fault crashes by 51% over the following five years as compared to a control group. It can also contribute to faster reaction times and reduced risky driving manoeuvres (Roenker et al., 2003). Overall it has been shown to reduce premature driver cessation (Edwards et al., 2009a) and in turn improve physical health, quality of life and reduce depressive symptoms in older adults

(Wollinsky et al., 2006a,b, 2009). It seems the training must be directly related to UFOV to be of impact, for example use of generic computer games, including Medal of Honour (1st person shooting game) and Tetris (shape arranging game), for example, although increase engagement and "flow" have few UFOV improvements and have no relation to improvements in driver behaviour (as measured on a simulator) (Belchoir, 2007).

Figure 2: Useful Field of View (UFOV) Test (via http://www.biopticdrivingusa.com/ufov-usefull-field-of-vision/)

(2) Trail making test. The Trail Making Test consists of two tests, Part A (figure 3 left) requires a participant to join up numbered shapes in sequential order from 1 to 25 as quickly as possible. This measures visual search capability. Part B requires the participant to join numbers and letter together in order 1-A-2-B-3-C and so on (figure 3 right). Part B measures working memory and task switching ability.

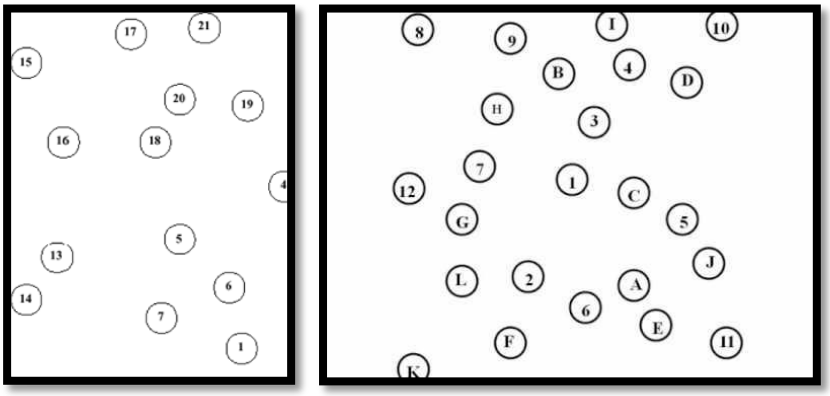

Figure 3: Trail Making test: Part A (left) and part B (right)

Emerson et al (2012) found poorer scores on part A or part B were related to the number of crashes an older driver had. Staplin et al. (2003) found part B is related to at fault crashes in their sample of 2,500 drivers in three samples drawn from license renewal, medical referral, and residential community populations. Training can be improved via cognifit techniques (see Shatil et al., 2014).

(3) Motor-Free Visual Perception Test, Visual Closure sub-test. The Visual Closure subtest of the Motor-Free Visual Perception Test (MVPT/VC) is a multiple-choice test that measures a person's ability to visualize incomplete figures when only fragments are presented (Colarusso and Hammil, 1996; see figure 4). This ability is important to the driving task, insofar as drivers must recognize a sign or other traffic control device that is only partly visible, or quickly perceive the safety threat represented by a vehicle or pedestrian that is partially obstructed (e.g., by a building or parked car) at the side of the road, and may be about to move into the driver's path. The Motor-Free Visual Perception Test/Visual Closure subtest was most predictive of (at-fault) crash involvement by drivers in the License Renewal sample of 2500 older drivers, by a wide margin (Staplin et al., 2003a,b).

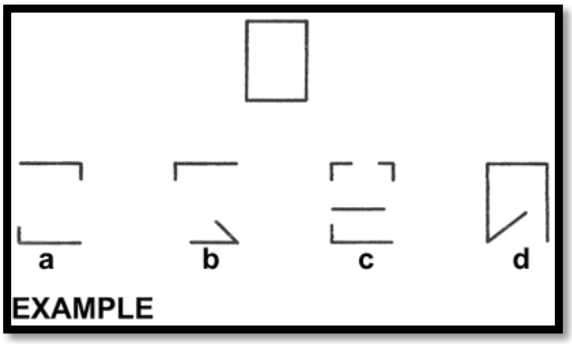

Figure 4: Example of Motor-Free Visual Perception Test, Visual Closure sub-test (Staplin et al., 2003)

(4) Delayed Recall Test. The Delayed Recall test, from the Mini-Mental Status Examination (Folstein, Folstein, and McHugh, 1975), is related to working memory. Working memory is important to safe driving because it allows a driver to recognise and remember signs, rules, navigation and moment to moment hazard detection and vehicle control (Staplin et al., 2003a,b). Performance on the test requires participants to recall three words, once achieved delayed recall condition is added by allowing a certain amount of minutes (often 10 minutes in the first instance) to pass before repetition is required (participants are told they should remember them for recall). Performance on the delayed recall test is related to at fault driver crashes (Staplin et al., 2003a,b). Delayed recall test can be improved with training, both specific memory training and more generic cognitive engagement with a task (see Kueider et al., 2012 for review), but whether such training is then related to reducing crashes at the wheel is yet to be tested.

(5) Computerized Maze Navigation. Participants complete trace a path through a computerised maze. A study by Ott et al. (2003, 2008) found analysing participants (n=133) completing a series of five mazes, calculating errors, planning time, drawing time and total time could distinguish older people's driving performance on a test track both for those with Alzheimer's disease and those with no cognitive impairment. The total test time was highly correlated with Trail Making A test and the Hopkins Verbal Learning Tests Trial 1 in both sets of participants. With a larger sample (n=692) of older people aged 70-93, Staplin et al (2003a,b) found maze test results are linked with crash involvement.

(6) Speed of processing training. Simple and choice reaction time was trained in a driver simulator with a group of older people with decreased cognitive function (Roenker, Cissell, Ball, Wadley, and Edwards, 2003). Simple reaction time was trained by making participants brake as fast as possible in relation to brake lights. Choice reaction time was trained by getting participants to react to different traffic signs which told the person to brake, turn the wheel or do nothing. The trained group had improved reaction time compared to the control group (no training), and improved on an on-road evaluation of their driving especially on turning and signal use. These improvements were not noted at an 18 month follow-up, however.

(7) Dual n-back task for working memory. The dual n-back task is related to working memory. In the ordinary n-back task, the participant is presented with a series of stimuli, for example words or letters and must indicate when the current stimulus matches one from n steps earlier in the sequence. The n is changed and made more difficult if the participant is performing well, so the task is incremental. In the dual-task version, two independent sequences are presented at the same time usually one presented verbally and one visually. Participants were given training for the test 5 days a week (lasting around 20-25 minutes) for five weeks, totalling 25 sessions, compared to a control that received training on trivia. Those who received training improved other elements of working memory and this did transfer to driving performance, albeit measured on a driver simulator (Seidler et al., 2010)

(8) Hazard perception tests. Horswill et al. (2010) found a relationship between the time taken to identify hazards on a standard hazard perception test and crash involvement among a sample of 271 older drivers.

Discussion

Performance by older people on the Useful Field of View (UFOV), Trail Making Test part A and B (TMT/A, TMT/B), Motor-Free Visual Perception Test, Visual Closure Subtest (MVP T/VC), Delayed Recall, Maze test and Dual N task have all been shown to be related to number of crashes. Of these only UFOV and Maze test have been examined are related to driver behaviour. Speed of processing is also related to driver performance. Training has been shown to improve performance on the UFOV, TMT A/B, Delayed Recall, Speed of Processing and the Dual N test. Although it might be assumed improved training would also improve driver behaviour or reduce driver crashes in those tests, research has not always been carried out that demonstrates this. Hence, we can only surmise that it is highly likely such training will have an effect on driver performance. We can only say for certain that UFOV and Dual N fitness training improvements have been demonstrated to translate into improved driver behaviour. UFOV has had the most attention in this area, having been shown to correlate to many different domains of driver behaviour in older adults including crash involvement, driver performance, driver cessation (and associated mental health and wellbeing domains). But it has had most research carried out in this area; other tests may still improve driver behaviour in similar ways but as yet have not been tested.

Mapping the training to known older driver issues shows that the UFOV again covers many particular problems, for example those involving attention, cognitive overload, cognitive processing speed and perceptual speed (see table 2). In combination with TMT A and B which covers working memory, task switching and visual search, the main cognitive issues related to older drivers are covered. These tests have been shown to be related to driver crashes and/or driver behaviour and can be trained for. Although more work is needed on how best to combine such training and how to present such training in a driver context, it is suggested these are the most appropriate tests and training to be considering when wanting to improve driver training for older people.

Education and driver training programmes targeted directly at improving driver behaviour sometimes involve some of the cognitive tests mentioned above coupled with scenario discussions and on-road evaluations and training. Overall, these programmes are evaluated well, older people enjoy training and having a chance to learn something new and they enjoy the opportunity to reflect on their skills and abilities and focus in on limitations. Some studies suggest driver behaviour can improve but links to fewer accidents have not yet been studied on the whole. The only study to include this as a measure has found an increase in collisions, perhaps being linked to creating over confidence in the older driver (Nasvadi and Vavrik, 2007). Improvements in driver behaviour where noted tend also to be fairly short-lived.

Suites of cognitive (and physical) tests are found in Cognifit, CogMed and DriveFit as well as appearing within the education and training programmes. Yet, bringing together the most appropriate tests in the best manner has not really had much attention, especially in relation to driving based outcomes. How does training on one type of intervention affect learning from others, for example? What are the best combinations of training available and why? More research is certainly needed.

Packaging this training as an attractive and coherent programme is more problematic. People who engage in training are often at either end of the spectrum, they are motivated, conscientious people who want to improve their driving, often those who are already very self-aware, very careful and overall very good drivers, or they are those who have been referred to training due to an identified problem, either health or an identified issue on the road (they been involved in a crash or been spotted driving dangerously or poorly by the police, for example). There will inevitably be a large gap of people in the middle of these extremes who would clearly benefit from training. Some of these will believe they are already good enough, some will believe that training is of little help, some will be anxious about being told to give-up should they attend training, some maybe anxious about being evaluated, especially in front of others. How to motivate this group to interact with training has not yet been investigated. Self-completion training can help those who do not want to be assessed and evaluated in a public setting. These have been evaluated to be shown to help older people become more self-aware of their own driving imitations and help them formulate intentions to change. There is evidence from the SAFER driving tool, for example, that completion of the self-awareness programme can improve driver performance (Molnar et al., 2010) but there is no evidence it makes any changes to crashes or how long such changes lock in and Dunn and Hellier (2011) note that actually there is little engagement with such tools beyond an initial selection. Hence, any self-completion training programme needs a mechanism to keep people engaged for a longer time period. Indeed this is an issue across all training interventions. Training is often a one-off event, perhaps a system involving continuous feedback and monitoring would be more appropriate and more synonymous with everyday driving. At least training could be provided at regular intervals to maintain standards. Research to date has not really addressed the right levels of interval of presenting an intervention in order to make the appropriate improvements to driver behaviour or reduce crashes. More research is therefore needed on the long-term effect on driving behaviour from a one-off intervention.

	UFOV	**TMT A**	**TMT B**	**MVPT VC**	**Delayed Recall**	**Maze**	**Speed of processing**	**Dual N**	**Rapid Pace**
Attention	x					Xx			
Cognitive Overload	x					X		x	
Cognitive processing speed	x						x		
Perceptual speed	x								x
Working memory			x	x	x			x	x
Task switching			x						
Visual search		x		x		X			
Neck									
Muscles									x
Optical lobe	x					X			
Related to crashes	x	x	x	x	x	X		x	
Related to driver behaviour	x					X	x		x
Can be trained for	x	x	x		X		x	x	
Training shown to improve driving	x						x (up to 18months after)	x	

Table 2: Overview of cognitive and physical tests and training and relationship of these to cognitive and physiological changes associated with crashes

Elements that have not been looked at in conjunction with training and interventions for older people include psychosocial responses to driving, including emotive reactions, attitudes and perceptions. Given the emotive nature of giving-up driving, this seems somewhat of an omission. Attitudes have been recognised as an important component of driver training for novice drivers (see Musselwhite, 2010) but have largely been disregarded for older drivers.

Ultimately, there is always the need for careful evaluation of a proposed intervention. Most worryingly with this type of training is the potential for over confidence that may lead to more risky behaviour and consequently more crashes. Alternatively the opposite may happen, people may lose confidence unnecessarily. The need for balancing this with appropriate feedback based on robust evaluation is crucial.

Overall any future plans for training should make sure that the package works within norms and expectations and have real-time quality feedback. Training that has reported to be successful is usually interactive (see also Henderson, 2003; Molnar et al., 2003) and often involves some form of social element. For example, in training and education sessions, discussions with others have been useful in getting individuals to reflect on their behaviour. Behaviour change can also be enhanced through social comparison and facilitation, so comparing progress on training interventions with those identified as similar to themselves can help with maximising the success of the intervention. This need not be in person but could be virtual connections if the training was done remotely on computers, for example. A suite of training programmes should be available and tailored to the older person's needs.

The suite should include cognitive tests of UFOV along with TMT A and B as well as encouraging neck and shoulder exercises and possibly general fitness. It should be investigated how far these might be developed as interactive games and within a driving format. Could UFOV and TMT A and B, for example, be converted into a game with incremental changes and levels to complete? Could UFOV or TMT A and B, for example, be developed as a hazard perception test or use scenes from a roadway?
Recommendations for future training programmes for older people to improve driver behaviour should include the UFOV and the TMT A and B test. A screening procedure linked to incremental training programmes with feedback akin to a game style package is suggested. However, much more research is needed to identify if the benefits to actual driver behaviour are sustained.

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