Chapter 6

OLDER DRIVERS’ RISKY AND COMPENSATORY DRIVING: DEVELOPMENT OF A SAFE DRIVING WORKBOOK FOR OLDER DRIVERS

Tsuneo Matsuura
Jissen Women’s University, Japan

ABSTRACT

We developed a Safe Driving Workbook for older drivers to understand whether their risky driving is increasing due to aging and if they exhibit compensatory action corresponding to the increase in risky driving. Drivers who reported more risky driving are recommended to adopt more compensatory driving in the workbook. A validity study was conducted with Japanese older drivers over age 70 (N=3,132) for both risky and compensatory driving scales developed by an interview and questionnaire. Multiple regression analysis revealed that older drivers with poor driving ability assessed by in-car observation and with accident/violations in the past three years were more likely to conduct risky driving. Although the analysis did not show the same result for compensatory driving, another analysis indicated that older drivers with at fault accidents tended to exhibit more compensatory driving. Drivers with higher risky driving score and some of those with higher compensatory driving scores were given feedback information in the workbook. Finally, significance and limitations of the workbook were discussed in terms of a tool for driver education.

INTRODUCTION

From a social public health perspective, older drivers’ injuries and fatalities are not necessarily a serious problem considering that the percentage of older people who die while driving due to traffic accident is small compared to other causes. For example, the annual death from traffic accidents for older people aged 65 and over (n = 3,757) accounts for only 0.39 % of the total death of them (n = 960,917) in Japan (Ministry of Health, Labour and Welfare, 2009).
However, in the field of traffic safety, the problem of older drivers represents one of the main current themes. The problem lies in the rapid increase in older drivers and their comparatively higher accident risk and vulnerability. When controlling for driving distance, they are much more dangerous than drivers in other age groups except teenage drivers. This U shaped curve for injury and fatality rates relative to exposure in terms of miles/kilometres driven has been reported by several studies (Evans, 1991, 2000; Massie, Campbell, and Williams, 1995; McGwin and Brown, 1999; Tefft, 2008; Williams and Carsten, 1989). Generally the percentage of high-risk drivers increases with age. However, all older drivers are not necessarily dangerous. It has been considered that the higher crash rate of older drivers is due to high risk subgroups within the older driver population, which stems from medical and functional impairments (Dobbs, 2005; Marshall, 2008; Sagberg, 2006), frailty (Evans, 2001), difficulty in adapting to new traffic environments, and decrease in driving amount leading to unfamiliarity with driving and to making trips on local roads with more potential conflict points (Janke, 1991; Langford, Methorst, and Hakamies-Blomqvist, 2006).

**Perceived Risk of One’s Own Driving**

Average older drivers may be either unaware of their risk in difficult driving situations or unwilling to admit that their risk is serious enough to lead to accidents (Cooper, 1990). Using the Manchester Driver Behaviour Questionnaire (DBQ), which measures three basic types of aberrant behaviour (i.e. violations, mistakes and, slips/lapses), Åberg and Rimmö (1998) found that the reported frequency of inattention errors, such as missing signs or signals, increased for drivers between 18 and 55, after which it levelled off. Another study (Rimmö and Hakamies-Blomqvist, 2002) of Swedish drivers aged 55 and 92 years also indicated that self-reported inattention and inexperience errors did not increase by age. These unexpected results have been attributed by Rabbitt (1990) to an age-related decrease in monitoring capacity. When comparing objective measures of errors with self-reports, older subjects were found to make more errors but reported fewer than younger subjects. In addition, Tränkle, Gelau, and Metker (1990) found that the risk ratings of traffic situations by older male and female drivers (65-75) were often close to those by middle age group (35-45), except for the situations characterized by darkness and greatly reduced visibility.

Perceived accident risk and self-perceived driving abilities are strongly interrelated, that is, when we find drivers making low estimate of risk we also find high estimates of ability (Matthews and Moran, 1986). Fujikawa and Nishiyama (2002) had older drivers self-rate their risky driving due to aging in areas such as “Pressing a brake-pedal lately and fiercely” and “Feeling difficulty in reading a traffic sign” and compared this with the extent to which older drivers overestimate their own driving skill. Drivers who self-reported less risky driving tended to show more overestimation of driving skill.

**Overestimation of One’s Own Driving Ability**

Some questionnaire studies have shown that older drivers also generally perceive their driving ability to be better than that of the average driver, younger drivers, or their peers (Cooper, 1990; Marottoli and Richardson, 1998; Ota and Hagiwara, 1996). However, these
Older Drivers’ Risky and Compensatory Driving

studies cannot tell whether a particular older driver is overconfident or actually possesses greater than average skill (Matsuura, 1999; Sundström, 2008). It is common that those older drivers who have no accident history tend to have higher confidence in their own driving.

Recently, a substantial number of studies have compared self-reports of subjective driving skill with actual driving skill and showed that older drivers tend to rate their driving skill higher than their actual skill. In some Japanese studies, older drivers rated their driving skill for seven behaviours (Fujikawa and Nishiyama, 2002) or 21 behaviours (Ota, Ishibashi, Oiri, Mukai, and Renge, 2004), on a 4-point scale either before or after their actual driving in a closed course without other traffic at a driving school. A driving instructor accompanied the participant driver in order to observe their driving skill for the pre-determined driving behaviours. Self-assessment of driving skill was compared to the performance on the driving test and results showed higher rating of subjective skill than that of objective skill. The tendency to overestimate one’s skill was more apparent for older drivers than younger drivers (Ota et al., 2004).

Marottoli and Richardson (1998) had older drivers rate their driving ability compared to other drivers of their own age and driving confidence for each of 10 driving conditions. The self-assessments were compared to the performance on a road test. No relationship was found between self-rating of driving ability and on-road driving performance, nor between confidence and driving performance. The results suggest that some older drivers are overconfident and do not recognize their risk on the road in spite of their poor driving ability. Freund, Colgrove, Burke, and McLeod (2005) compared self-rated driving performance of older drivers, which was obtained by asking “how well do you think you will perform today on your driving evaluation compared to others your own age?”, with driving performance which was subsequently tested by a driving simulator. As self-rated driving evaluations increased, there was an increased risk of hazardous errors and traffic violations during the simulated drive. This demonstrates that overestimation is more likely to appear among older drivers with poorer driving skill.

We have pointed out that overconfidence may result in an underestimation of the potential hazards and risks on the road (Deery, 1999; Gregersen, 1996; Matthews and Moran, 1986). In addition to this effect, overconfidence may reinforce the feeling of “illusion of control” (Delhomme, 1991; McKenna, 1993; Rumar, 1988) that increases the vulnerability of drivers in risky situations, and may ultimately lead to a disbelief or lack of motivation to take part in safety campaigns (McCormic, Walkey, and Green, 1986; Svenson, 1981; Ulleberg, 2002). There is also evidence that older drivers with high levels of confidence are less likely to avoid hazardous driving situations (Baldoc, Mathias, McLean, and Berndt, 2006; Charlton et al., 2006).

Compensatory Driving

It is generally assumed that some older drivers modify or regulate their driving behaviour to minimize their risk of accidents. This type of driving is called self-regulatory driving or compensatory driving. We review the studies on this type of driving because it can help prevent accident involvement in older drivers and it is what we advise older drivers to assess and adopt in our workbook.
The research group of OECD (1985) have classified compensatory driving into three types. Many studies define compensatory driving as actions taken to offset declining driving abilities, including driving limitations/avoidance, limiting exposure, and cautious actions. Driving limitations occur in potentially challenging driving situations, such as driving at night, high-traffic roads, rush-hour, high-speed interstate/expressways, driving alone, left-hand turns across oncoming traffic, and driving in the rain (Ball et al., 1998). Limiting of driving exposure includes decreased driving distance (i.e. annual mileage) and driving frequency (Charlton et al., 2006; Christ, 1996; Lyman, McGwin, and Sim, 2001). Cautious actions are behaviours selected below driver capacity, such as driving at lower speeds (Hakamies-Blomqvist, 1994; OECD, 1985), or adaptive behaviours like maintaining greater distances from preceding vehicles, choice of adaptive speed, or anticipatory behaviours (De Raedt and Ponjaert-Kristoffersen, 2000); all of which represent actions taken to reduce the risks of driving (Schlag, Schwenkhagen, and Tränkle, 1996). A few studies have even extended compensatory driving to cover the notion of ‘the mastering of internal states’ (Hakamies-Blomqvist, 1994) and ‘the use of devices which reduce the demand for the driver, like automatic gear shifting’ (Christ, 1996). However, these latter actions will not be of focus here.

Two psychological models help to understand compensatory driving. One is a hierarchical classification of driving (e.g., Janssen, 1979; Michon, 1985) and the other is the model of successful ageing (Baltes and Baltes, 1990). The model of hierarchical classifications of driving considers driving as concurrent activities at strategic (planning), tactical (manoeuvring), and operational levels of control. The strategic level defines the general planning stage of a trip, including the determination of goals, route, modal choice, plus an evaluation of the costs and risks involved. The tactical level involves manoeuvring of controls, which allows drivers to negotiate the current driving situation (e.g. altering speed). Finally, the operational level includes the capabilities and skills needed for vehicle control (e.g., steering and shifting) (Michon, 1985). A few researchers have classified driving compensation in terms of this model, for example Schlag et al. (1996) who argued that the strategic and tactical levels of driving seem to be more important for the compensation of deficits. Compensation on a strategic level refers to decisions older drivers make before starting on a trip, such as avoiding driving in heavy traffic or trying to avoid crossings they judge to be difficult. Alternately, the tactical level of compensation includes actions taken while driving to reduce the risk, like speed reduction. Christ (1996) pointed out that although compensation strategies are feasible and can be made at various levels, compensation primarily on the strategic level is practical for older drivers. De Raedt and Ponjaert-Kristoffersen (2000) also used the term ‘strategic and tactical compensation’. Strategic compensation was measured using a questionnaire with 16 difficult traffic situations like driving in rush hour, while tactical compensation was studied using four specific observations during a road test as mentioned above.

Recent research has also used the successful model of ageing to explain ageing-related self-regulation (Baltes and Baltes, 1990). This includes Selection, Optimization, and Compensation (SOC) that can help explain how individuals maintain important competencies despite age-related losses. Selection refers to focusing one’s resources on a subset of potentially available options, either in response to new demands or tasks (elective selection) or in response to actual or anticipated losses (loss-based selection). Optimization involves acquisition, refinement, and coordinated application of resources directed at the achievement
of higher functional levels. Compensation denotes efforts to maintain a given level of functioning despite actual or anticipated decline in or loss of previously available resources. De Raedt and Ponjaert-Kristoffersen (2000) applied this model to driver behaviour. Selection corresponded to strategic compensation and compensation to tactical compensation in Michon’s hierarchical driving model. Optimization was not described as a strategy of adaptive driver behaviour. Due to the fact that driving is one of the daily activities of older individuals, it is likely that a general model on age-related self-regulation model applies also to driving.

Prevalence of Compensatory Driving among Older Drivers

Generally older drivers drive less distance annually compared to younger drivers (Alvarez and Fierro, 2008; Hu and Reuscher, 2004; Rimmö and Hakamies-Blomqvist, 2002). The main reason may be due to changes in lifestyle after retirement. However, a large number of older drivers still use their vehicle five to six times a week (Ackerman, Edwards, Ross, Ball, and Lunsman, 2008; Lyman et al., 2001; Schlag et al., 1996). Further, despite self-imposed limitations, total avoidance may not be so common among older drivers. For example, Charlton et al. (2006) reported that even in the most commonly avoided situations (i.e., on wet nights, at night, in busy traffic) only one quarter of their Australian sample (aged 55 and over) indicated that they intentionally avoided such conditions in the previous six months. Similarly, the proportions of Swedish older drivers (aged 65-74) who avoided driving under dark hours and rush hours or dense traffic were 40.3% and 32.7%, respectively (Rimmö and Hakamies-Blomqvist, 2002). According to Baldoc et al. (2006), the percentages of older drivers who reported avoidance at night in the rain, at night, high traffic roads on the scale of ‘sometimes’, ‘often’, or ‘always’ were 24.0%, 19.2%, and 10.6%, respectively.

There are several social and individual factors that have been found to influence the decision to avoid driving. One of the individual factors is the age of the driver. Many studies show that those most likely to adopt avoidance behaviour were older, particularly those 75 years and older (Charlton et al., 2006; Donorffio, D’Ambrosio, Coughlin, and Mohyde, 2008; Rimmö and Hakamies-Blomqvist, 2002; Ross et al., 2009). Another factor is gender with female drivers reporting greater avoidance (Charlton, et al., 2006; Kostyniuk and Molnar, 2008; Rimmö and Hakamies-Blomqvist, 2002). However, some studies indicate that females drive less but do not necessarily avoid difficult situations (Dellinger, Sëhgal, Sleet and Barrett-Connor, 2001; Loss et al., 2009). The influence of gender on driving mobility may ultimately be due in part to societal differences (Hakamies-Blomqvist and Siren, 2003; Loss et al., 2009).

Many researchers have reported that impaired health is also associated with self-imposed driving limitations (Donorffio et al., 2008; Lyman et al., 2001). Studies have shown that most drivers cite poor vision as a major factor in determining avoidance of driving at night or in poor weather (Ball et al., 1998; Lagland, Satariano, and MacLeod, 2004; McGwin, Chapman, and Owsley, 2000; West et al., 2003). Poor vision includes reduced visual acuity, reduced contrast sensitivity, and poor performance on the Useful Field of View (UFOV) test. Studies of driving cessation, which is the ultimate goal of driving avoidance, also reveal that older age, poorer health, poorer physical functioning, and slower speed of processing are significant
predictors for driving cessation (Anstey, Windsor, Luszcz, and Andrews, 2006; Dellinger et al., 2001; Edwards et al., 2008; Sims, Ahmed, Sawyer, and Allman, 2007).

Given that driving behaviour is sensitive to medical and functional impairments of the driver, poor driving ability has been identified as a factor for driving avoidance in difficult driving situations like driving in the rain and driving at night (Baldock, et al., 2006; De Raedt and Ponjaert-Kristoffersen, 2000; Rimmö and Hakamies-Blomqvist, 2002). However, those with poor driving ability would have greater difficulty with cautious types of compensatory driving because such drivers would be less capable of efficient self-regulation of their driving (De Raedt and Ponjaert-Kristoffersen, 2000). As an extension of this, some studies have shown that older drivers with a history of traffic accidents in the past few years reported more avoidance than those who had crash-free records (Ball et al., 1998; Charlton et al., 2006). Another study indicated no relationship between driving avoidance and accident history, and found more tactical types of compensation (i.e. cautious driving behaviour) in the accident-free drivers (De Raedt and Ponjaert-Kristoffersen, 2000).

Psychological Solutions to Safety of Older Drivers

Solutions to traffic safety can sometimes be classified into four “Es” of Education, Enforcement, Engineering, and Environment. Since the current study is focused on the Educational component of the four “Es”, we shall now look roughly into the studies on it, specifically educational programs, training, self-assessment, and testing and screening for older drivers.

Educational Programs

Educational programs have been developed by governmental organizations or semi-official organizations like the American Automobile Association (AAA refresher courses for older drivers) in many countries. They usually address topics through classroom instruction, such as age-related functional changes that impact driving, the characteristics of accidents in which the elderly are commonly involved, and new traffic laws. In Japan, older drivers aged 70 and over whose licenses are due for renewal have to attend the Older Driver Program. The program requires participants to operate a motor vehicle and undergo testing with aptitude test machines as well as lectures. Educational programs are popular and must be effective to some extent but there is little evidence that they show a safety benefit among people exposed to them (Eby, Molnar, and Vivoda, 2009; Janke, 1994). A more specific educational intervention, however, indicated the efficacy of it in promoting self-regulatory behaviours among older drivers who were visually-impaired and crash-involved (Owsley, Stalvey, and Phillips, 2003).

Training

Driver training with a driving instructor in the passenger seat is also popular in older-driver education. Taking a driving lesson with a driving instructor will help older drivers get immediate feedback regarding their driving behaviour and improve behaviours in routine situations (Christ, 1996). Although few studies have evaluated the effectiveness of on-road driving training for older drivers, a recent study demonstrated a statistically significant
improvement in driving performance among intervention participants relative to controls (Marottoli et al., 2007). Renge, Mukai, Ogawa and Ota (2009) also showed a positive effect of a driver training program in which participants watched videotaped scenes of their own driving and discussed with other participants and instructors.

Some medical training interventions, other than treatment of disease and injury, that enhance speed of processing or that improve balance may also be effective for the purpose of delaying or avoiding driving cessation (Ackerman et al., 2008; Edwards, Delahunt, and Mahncke, 2009).

Self-Assessment

The older driver can evaluate his or her driving skill, driving style, and fitness to drive in a private setting using a self-assessment tool. It is the driver who both administers and scores the test. Potential benefits of self-assessment compared to the other types of assessment are more willingness to engage in the test, ease of use, and getting feedback sooner (Eby, Molnar, Shope, Vovoda, and Fordyce, 2003). However, older drivers can only use a self-assessment if they are free of serious cognitive impairment.

A widely distributed self-assessment in the U.S. includes “Drivers 55 Plus: Check Your Own Performance”, created by the American Automobile Association (AAA) Foundation for Traffic Safety, and the “Driving Decisions Workbook” (Eby et al., 2003). For example, the AAA’s 16-page booklet is composed of three sections. The first section contains self-rating of 15 questions that inquire about driving behaviours and problems of vision and health, such as difficulty joining traffic on busy interstate highways. The second section is the rating guide to compute their score. Drivers are told the higher the score, the more dangerous they are to them-self and others. The third section consists of suggestions to improve each driving skill highlighted in the questionnaire.

Testing and Screening

Testing of older drivers includes off-road test batteries and on-road tests. Many studies suggest that the most promising off-road test battery that distinguishes accident prone individuals from their peers is a combination of vision, physical function, and cognitive capabilities tests (Department for Transport, 2001; McCarthy, Mann, and Langford, 2009). On-road tests are also validated and used for examining driving competence of older drivers in some countries (Brendemuhl, Schmidt, and Schenk, 1988; Di Stefano and Macdonald, 2003; Janke and Eberhard, 1998).

Testing is conducted for either education or screening. Educational testing affords older drivers the opportunity to test function and give them some feedback and advice. Testing for screening is conducted to detect problem drivers sensitively but it is not as specific as to accurately identify actual risky drivers. Those drivers detected by these screens are subjected to further tests, which are highly specific to identify more specifically risky drivers. However, a mandatory elderly driver screening is supported in few countries. One reason is the difficulty of defining levels of physical and mental ability for older drivers at which their driving should be stopped. A cognitive test detecting subjects with dementia like the Trail-Making Test (Stutts, Stewart, and Martell, 1998; Tarawneh, McCoy, Bishu, and Ballard, 1993), and the Clock Drawing Test (Freund, Gravenstein, Ferris, Burke, and Shaheen, 2005) and a vision test like the Useful Field of View Test (Ball and Owsley, 1991; Ball et al., 2006) are argued to be appropriate candidates of the screening tests.
As an alternative to screening, many countries and states distinguish older and younger drivers by shortening renewal intervals for drivers older than a specified age. For example, drivers 65 years and older in Maine are required to renew their driving licence every 4 years in place of 6 years. In Japan, renewal applicants aged 70 and older have to renew their driving licence every 3 years instead of every 3 or 5.

**Development of a Safe Driving Workbook for Older Drivers**

A brief summary of the process of developing a Safe Driving Workbook for Older Drivers (Matsuura, Ishida, and Mori, 2008) is provided here. From 2004 to 2007, a project team from the Japanese Association of Traffic Psychology (JATP) conducted a study of older drivers for assessing potential problems in driving and developing effective educational countermeasures that have the potential to reduce older-driver accidents. The project staff comprised six experts including the author who is a head of the project. Several surveys have been performed in the four years, not only for older drivers aged 70 and over but also for younger drivers. The older participants amounted to nearly 4,000 drivers in total who took part in the surveys in 60 driving schools at the time of the Older Driver Program. As mentioned above, Japanese older drivers (70 years and older) are required to attend a driving school and complete the program prior to renewing their driving licence.

The workbook was one of the main products of the project. The aim of the 10-page workbook included:

1. Let older drivers recognize their risky driving behaviours due to functional deficits.
2. Let them reflect on how they self-regulate their driving to compensate for their risk.
3. Let them self-determine three compensatory or adaptive driving behaviours that they will adopt to cope with their risky driving.

**Interview Survey with Older Drivers**

An interview survey was conducted in 10 driving schools for 296 older drivers who attended an Older Driver Program. The interviewers consisted of members of JATP working in the schools. They read an instruction manual in advance to self train by familiarizing themselves with the survey questionnaire. The interview was implemented face-to-face for about one hour for each older driver. The interviewer read the questionnaire verbatim, which asked older drivers about medical and functional deficits, their perceived influence on driving, and coping strategies used to overcome them. If a respondent did not answer a question fully, the interviewer used nondirective follow-up probes like repeating the question in different words and asking “Anything else?”. Answers were recorded without interpretation or editing, and were sent to the author by e-mail, where they were then classified into a number of items used to construct a risky driving scale and a compensatory driving scale (see Appendix for questions).
Preliminary Questionnaires and Pilot Tests

Based on the items generated in the interviews, the preliminary risky driving scale comprised 30 items describing typical risky driving behaviours due to medical/functional declines (e.g., I cannot drive for a long time) and the preliminary compensatory driving scale included 31 items describing typical self-regulatory driving behaviours (e.g., I avoid driving at night). Eight driving schools participated in the surveys utilizing older drivers (aged 70 or older from Older Driver Programs) and three schools participated using younger drivers (i.e. younger than 70 years of age representing a control). A large portion of the older participants \((N = 213)\) answered both preliminary risky driving and compensatory driving scales and a small number of them answered only the preliminary compensatory driving scale \((N = 79)\). Younger drivers from 18 to 68 years old completed either the preliminary risky driving scale \((N=264)\) or preliminary compensatory driving scale \((N = 305)\).

Item analysis, including the response rate of the items, the difference between older and younger drivers in the mean score of the items, and individual differences in the score of the items, led to the selection of 15 items from each of the risky driving and compensatory driving scales.

A preliminary version of the workbook with both risky driving and compensatory driving scales was pilot tested to assess their reliability and validity, and examine whether the workbook was perceived as useful by older drivers. Details of this stage will be provided later. Two further studies were conducted to improve the preliminary version of the workbook. The first study developed feedback information to increase self-awareness and knowledge for coping with eight typical risky driving behaviours and four compensatory actions that were selected from the items used in the above mentioned pilot test.

Table 1. The Content of the Safe Driving Workbook for Older Drivers

<table>
<thead>
<tr>
<th>Page</th>
<th>Theme</th>
</tr>
</thead>
</table>
| 1    | Introduction  
Purpose, How to proceed |
| 2,3  | Reflection of one’s own driving  
Risky driving scale, Compensatory driving scale |
| 4,5  | Evaluation and feedback of risky driving  
Self-evaluation of the degree of risky driving using the risky driving score and age of the respondent, Feedback information for the eight risky driving items |
| 6,7  | Evaluation and feedback of compensatory driving  
Self-evaluation of the degree of compensatory driving using the compensatory driving score and age of the respondent, Feedback information for the four compensatory driving items |
| 8,9  | Confirming driving change in these 5 or 6 years in terms of risky and compensatory driving |
| 10   | Summary and goals of participant’s driving |
The idea was that feedback would be provided for items where participants show more risky behaviours on the risky driving scale and which relate to poorer driving on the compensatory driving scale. Greater details on the selection of items for compensatory driving will be provided later. After the selection of the items for feedback information, the contents of the feedback or tips for safe driving were developed by project staff based on the comments of 106 driving instructors.

The next pilot study was a questionnaire study which was conducted to examine the usefulness and ease of each part of the workbook. The workbook was distributed to 231 older drivers aged 70 and over in 13 driving schools. It was also distributed to 56 driving school staff who were the instructors of the self-assessment of the workbook in the 13 driving schools. The instructors were asked to indicate where they had difficulty in explaining each part of the workbook and where the participants made mistakes in each part of the workbook. Their responses were used to improve the readability of the workbook. The final version of the workbook was completed in 2008 (Matsuura et al., 2008) and consists of a 10 pages B5 booklet and contains personal reflections, as well as evaluation and feedback on risky driving and compensatory driving (see Table 1 for summary of content).

The Present Study: Validity of Risky Driving and Compensatory Driving Scales

Preliminary interviews revealed that many older drivers suffer from functional decline and stressful driving environments, and that they self-regulate their driving by coping strategies prior to driving as well as cautious behaviours while they are driving. Risky driving items identified from the pilot questionnaires included erroneous driving behaviour because of inattention (e.g., failure to notice traffic sign), operational errors (e.g., improper handling), and poor vision. These became the basis for the current 15 risky driving items. Coping behaviours engaged prior to driving consisted of driving limitations and preparation for driving (e.g., fitness to drive, leaving in good time, planning routes, pre-driving checks). Overall, coping strategies engaged prior to driving were less common than more cautious styles. Cautious driving included speed controls, observing, concentrating on driving, keeping a safe distance, keeping a long distance in front, and complete stopping. These became the basis for the current 15 compensatory driving items.

The main purpose of this study was to assess the validity of both risky driving and compensatory driving scales used in the workbook. It was hypothesized that older drivers reporting more risky and compensatory driving would be comparatively older, fail to respond correctly to the questionnaire in the workbook, drive less frequently, show poor driving behaviour, and have had an accident in recent years. The analysis to select some items for feedback information was also conducted in the study in the present chapter.

Method

Participants in the study were older drivers (N = 3,132), age 70 and over, who attended one of 34 driving schools to take part in the Older Driver Program. Participants responded to
Older Drivers’ Risky and Compensatory Driving

the questionnaire either before or after the older driver program. Data on driving behaviour taken during the program was also used in this study.

The questionnaire, which was a part of the first version of a Safe Driving Workbook for Older Drivers, consisted of seven pages. Demographic variables (i.e., age and gender) and driving frequency (almost every day = 1, three or four days a week = 2, one or two days a week = 3, one or two days a month = 4, rarely = 5, not at all = 6), were examined on page 1. The risky driving and compensatory driving scales were presented on the next pages. For the risky driving scale, older drivers answered each of the 15 items of the risky driving scale on a 3-point scale; (1) seldom, (2) recently experienced, and (3) have been experiencing for 5 or 6 years. For the compensatory driving items, participants indicated how often they engage in each item (seldom do it = 1, recently did it = 2, have been doing it for 5 or 6 years = 3). A driving school staff member helped older drivers to reply to the questions by reading each of them slowly.

Accident and traffic violation histories were also examined by questioning whether respondents had experienced each of the five kind of accidents and traffic violations in the last three years, giving yes (= 1) or no (= 0) answers. Accident/violation risk score was calculated by summing the five accident and violation scores (from 0 to 15, with giving yes to ‘at-fault’ injury accident = 5, ‘at-fault’ damage-only accident = 4, ‘not-at-fault’ injury accident = 3, ‘not-at-fault’ damage-only accident = 2, traffic violation = 1).

Driving behaviour was measured by in-car observations during the Older Driver Program on a driving course at a driving school. An instructor assessed each participant’s driving skill and safety-oriented driving style using seven items: driving position and course, signalling, speed regulation, stopping at stop signs, observation, decisiveness, and riskiness. Each item consisted of a five-point rating scale, from 1 (very bad) through 3 (average) to 5 (very good). A driving behaviour score was calculated by adding the responses to the seven driving behaviour items (from 7 to 35).

RESULTS

Risky Driving

Table 2 shows the results of the response to each risky driving scale item. The proportion of older drivers who committed a risky action related to functional declines was about one third (31.2%). The percentage of the older drivers who did not reply to the questions was very small, less than one percent on average (0.7%) and 1.7% at most. Cronbach’s alpha was used to test the internal consistency and showed a high level of reliability (α = .798). Further analysis indicated that exclusion of item 5 increased the alpha level to .804.

To test criterion validity, comparisons were made with (1) driving performance on a driving test conducted at driving courses in driving schools, and (2) self-reported involvement of traffic accident and violation in the last three years. Data was analysed for older driver participants who answered 13 or more items on both the risky driving and compensatory driving scales, which comprised 98.8% (N = 3,093) of all participants. A multiple regression analysis was performed to identify the variables that predict risky driving.
Table 2. Distribution of Answers to the 15-item Risky Driving Scale

<table>
<thead>
<tr>
<th>Question (items of risky driving)</th>
<th>(1) seldom</th>
<th>(2) recently experienced</th>
<th>(3) have been experiencing for 5 or 6 years</th>
<th>Non response</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel my eyesight has weakened.</td>
<td>39.7</td>
<td>50.4</td>
<td>9.7</td>
<td>0.1</td>
</tr>
<tr>
<td>Friends or relatives say my driving frightens them.</td>
<td>87.8</td>
<td>9.6</td>
<td>1.9</td>
<td>0.7</td>
</tr>
<tr>
<td>I find it difficult to back a car.</td>
<td>62.2</td>
<td>31.3</td>
<td>5.7</td>
<td>0.8</td>
</tr>
<tr>
<td>Response speed became slower.</td>
<td>54.5</td>
<td>42.0</td>
<td>2.7</td>
<td>0.8</td>
</tr>
<tr>
<td>I go to hospital more than once a week.</td>
<td>79.4</td>
<td>13.2</td>
<td>5.7</td>
<td>1.7</td>
</tr>
<tr>
<td>My control of a car became awkward.</td>
<td>77.2</td>
<td>20.7</td>
<td>1.6</td>
<td>0.6</td>
</tr>
<tr>
<td>I feel my visual field has decreased.</td>
<td>60.3</td>
<td>36.7</td>
<td>2.5</td>
<td>0.5</td>
</tr>
<tr>
<td>I failed to judge the speed of an oncoming vehicle.</td>
<td>86.5</td>
<td>11.7</td>
<td>0.8</td>
<td>1.0</td>
</tr>
<tr>
<td>I scraped the side of my car on a narrow road.</td>
<td>88.6</td>
<td>9.3</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Dazzling headlights bother me more than they used to.</td>
<td>50.2</td>
<td>45.3</td>
<td>3.9</td>
<td>0.7</td>
</tr>
<tr>
<td>Judgment and car control errors have increased.</td>
<td>83.0</td>
<td>15.6</td>
<td>0.8</td>
<td>0.6</td>
</tr>
<tr>
<td>I have become more forgetful.</td>
<td>38.2</td>
<td>56.7</td>
<td>4.7</td>
<td>0.4</td>
</tr>
<tr>
<td>I am reluctant to drive a car.</td>
<td>84.2</td>
<td>13.9</td>
<td>1.3</td>
<td>0.6</td>
</tr>
<tr>
<td>I feel difficulty driving at the same speed as other traffic.</td>
<td>70.6</td>
<td>26.6</td>
<td>2.3</td>
<td>0.5</td>
</tr>
<tr>
<td>I find it difficult to drive for a long time.</td>
<td>58.7</td>
<td>36.8</td>
<td>4.0</td>
<td>0.6</td>
</tr>
<tr>
<td>Total</td>
<td>68.1</td>
<td>28.0</td>
<td>3.2</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Explanatory variables included gender, age, correct answers to counting and recording the number of checked circles that indicate the risky and compensatory scores (from 0 to 4), driving frequency (from 1 to 6), as well as driving behaviour score (from 7 to 35) and the accident/violation risk score (0 to 15). Correlations between the six explanatory variables were relatively small, from \( r = -0.15 \) to \( r = 0.06 \), indicating no multicollinearity. The dependent variable was a mean score of the 15 risky driving items. Table 3 lists the mean and standard deviation of each variable used in the multiple-regression analysis, along with the results of the analysis. All of the variables except gender explained risky driving scores significantly. This means that older drivers, drivers who are more inattentive or cognitively impaired, drivers who drive less frequently, drivers whose driving behaviour is poorly evaluated, and drivers with more accidents and/or violations were more likely to exhibit risky driving.
Table 3. Descriptive Statistics of Variables Used in Multiple Regression Analysis Predicting Risky Driving

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Max.</th>
<th>Min.</th>
<th>Mean</th>
<th>SD</th>
<th>β</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risky driving score</td>
<td>3091</td>
<td>1</td>
<td>2.8</td>
<td>1.35</td>
<td>0.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explanatory variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>3091</td>
<td>0</td>
<td>1</td>
<td>0.14</td>
<td>0.35</td>
<td>-.00</td>
<td>-.00</td>
</tr>
<tr>
<td>Age</td>
<td>3085</td>
<td>69</td>
<td>93</td>
<td>74.44</td>
<td>4.17</td>
<td>.07**</td>
<td>.09***</td>
</tr>
<tr>
<td>Correct answers</td>
<td>3093</td>
<td>0</td>
<td>4</td>
<td>3.94</td>
<td>0.32</td>
<td>-.07***</td>
<td>-.06***</td>
</tr>
<tr>
<td>Driving frequency</td>
<td>3083</td>
<td>1</td>
<td>6</td>
<td>1.55</td>
<td>0.92</td>
<td>.18***</td>
<td>.19***</td>
</tr>
<tr>
<td>Driving behaviour</td>
<td>2854</td>
<td>7</td>
<td>35</td>
<td>18.82</td>
<td>3.90</td>
<td>-.05***</td>
<td>-.08***</td>
</tr>
<tr>
<td>Accident/violation risk</td>
<td>3042</td>
<td>0</td>
<td>15</td>
<td>1.09</td>
<td>2.21</td>
<td>.11***</td>
<td>.10***</td>
</tr>
</tbody>
</table>

Note: $R^2 = .06**$; $F = 0.48***$

Another analysis was conducted to illustrate the relationship between risky driving and accident history. Figure 1 shows the percentages of accident involved drivers, irrespective of responsibility, for both injury and damage-only accidents across three groups stratified by low, medium, and high risky driving scores. Clearly, drivers with higher risky driving scores were more likely to experience both injury and damage-only accidents in the last three years. Tests of association across a $2 \times 3$ table of accident involvement (involved, not involved) against risky driving score (low, medium, high scores) indicated that associations between the two factors were almost significant (Gamma = -.105, $p < .1$ for injury accident and Gamma = -.192, $p < .01$ for damage-only accident).

Figure 1. Percent of drivers involved in injury and damage-only accidents for a group of drivers with low (from 1 to 1.25, $n = 1,193$), medium (from 1.25 to 1.5, $n = 1,206$), and high (from 1.5 to 3, $n = 692$) risky driving scores.
Compensatory Driving

Responses to each of the 15 items are shown in Table 4. The percentage of older drivers who engaged in self-regulatory driving was higher (71.8% on average) than those who engage in risky driving (31.2% on average). Almost all older drivers answered each question, where the “non response” rate was less than one percent (M = 0.5%). Internal consistency measured by Cronbach’s alpha showed high reliability (α = .878).

The items in Table 4 can be classified into two types of compensatory driving: coping strategies before driving, including driving avoidance and preparation, and cautious driving strategy while driving, including concentration, yielding, and speed control. An analysis was conducted to determine which strategy older drivers adopt more at 5 or 6 years ago and now. Repeated measures analysis of variance revealed a significant main effect of Time, $F(1, 3092) = 9162.02, p < .001, \eta^2 = .56$, and Compensatory strategy, $F(1, 3092) = 1160.83, p < .001, \eta^2 = .05$, and a significant Time $\times$ Compensatory strategy interaction, $F(1,3092) = 38.81, p < .001, \eta^2 = .00$. The $\eta^2$ values indicate that the effect size is large for Time, medium for Compensatory driving, and very small for the interaction, meaning that many older drivers have adopted compensatory driving recently and that cautious driving strategy while driving is more adopted than coping strategy before driving (See Figure 2).

Table 4. Distribution of Answers to the 15- Item Compensatory Driving Scale

<table>
<thead>
<tr>
<th>Question (items of compensatory driving)</th>
<th>(1) seldom do it</th>
<th>(2) recently did it</th>
<th>(3) have been doing it for 5 or 6 years</th>
<th>Non response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan a drive with additional time P</td>
<td>31.3</td>
<td>42.2</td>
<td>26.1</td>
<td>0.4</td>
</tr>
<tr>
<td>Drive in good health conditions P</td>
<td>38.4</td>
<td>40.9</td>
<td>20.0</td>
<td>0.7</td>
</tr>
<tr>
<td>Make pre-driving checks P</td>
<td>41.7</td>
<td>34.3</td>
<td>23.2</td>
<td>0.7</td>
</tr>
<tr>
<td>Avoid driving at night A</td>
<td>31.4</td>
<td>47.4</td>
<td>20.5</td>
<td>0.8</td>
</tr>
<tr>
<td>Avoid long distance driving A</td>
<td>28.3</td>
<td>50.4</td>
<td>20.7</td>
<td>0.6</td>
</tr>
<tr>
<td>Avoid driving in the rain A</td>
<td>47.0</td>
<td>38.6</td>
<td>13.9</td>
<td>0.5</td>
</tr>
<tr>
<td>Drive more slowly than previously S</td>
<td>16.1</td>
<td>59.7</td>
<td>23.8</td>
<td>0.4</td>
</tr>
<tr>
<td>Obey the speed limit S</td>
<td>15.8</td>
<td>46.6</td>
<td>36.9</td>
<td>0.6</td>
</tr>
<tr>
<td>Pull to the side of the roads to allow a vehicle behind to pass Y</td>
<td>35.0</td>
<td>43.3</td>
<td>21.1</td>
<td>0.6</td>
</tr>
<tr>
<td>Stop to wait for oncoming vehicle on single narrow track roads Y</td>
<td>19.4</td>
<td>49.9</td>
<td>30.4</td>
<td>0.3</td>
</tr>
<tr>
<td>Keep a safe distance from unpredictable cars and bicycles Y</td>
<td>10.9</td>
<td>50.3</td>
<td>38.3</td>
<td>0.5</td>
</tr>
<tr>
<td>Not look at objects or scenery that are not part of the driving task C</td>
<td>16.0</td>
<td>43.6</td>
<td>40.0</td>
<td>0.4</td>
</tr>
<tr>
<td>Drive without listening to the radio or music C</td>
<td>39.0</td>
<td>30.5</td>
<td>29.9</td>
<td>0.6</td>
</tr>
<tr>
<td>Not think about something not related to driving C</td>
<td>26.0</td>
<td>43.2</td>
<td>30.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Not get irritated or hurry while driving C</td>
<td>19.6</td>
<td>43.4</td>
<td>36.6</td>
<td>0.3</td>
</tr>
<tr>
<td>Total</td>
<td>27.7</td>
<td>44.3</td>
<td>27.4</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Note. P = Preparation; A = Avoidance; S = Speed control; Y = Yielding; C = Concentration.
Criterion validity was examined to ascertain whether the compensatory driving scale measures the content that should be measured. Multiple regression analysis was conducted, where the dependent variable was the mean compensatory driving score (which ranged from 1 to 3). Explanatory variables consisted of risky driving scores as well as the same variables used for the analysis of risky driving. Table 5 presents the result of the regression analysis. All of the explanatory variables except correct answers and accident/violation risk explained compensatory driving significantly. This means that female drivers, older drivers, drivers with higher (i.e. riskier) self-evaluation scores of risky driving, drivers who drive less frequently, and drivers with more positively evaluated driving behaviour were more likely to exhibit compensatory driving. Self-regulatory drivers tended to drive better and not necessarily show accident/violation risk, while they self-reported more risky driving.

Table 5. Multiple Regression Analysis Predicting Compensatory Driving

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>$\beta$</th>
<th>$r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>.05*</td>
<td>.04*</td>
</tr>
<tr>
<td>Age</td>
<td>.08***</td>
<td>.08***</td>
</tr>
<tr>
<td>Correct answers</td>
<td>.01</td>
<td>.01</td>
</tr>
<tr>
<td>Risky driving</td>
<td>.10***</td>
<td>.12***</td>
</tr>
<tr>
<td>Driving frequency</td>
<td>.10***</td>
<td>.13***</td>
</tr>
<tr>
<td>Driving behaviour</td>
<td>.04*</td>
<td>.02</td>
</tr>
<tr>
<td>Accident/violation risk</td>
<td>-.03</td>
<td>-.02</td>
</tr>
</tbody>
</table>

Note. $R^2 = .03***; F = 14.12***

*p < .05. ***p < .001.
Although total accident/violation scores did not explain the level of compensatory driving of older drivers, compensatory driving is expected to increase after experiencing an accident and after committing a traffic violation. Table 6 shows the result of each effect of these specific events on increased compensatory driving. Drivers who were responsible for an accident that had occurred in the last three years significantly increased their compensatory driving compared to those free of that type of accident. However, there was no more increase in compensation for drivers who were involved in a non-responsible accident as for drivers who were ticketed.

Table 6. Compensatory Driving Recently Done Among Those Who Experienced Accidents/Violations and Those Who Did Not

<table>
<thead>
<tr>
<th>Experience</th>
<th>Injury accident</th>
<th>Property accident</th>
<th>Violation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Responsible</td>
<td>Less responsible</td>
<td>Responsible</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>7.06</td>
<td>6.64</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.55</td>
<td>3.77</td>
</tr>
<tr>
<td></td>
<td>(n = 423)</td>
<td>(n = 365)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td>6.61</td>
<td>6.67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.95</td>
<td>3.92</td>
</tr>
<tr>
<td></td>
<td>(n = 2,642)</td>
<td>(n = 2,687)</td>
<td></td>
</tr>
<tr>
<td>t-test</td>
<td>p &lt; .05</td>
<td>n.s</td>
<td>p &lt; .05</td>
</tr>
<tr>
<td>Cohen’s d</td>
<td>0.12</td>
<td>-0.01</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Table 7. Spearman Rank-Order Correlation Coefficients Between Two Types of Compensatory Driving Items and Explanatory Variables

<table>
<thead>
<tr>
<th>Type of compensatory</th>
<th>Gender</th>
<th>Age</th>
<th>Driving frequency</th>
<th>Risky driving score</th>
<th>Driving behaviour</th>
<th>Accident/violation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(N = 3,091)</td>
<td>(N = 3,086)</td>
<td>(N = 3,083)</td>
<td>(N = 3,091)</td>
<td>(N = 2,854)</td>
<td>(N = 3,042)</td>
</tr>
<tr>
<td>Before driving (6 items)</td>
<td>.02</td>
<td>.09***</td>
<td>.14***</td>
<td>.22***</td>
<td>-.01</td>
<td>-.00</td>
</tr>
<tr>
<td>While driving (9 items)</td>
<td>.06**</td>
<td>.10***</td>
<td>.10***</td>
<td>.08***</td>
<td>-.02</td>
<td>-.03</td>
</tr>
</tbody>
</table>

Note. **p < .01. ***p < .001.

Predictive power of the explanatory variables of compensatory driving may differ according to the type of compensation. Thus, correlations between the two types of compensatory driving and some explanatory variables in Table 5 were examined. Table 7
shows that driving frequency and risky driving scores were more related to compensatory strategy before driving than that while driving, and that females tended to exhibit compensatory driving only while driving.

### Selection of Feedback Items

It is likely that feedback for promoting self-regulatory driving is appropriate for older drivers with low or medium score on the compensatory driving scale, perhaps because they have “room” to adopt such adaptive driving in their daily driving routines to improve their safety. The question is how to provide feedback to a group of older drivers who have already begun high levels of compensatory driving, especially those with higher accident risk in spite of current compensations. A good place to start is to find out the compensatory driving items that are related to unsafe drivers (i.e., those of older age, with lower driving frequency, higher self-reported risky driving score, poor driving ability, and history of involvement in accident and/or violation). The correlations between each score for the 15 compensatory driving items and the five above-mentioned criteria of unsafe drivers were calculated (see Table 8 for rank-order correlation coefficients). It was decided that feedback would be developed for the five compensatory driving items with the strongest relationship to the unsafe driving criteria. Drivers who currently engage in compensation using these five items would be recommended to read each feedback comment in the workbook.

### Table 8. Rank-order Correlation Coefficients Between Compensatory Driving Items for Feedback and Criteria Variables of Unsafe Drivers

<table>
<thead>
<tr>
<th>Compensatory driving item</th>
<th>Age</th>
<th>Driving Frequency</th>
<th>Risky Driving Score</th>
<th>Driving Behaviour</th>
<th>Accident/ Violation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid driving at night</td>
<td>.11***</td>
<td>.17***</td>
<td>.21***</td>
<td>-.02</td>
<td>-.02</td>
</tr>
<tr>
<td>Avoid long distance driving</td>
<td>.09***</td>
<td>.11***</td>
<td>.23***</td>
<td>-.04*</td>
<td>-.01</td>
</tr>
<tr>
<td>Avoid driving in the rain</td>
<td>.10***</td>
<td>.18***</td>
<td>.20***</td>
<td>-.05**</td>
<td>-.00</td>
</tr>
<tr>
<td>Pull to the side of the roads to allow a vehicle ...</td>
<td>.06***</td>
<td>.06***</td>
<td>.09**</td>
<td>-.02</td>
<td>.00</td>
</tr>
<tr>
<td>Drive without listening to the radio or music</td>
<td>.14***</td>
<td>.06***</td>
<td>.04*</td>
<td>-.05**</td>
<td>-.02</td>
</tr>
<tr>
<td>Total (15 items)</td>
<td>.06***</td>
<td>.13***</td>
<td>.10***</td>
<td>.00</td>
<td>-.02</td>
</tr>
</tbody>
</table>

*Note. Five items were selected from the 15 items of compensatory driving because of their significant correlations between more than two criteria variables.*

*p < .05. **p < .01. ***p < .001.*
DISCUSSION

Both risky and compensatory driving scales of older drivers were self-assessed in the workbook. The risky driving scale was developed using older drivers’ self-reported experiences on the road that surprised them, distracted them, caused anxiety, gave them stress, and bothered them while driving, which fundamentally stemmed from their aging. The compensatory driving scale was defined as driving behaviour used to cope with the above-mentioned risky driving, which included driving avoidance in difficult conditions and cautious driving which compensates for such risky driving behaviour. One main purpose of the study in this chapter was to examine how well responses on these two scales correlated with observed driving performance on a course in driving schools, accident and violation history in the last three years, as well as gender, age, and cognitive ability measured by counting and recording errors, and driving frequency. If some positive correlations were found between risky driving score and the explanatory variables like accident/violation scores, for example, the risky driving scale would be valid as a psychological driving test. And practically, feedback information such as “Drivers who experience specific risky driving behaviours are more dangerous than the others” should be useful.

Self Reported Risky Driving of Older Drivers

In order to select the 15 items of the risky driving scale, mean score differences between older (70 +) and younger groups (under 70) were examined. The result of our preliminary research showed that, overall, older drivers were less likely to self-assess their driving as risky compared to younger drivers in spite of their poorer driving performance. Their incorrect and unrealistic self-evaluation, which may account for their general overestimation of driving ability (e.g., Marottoli and Richardson, 1998; Ota et al., 2004), is what they should recognize through driver education. While a number of items were excluded due to the lower scores for older drivers, the preliminary risky driving scale was improved for use with older drivers by selecting those items of greater risk for this age group.

Multiple regression analysis revealed a significant relationship between risky driving scores and several explanatory variables. Drivers whose driving behaviour was poorly evaluated on the road, drivers with more accident/violation history, older drivers, drivers who are more inattentive, and drivers who drive less frequently were independently more likely to exhibit self-reported risky driving. Because these drivers are considered to be risky, a higher risky driving score of a driver tells that he/she is certainly a risky driver. In other words, the risky driving scale has validity and is suitable for self-assessment instrument when evaluating older drivers’ risky driving due to aging.

An important limitation of this scale is that older drivers may not respond correctly to it as shown in the contrary difference between older and younger group. Older people may be more sensitive to their declining driving ability and be reluctant to report their risk, or they simply might not know that they are a poor driver owing to gradual degradation of skills. This limitation will most apply to problem older drivers to whom this kind of self-assessment is most needed.
Self-Reported Compensatory Driving of Older Drivers

A large number of studies have defined compensatory or self-regulatory driving as driving avoidance (or limitations) of potentially challenging driving situation such as night and high-traffic roads and some studies have added cautious behaviour, including selecting driving tasks below their capacity in risky driving conditions.

Based upon our previous research on factor analysis of 30 compensatory driving items, the compensatory driving scale consisted of five subtypes of compensatory driving: driving avoidance, preparation, concentration, yielding, and speed control. In relation to the hierarchical classification of driving model (Christ, 1996; DeRaedt and Kristoffersen, 2000; Schlag et al., 1996), driving avoidance and preparation would be considered forms of “strategic” compensation and the remaining three subtypes would be considered “tactical” compensation. With respect to the SOC model, driving avoidance would correspond to “Selection” and the remaining subtypes to “Compensation” (see DeRaedt and Ponjaert-Kristoffersen, 2000). Otherwise, preparation such as ‘Plan a drive with additional time’ and ‘Drive in good health conditions’ may be included in “Optimization”, although better examples would be the use of cars with safety equipment designed for active safety like Anti-lock brake system (ABS), adaptive cruise control (ACC), and night view, and for passive safety like seatbelts, airbags, and active headrests.

This study indicated that classification into strategic compensation, or compensation before driving, and tactical compensation, or compensation while driving, makes sense because it became clear that cautious driving strategies while driving were more often adopted than coping strategy before driving. It was also found that self-reported risky drivers were more likely to conduct strategic compensation compared to tactical compensation.

The percentages of older Japanese subjects who reported avoidance ‘at night’ and ‘in the rain’ on the scale ‘have been doing it for 5 or 6 years’ or ‘recently did it’ were 68% and 53%. These percentages were lower than US older drivers (Ball et al., 1998) but higher than older drivers in Australia and Sweden (Baldoc et al., 2006; Charlton et al., 2006; Rimmö and Hakamies-Blomqvist, 2002). Despite some differences, these types of avoidance seem to be common among older drivers universally.

In terms of who compensates, multiple regression analysis used to predict compensatory driving score revealed that older drivers, female drivers, drivers who drive less frequently, drivers with more positively evaluated driving behaviour on the road, and drivers with higher self-evaluation scores of risky driving were more likely to exhibit compensatory driving. The results that the oldest of these drivers tended to adopt more compensation were consistent with many past studies (Charlton et al., 2006; Rimmö and Hakamies-Blomqvist, 2002). Gender effect that females tended to exhibit compensatory driving more than males was also in agreement with previous studies (Charlton, et al., 2006; Kostyniuk and Molnar, 2008; Rimmö and Hakamies-Blomqvist, 2002), which defined compensation as avoidance. However, our results indicated that gender had a significant effect on tactical compensation while driving but did not on strategic compensation, like driving avoidance. The latter result is consistent with the finding that females do not avoid difficult situations (Dellinger, et al, 2001; Ross et al., 2009). Whether females are more likely to exhibit avoidance strategy is still unclear. Since driving fewer days per week is a part of driving avoidance, it is understandable that drivers who drive less frequently exhibited higher compensatory driving score.
The findings that good driving behaviour evaluated by in-car observation as well as higher risky driving score predicted compensatory driving score may be seen as contradictory. Certainly, the congruence between self-reported risky driving and compensatory driving is in agreement with prior studies, which have shown a positive relationship between poor driving and driving avoidance (Baldock et al., 2006; De Raedt and Ponjaert-Kristoffersen, 2000; Rimmö and Hakamies-Blomqvist, 2002). However, on the other hand, the unexpected positive association between good driving behaviour in actual driving evaluations and higher compensatory driving scores can be explained by the driving situation in which the driving behaviour was evaluated. In the present study, an in-car observer assessed driving behaviour on a simulated road in driving schools. Although other trainees were on the simulated road, the road was usually not as “busy” and driving situations were not as “difficult” compared to open road situations. In these easy situations, cautious drivers with higher compensatory driving score might have exhibited even better driving behaviour, which may not be true in more difficult driving conditions as shown in De Raedt and Ponjaert-Kristoffersen (2000).

Some studies have shown that older drivers with a recent history of traffic accidents reported more avoidance than those who had crash-free records (Ball et al., 1998; Charlton et al., 2006). Although drivers with higher accident/violation history did not show more compensatory driving in the regression analysis, comparisons that included accident responsibility were more consistent with previous findings. Specifically, drivers involved in at fault accidents over the past three years showed greater compensatory driving than those who did not. Interestingly, there was no more increase in compensation for drivers who were involved in not at-fault accidents and those who were ticketed for traffic offences. Hence, it appears that only the at-fault accident makes older drivers aware of their poor driving ability and increase their compensatory driving.

**Effects and Limitations of Compensatory Driving**

Compensatory driving appears to be an effective driving strategy for many older drivers. However, the outcomes of compensatory driving differ based on the extent to which older drivers maintain their driving ability. For those whose abilities have not declined as much, self-regulation would enable them to remain active as drivers. However, for those with greater decline due to more serious physical or cognitive abilities, compensatory driving may not be sufficient to prevent accidents (Ross et al., 2009). In such instances, they must be informed about the necessity to stop driving (Christ, 1996) and given education about driving cessation.

Our study suggests that some compensatory behaviours are particularly related to poorer driving among older drivers. It is likely that these drivers perform this type of compensatory driving, not because they were recommended to adopt it as a precaution, but because they cannot help doing so for their safety. Thus, with respect to the current workbook, they are advised to read feedback comments specific to each action, which presents additional information and more specific compensatory strategies.
Significance and Limitations of the Study and Workbook

The workbook was developed for older drivers to determine whether their risky driving is increasing due to aging and if they exhibit compensatory action corresponding to their increased risky driving. It is evident that respondents can benefit from information on their levels of both risky and compensatory driving in their age group (i.e. age 69-72, 73-76, 79+); for example, the higher the self-reported risky driving score, the greater the danger for the driver. Six feedback suggestions were prepared for older drivers who self-reported that they committed each of the corresponding six most risky driving behaviours. For compensatory driving scores, those who reported some compensatory driving relating to poor driving were warned and given feedback information, which should benefit future driving. Another positive point of the workbook is that older drivers can recognize their change in driving behaviours by comparing 5 or 6 years ago with current behaviour for risky and compensatory driving, possibly leading to positive change.

Several limitations also should be kept in mind when interpreting the results of this study and when using the workbook. We have already pointed out that, generally, older drivers tended to underreport their risky driving. Another important limitation is that individuals can only complete the workbook if they are free of serious cognitive impairment. Older drivers over 70 years of age who need assessment like that found in this workbook are most likely to suffer from this type impairment. However, one of the means to find the signs of impairment is to examine whether the respondents correctly counted and recorded the numbers of checked circles on another page where their risky and compensatory scores are evaluated. Finally, the workbook may be difficult to complete alone. In such cases, an instructor can help older respondents to fill in the workbook when it is conducted in a classroom.

APPENDIX

Interview Survey Questions

Q1. “Is there something wrong with you?”, “When do you feel that you become old?”, and “What has changed in your health since you were middle age?”

Q2. “Tell me your recent experiences while driving that surprised you?” and “Tell me what errors have you recently made while driving?”

Q3. “Tell me what distracts, causes anxiety for, gives you stress, and bothers you while driving?”

Q4. “You have suffered from a few troubles while living or driving. How have you coped with your functional decline and stressful driving environments?” and “Tell me what you pay attention to on the road and your safe driving practices.”
REFERENCES


Older Drivers’ Risky and Compensatory Driving


Tsuneo Matsuura


**NOTE**

This research was supported in part by a grant from the General Insurance Association of Japan. We thank Professor Toshiro Ishida (Waseda University), Mr. Nobuaki Mori (Fuji Kougeisha Company), Mr. Junya Ishikawa (Chuo Driving School), Professor Yukiko Kakimoto (Jissen Women’s University), and Professor Masabumi Tokoro (Kokushikan University) for their cooperation in conducting the study.