Examination of Winter Driving using In-vehicle Devices and the Perceptions of Older Drivers

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Introduction: Although several studies have examined self-regulatory practices in older drivers, most have relied on self-report. Blanchard (2008) was the first to examine actual driving patterns more objectively (using in-vehicle devices), and the associations between driver perceptions and self-regulatory practices. However, her sample of older drivers living in Southwestern Ontario was only monitored for one week between June and October. Winter conditions in northern climates appear to influence the driving patterns of older adults, however the only evidence to date is based on self-report (e.g., Sabback & Mann, 2005).

Purposes: The aims of the thesis were to: 1) replicate Blanchard's findings on the associations between driver perceptions and self-regulatory practices in older drivers; and 2) extend this investigation by examining driving over a longer monitoring period in the winter.

Methods: A convenience sample of 47 drivers aged 65 to 91 (49% female) from Southwestern Ontario was monitored for two consecutive weeks between late November and March. Driving data was collected using two electronic devices (one with GPS), which were installed at the first of two home visits. Information on weather and road conditions was collected from archives and descriptions in participant trip logs. Participants completed questionnaires concerning background and usual driving habits. Driver perceptions were assessed using the Driving Comfort (DCS) and Perceived Driving Abilities (PDA) scales, while self-reported usual practices were examined using the Situational Driving Frequency (SDF) and Avoidance (SDA) scales. Functional driving-related abilities were assessed using the AAA/CAA's Roadwise Review and interviews were conducted at the second home visit, at which point devices were removed and trip logs collected.

Results: Driver perceptions (particularly night comfort) were significantly related to multiple indictors of driving (distance, duration, radius from home and night driving) in the expected directions. Men had higher comfort scores and better perceptions of their driving abilities and concurrently drove more often, greater distances and further from home. Participants drove on average five days a week over the winter monitoring period. Over half the 94-day monitoring period had inclement weather, while 67% of the period had poor road conditions. Nonetheless, all 46 participants drove at least once in bad weather and 73% did so in darkness. Distance driven at night varied by month of participation, with people driving more at night during December (average 50 km), compared to March (average of only 13 km). Those with lower daytime comfort scores (>50%) scores drove less on days with inclement weather (p=.03). The sample was also more likely to make social trips on clear days (p=.002) and out-of-town trips on days with good road conditions (p=.02).

Conclusions: The study replicated Blanchard's (2008) findings that driver perceptions are strongly associated with actual behaviour, regardless of the season. And both studies indicate that older drivers may not self-regulate as much as they say they do on avoidance questionnaires. Driving was fairly consistent over the two weeks, except for radius and night distance and the additional week of monitoring was more likely to capture night driving. Nonetheless, the present study provides only a snapshot of behaviour and findings should not be generalized beyond urban dwelling, well-educated, healthy and active older drivers from one part of Canada. Further studies, with larger more diverse samples (living in different regions) and longer monitoring periods, are required to advance our knowledge of self-regulatory practices in older drivers and related decision-making processes.

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Aileen Trang
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Chapter 1– Introduction and Overview

Driving has become intertwined with contemporary lifestyle and independence. Driving is the preferred mode of transportation in North America and allows seniors to stay connected to the community, maintain social ties, and access services (e.g., Burkhardt, Berger & McGavock, 1996; Dickerson et al., 2007). A valid license, together with access to a household vehicle, increases the probability that older Canadians will leave their home on a given day and engage in community activities (Turcotte, 2006). Conversely, driving cessation has been associated with increased depression (Fonda, Wallace & Herzog, 2001; Marotolli et al., 1997), reduced out-of-home activity (Marotolli et al., 2000), and other negative consequences such as loss of identity, self-worth and loneliness (Eby & Molnar, 2009; Johnson, 1999). Not surprisingly, many older drivers are reluctant to cease driving and those that do often regret this decision (e.g., Johnson, 1999; Rudman, Friedland, Chipman & Sciortino, 2006).

The older driver population, which is rapidly increasing, is disproportionately involved in serious collisions. Concerns for public safety, however, must be balanced against the costs of population level screening and the impact on senior mobility. Regulating older drivers via age-based licensing policies is highly controversial; there are no accepted standards (i.e., policies vary widely between and within countries), and with the exception of in-person renewal, such policies have not been shown to be highly effective in reducing fatal crashes (e.g., Grabowski, Campbell & Morrisey, 2004; Landford and Koppel, 2006). It has also been argued that many older drivers are capable of regulating their own behaviour (e.g., Eberhard, 1996), and research supports the premise that many drivers do in fact change their driving practices as they age. However, judging by the collision statistics, clearly not all older drivers adapt their driving appropriately or effectively. As described in the second section, there are a growing number of studies, some of which have been conducted at the University of Waterloo, investigating factors that may influence driver decisions to self-regulate or restrict their driving behaviour. While further detail is presented in Chapter Two, an overview of this research is provided in this chapter, together with the rationale for the present study.

1.1 Statement of the Problem

1.1.1 Growing Number of Older Drivers

Older drivers are the fastest growing segment of licensed drivers in North America, particularly among women (Burkhardt & McGavock, 1999; Hopkins, Kilik, Day, Rows & Tseng, 2004; Lyman, Ferguson, Braver & Williams, 2002). In Ontario alone, the number of older drivers (65+) is projected to increase to 2.5 million by the year 2028 (Hopkins et al., 2004). Changes in the driving population mirror demographic patterns in general, influenced by the aging of baby boomers in both Canada and the United States (Dobbs, 2008). In response to urban development and more active lifestyles, future cohorts of older drivers are expected to hold licenses longer, travel further and take more trips than today's older drivers (Burkhardt & McGavok, 1999; Dobbs, 2008; Lyman et al., 2002). Until public transportation options substantially improve (Dickerson et al., 2007), seniors will continue to drive as long as possible to maintain their mobility and lifestyle. The concern is that age-related declines in abilities, together with the development of medical conditions, can compromise safe driving.

1.1.2 Age-related Declines in Driving Capabilities

Driving is a complex task, involving the interplay of physical, sensory and mental functions. Age-related declines in any one of these areas can affect driving performance. For example, reduced neck flexibility makes it difficult for older drivers to appropriately check blind spots (Stelmach & Nahom, 1992). Slower reaction time and lower body fragility, meanwhile, can hinder braking and accelerating (Dickerson et al., 2007).

Declines in vision and processing speed are especially germane to driving safety (Owsley, Stalvey, Wells & Sloane, 1999; Satariano, MacLeod, Cohn & Ragland, 2004). Visual attention plays a critical role in scanning the driving environment and discriminating relevant stimuli (Richardson & Marottoli, 2003), and vision problems can exacerbate the hazards of driving at night (Owens, Wood & Owens, 2007) or when it is raining or snowing (Eisenberg & Warner, 2005). While declines in some areas (e.g., information processing or reaction speed) may be less noticeable to drivers themselves, vision-related difficulties-- focusing, reading signs, judging distances or dealing with glare from sun and lights-- have been reported by older adults as primary reasons for driving reduction and cessation (e.g., Satariano et al., 2004).

Although the elevated crash risk of older drivers has been challenged as noted below, there is general agreement that older people involved in crashes are more likely to sustain serious injuries and death (Eby & Molnar, 2009; Dickerson et al., 2007; Dobbs, 2008). By 2025, Staplin, Lococo, Gish and Decina (2003) predict that more that 40% of all fatal crashes may be due to age-related frailties, particularly due to visual and cognitive impairments. It is now believed that the increased prevalence of functional deficits (resulting from certain medical conditions and associated treatments) rather than age per se, is responsible for the alarming rate of collisions, injuries and fatalities in older drivers (Chaparro, Wood & Carberry, 2005; Dickerson et al., 2007; Eby & Molnar, 2009). Thus, the focus should be determining the functional capabilities (fitness-to-drive) of medically-at-risk drivers *of any age* who come to the attention of physicians or licensing authorities (e.g., Dobbs, 2008; Dickerson et al., 2007).

1.1.3 Collisions and Fatalities

Comparatively, older drivers are involved in a small fraction of collisions. However, when statistics are adjusted for exposure (per mile driven), age becomes a factor. The risk of collisions, as well as serious injuries and death, increases beginning around age 70 and escalates thereafter (Bédard, Stones, Guyatt & Hirdes, 2001; Dickerson et al., 2007; Lyman et al., 2002; Eby & Molnar, 2009; Zhang, Linsay, Clark, Robbins & Mao, 2000). In Ontario, drivers age 80 and older have the second highest rate of fatalities after the youngest age group (MTO, 2003).

Some have argued, however, that the statistics may be biased upward due to the tendency of older adults as a group to drive fewer miles in total. For instance, Hakimies-Blomqvist, Raitanen & O'Neill (2002) and Langford, Methorst & Hakimies-Blomqvist (2006) showed that low mileage (< 3,000 km per year) rather than age per se may be the key factor in collision rates. Others (e.g., Staplin, Gish & Joyce, 2008) have challenged this "low mileage bias" hypothesis based on the questionable reliability of self-reported mileage and crash data. Nonetheless, the argument initially proposed by Janke (1991) is that looking at driving exposure (distance) in isolation fails to consider the ***context*** or ***conditions*** under which people drive (i.e., when and where). Keall and Firth (2004) provided some empirical support for

Janke's (1991) argument showing that low mileage drivers were more likely to drive in congested urban areas which pose a greater risk for collisions than highway driving.

It is well known that older drivers tend to be involved in different types of crashes than younger drivers. They are less likely to be in crashes involving alcohol or speeding, but more likely to be involved in two-vehicle crashes, those occurring at lower speeds and at intersections (e.g., Preusser, Williams, Ferguson, Ulmer & Weinstein, 1998; Ryan, Legge & Rosman, 1998; Zhang et al., 2000). Errors of omission, such as failure to yield the right of way, failure to obey signs or see other road users, poor lane changes, lane deviation and making riskier turns (i.e., left turns) are also more common among older drivers (e.g., Cooper, 1990; Goggin & Keller, 1996; Zhang et al., 2000).

Some researchers have found that traffic accidents involving older drivers were more likely to occur during the day and in dry (versus wet or icy) road conditions (e.g., Cooper, 1990; Zhang et al., 2000). However, Zhang et al. (2000) did find that the rate of fatal collisions in Ontario increased by 60% for older drivers when it was snowing. Eisenberg and Warner (2005) found that the first snow day of the season posed the greatest risk for fatal crashes, particularly for older drivers. Inclement weather (particularly heavy precipitation) is an environmental risk factor that affects collisions and casualty rates by impairing visibility, reducing tire adherence and making vehicle handling more difficult (Andrey, 2010).

In northern countries such as Canada and Finland, drivers must deal with winter conditions (reduced daylight, snow or freezing rain, slippery roads). Precipitation (snow or sleet) and darkness additively affect traffic flow and risk estimates (Kipelainen & Summula, 2007). As noted by these Finnish researchers, drivers can control their risk either tactically (e.g., reducing speed) or strategically (e.g., choosing studded tires, allowing more time, postponing a trip or taking public transportation). Older drivers (particularly retirees) have more freedom to postpone trips on bad winter days. Cooper (1990) and Zhang et al. (2000) speculated that older drivers may not be involved in many collisions at night or on wet roads simply because they may not drive as frequently in these situations.

1.2 Driver Decision-Making and Self-Regulation

As Eby and Molnar (2009) point out, *"efforts to help older drivers maintain safe mobility need to be based on a thorough understanding of not only the abilities that decline with age but also the critical skills needed for driving that can be compromised"* (p. 290). They discuss a hierarchy of skills (operational, tactical, strategic and life goals), some of which are amenable to self-regulation (i.e., under the control of the driver).

The model of driving behaviour being applied to older adults postulates that drivers have little control over ***operational*** aspects of the vehicle, which are largely automated (Eby & Molnar, 2009). Although drivers can make ***tactical*** changes (such as reducing driving speed), such changes may not necessarily decrease crash risk (for instance if they drive much slower than the flow of traffic). Decisions at the higher-order, ***strategic*** level in terms of how much to drive and under what conditions, together with ***life goals*** or ***lifestyle*** (such as where to live or what kind of vehicle to drive) present the greatest opportunity for safe, self-regulation. As acknowledged by Eby and Molnar (2009), higher-order decisions by older drivers are influenced by a variety of factors (age, gender, personality) and changes in driving may result from various circumstances (notably retirement), not simply recognition of declining abilities.

Self-regulation has been described as a gradual process of self-imposed restrictions, which may eventually lead to driving cessation (Dellinger, Sehgal, Sleet & Barrett-Connor, 2001; Hakamies-Blomqvist & Wahlstrom, 1998). For example, former older drivers have reported driving less than 50 miles per week prior to cessation (Dellinger et al., 2001). Hakamies-Blomqvist and Wahlstrom (1998), meanwhile, surveyed over 3,000 older drivers and found nearly half reported driving less in comparison to 10 years ago and tried avoiding peak hours, on highways, at night and in bad weather.

There is substantial supporting evidence that driving changes with age. Compared to younger drivers, older adults as a group drive less (e.g., Benekohal, Michaels, Shim & Resende, 1994), and more often in the daytime, in familiar areas and closer to home (e.g., Collia, Sharp & Giesbrecht, 2003; Keall & Firth, 2006). Older drivers also are more likely to report that they avoid driving in bad weather, at night, in heavy traffic or in rush hour, on highways, and making left turns (Baldock, Mathias, McLean & Berndt, 2006; Charlton et al., 2006). However, estimates concerning the proportion of older drivers who regulate their driving vary widely across studies. One fairly consistent finding is that older women appear to regulate their driving more than older men (Charlton et al., 2006; Kostyniuk & Molnar, 2008).

Clearly, not all older drivers change their driving patterns and researchers are attempting to understand factors that precipitate and inhibit the adoption of self-regulatory patterns. A growing number of studies indicate that driver perceptions (particularly confidence or comfort level) may be a key determinant of self-regulatory practices in older drivers (e.g., Baldock et al., 2006; Charlton et al., 2006; Marotolli & Richardson, 1998; Rudman et al., 2006). As described below, work by researchers at the University of Waterloo has developed new tools for measuring driver perceptions to further this area of investigation.

1.3 Work to Date and Rationale for the Present Study

Although many researchers have alluded to the importance of driver perceptions (e.g., Satariano et al., 2004) and some have attempted to measure confidence, nervousness and/or perceived abilities in older drivers (e.g., Marottoli & Richardson, 1998; Parker, MacDonald, Sutcliff & Rabbitt, 2001), until recently these constructs were poorly defined and measured. To fill this gap, Dr. Myers and her graduate students (Joseé Paradis, Lisa MacDonald and Robin Blanchard) undertook the systematic, multi-phase process of scale construction beginning with an inductive, qualitative exploration of the constructs with older drivers. Tool development entailed item ratings, examination of test-retest reliability and scale properties via Rasch analysis, followed by pilot-testing and further refinement. This work began in 2005 as part of a Master's thesis and was subsequently published (Myers, Paradis & Blanchard, 2008a).

The resulting Driving Comfort Scales (DCSs) differ in important respects from prior tools. First the scale was inductively developed with older drivers themselves, guided by Bandura's (1977) theoretical framework. From their perspective, older drivers felt that "comfort level" (which encompassed both confidence in their abilities as well as dealing with road situations, including other drivers) best captured this phenomenon. The qualitative study independently conducted by Rudman and colleagues (2006) supports this conceptualization. Secondly, participants were adamant that most driving situations were more challenging at night, leading to the creation of two, separate DCS-D (daytime) and DCS-N (nighttime) scales. Comparatively, prior (Marottoli & Richardson, 1998) and subsequent scales (e.g., Baldock et al., 2006; Charlton et al., 2006; George, Clark, Crotty, 2007) have included only one or two items on night driving; Parker et al. (2001) did not include any night items. Unlike other tools, the DCSs have a high degree of context (traffic flow) and situational-specificity (e.g., actual speed). Finally, the 13-item DCS-D and 16-item DCS-N have demonstrated properties of hierarchiality, person-, item- and test-retest reliability (Myers et al., 2008a).

The next series of studies were conducted by Lisa MacDonald for her Master's thesis from 2006 to 2007. Lisa extended work already begun on measures of Perceived Driving Abilites (PDA) and Perceived Changes in Driving Abilities (PDA Change), compared to 10 years ago, as well as scales to measure self-regulation practices: the Situational Driving Frequency (SDA) and the Situational Driving Avoidance (SDA) Scales. Similar to confidence, perceived driving abilities had previously been assessed with one item (e.g., *How would you rate your abilities compared to other drivers your age?*). As reported in MacDonald, Myers & Blanchard (2008), Rasch analysis showed that the 15-item PDA (current and change) scales were unidimensional, hierarchial, with good person and item reliabilities. The development of these tools permitted the examination of associations between perceived driving abilities and comfort level, as well as associations between perception and self-regulatory practices. As was expected, lower comfort scores were significantly related to poorer perceptions of current abilities and greater decline in abilities (perceived change), lower scores on the SDF (reported frequency of driving in challenging situations), and greater situational avoidance. All associations with perceived comfort were stronger for nighttime versus daytime driving.

MacDonald also administered tests of more objective, functional abilities: visual acuity, contrast sensitivity, disability glare, brake reaction, lower body mobility, visual attention (using the Useful Field of View or UFOV, subtest 2) and executive skills (Trails Making Test). Specific (versus general) perceptions of vision (particularly items related to night driving) and mobility (getting in and out of a car) were significantly related to corresponding performance measures. Overall, however, reported self-regulatory practices (SDF and SDA scores) were more strongly related to driver perceptions (DCS and PDA scores) than to objective abilities. Drivers with discrepancies between their perceived and actual abilities (indicating lack of awareness) were also more confident and less likely to regulate their behaviour (MacDonald et al., 2008), consistent with prior findings by Marottoli & Richardson (1998) who assessed confidence, perceived abilities (one-item) and on-road performance.

Robin Blanchard took this work a significant step further by examining driver perceptions and reported self-regulatory practices (using our measures) in relation to *actual* or *naturalistic* driving patterns collected by two in-vehicle devices: a CarChip EX® and the Otto Driving Companion® (which has GPS capabilities). This project was done in collaboration with Dr. Michelle Porter from the University of Manitoba and entailed electronically monitoring the driving behaviour of 61 older drivers over one week. The findings, which will be highlighted in Chapter Two, are reported in her dissertation (Blanchard, 2008) as well as two ensuing publications (Blanchard, Myers & Porter, 2010; and Blanchard & Myers, 2010).

While Blanchard's study was the first to demonstrate relationships between driver perceptions, self-reported regulatory practices and actual driving behaviour, her data was collected between June and October of 2007. Over the 148-day study (in which devices were installed in participant vehicles), inclement weather (i.e., rain, thunderstorms or fog) occurred on only 34 days or 23% of the period. As noted above, winter conditions (reduced daylight, weather and road conditions) present additional challenges for Canadian drivers and those living in other northern countries. As will be discussed in Chapter Two, one study (by

Sabback & Mann, 2005) found that older drivers in upper state New York changed their driving behaviour in the winter, but their findings were based solely on self-report. And, with the exception of pilot data collected by Dr. Porter and her colleagues (on 9 older drivers in Winnipeg), no one has yet assessed or compared seasonal driving patterns in older drivers in relation to weather and road conditions.

The aims of the present study were to replicate Blanchard's findings and extend her work by examining driving behaviour (exposure and patterns) of older drivers (living in the same region) over the winter period. As noted by Blanchard et al. (2010) and others (e.g., Grengs, Wang & Kostyniuk, 2008), driving behaviour may fluctuate not only from season to season, but week to week. Thus, the present study employed a longer, two-week monitoring period.

A summary of the relevant literature is presented in the next chapter. Chapter Three outlines the study objectives and expectations, sample selection and recruitment, as well as data collection procedures. The findings are presented in Chapter Four and discussed in Chapter Five.

Chapter 2 - Literature Review

2.1 Introduction

As described in Chapter One, the importance of driving is well-recognized. The goals are to assist older adults in driving safely for as long as possible, help them plan for eventual cessation and develop better transportation alternatives (e.g., Dickerson et al., 2007). The present study was conducted to build on the work by Blanchard (2008) and further our understanding of driver decision-making at the higher-order, strategic level (Eby & Molnar, 2009), namely, self-regulation. To set the stage for the present study, this chapter begins by looking at the factors that may influence the adoption of self-regulatory practices, including driver perceptions, using Rudman et al.'s (2006) model. The next section reviews empirical studies that have assessed self-regulatory behaviour in older drivers and the methods used. The chapter concludes with a brief summary and implications section.

Key articles cited in Blanchard's thesis (2008) were obtained and reviewed. A literature search was then conducted to find additional articles pertaining to: (1) self-regulatory practices; (2) driver characteristics, including perceptions; as well as (3) the driving context, specifically geographic and seasonal considerations. Search engines used covered multiple databases including: Ageline; Medline; Psych-info; Health Sciences; Social Gerontology Abstracts; Sociological Abstracts; Transportation Research Information Services; and Urban Studies and Planning. Search terms included: "Seniors", "Older adults", "Elderly", "Drivers", "Driving Behaviour and Patterns", "Perceptions", "Confidence", "Weather, Road, Seasonal and Winter", "Self-regulation", and "Avoidance".

2.2 Model of Self-regulation

Based on qualitative data obtained from current and former senior drivers, Rudman and colleagues (2006) developed a model of self-regulation, as shown in Figure 2.1.

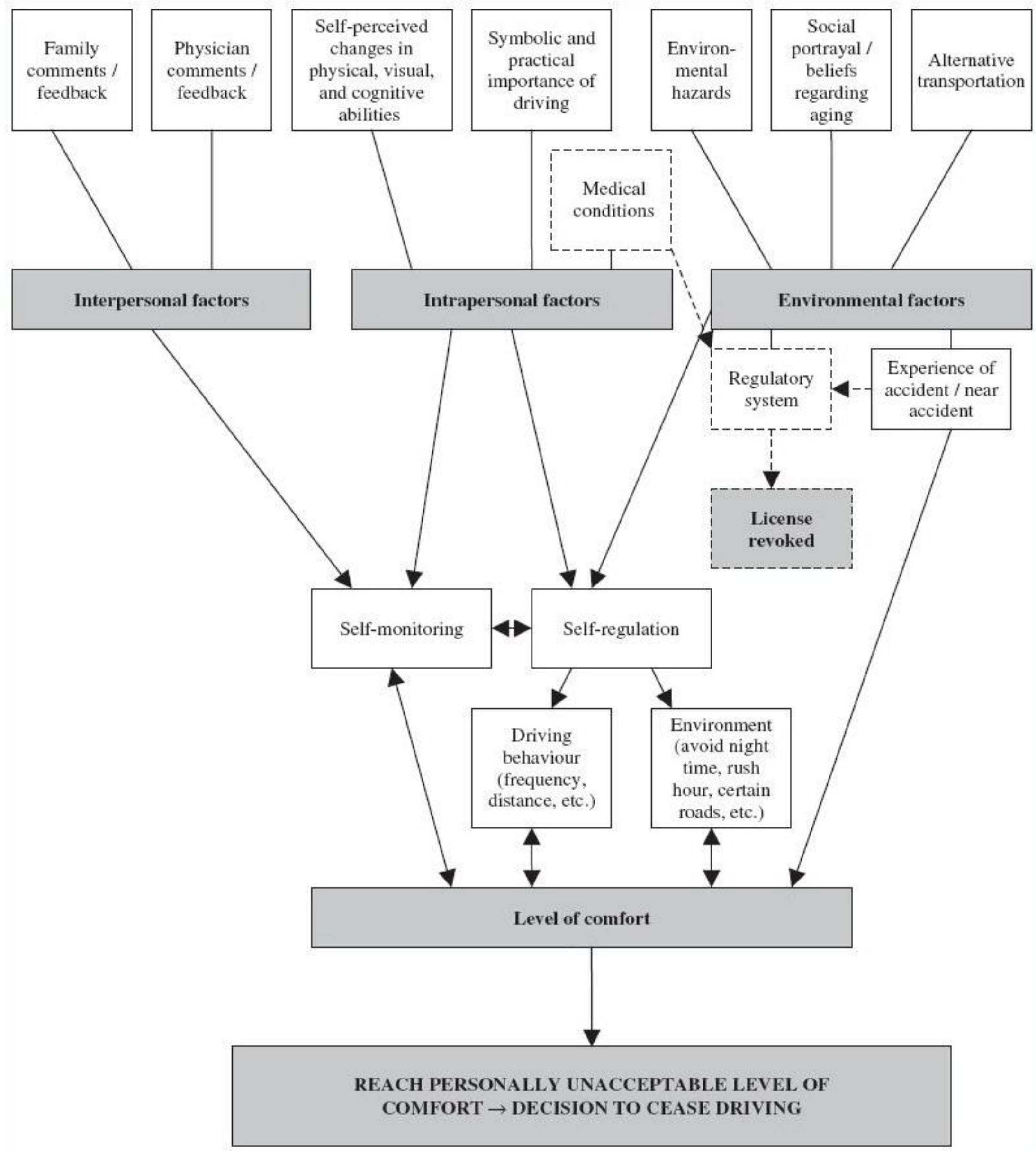


Figure 2.1 Model of the process of driving self-regulation with aging. Rudman et al. (2006). *Canadian Journal on Aging, 25*(1), 65-76. Reprinted with permission.

Rudman et al.'s (2006) model illustrates the complex interplay of interpersonal, intrapersonal and environmental factors required to fully understand decisions to self-restrict or stop driving. Empirical evidence concerning each of these factors is reviewed below and gaps in our knowledge base (need for further research) are identified.

2.2.1 Interpersonal Factors

As noted in Rudman et al.'s (2006) model, comments or feedback from others (such as family and physicians) can influence a person's decision to reduce or stop driving. Much of the work in this area comes from studies on former drivers. For instance, Johnson (1999) conducted semi-structured interviews with 285 adults (aged 70+) who had stopped driving in the prior year. In 75% of the cases, their licenses had been confiscated by authorities. Fear of driving, as illustrated by the following comment-- "I just can't see too good anymore so I guess I scared myself into not wanting to drive anymore"-- was a factor in 42% of the cases. The majority (73%) felt that their family gave them little choice in the matter; however the influence of friends was more influential in their decision.

A further study by Johnson (2002) interviewed 45 seniors living in rural communities in the western United States who had been advised by health professionals, family or friends to stop driving due to declining health, but elected not to heed this advice. All participants (mean age 82) were mentally alert and lived in their own homes; 79% lived alone (either widowed or never married), while the remainder lived with a spouse who did not drive. Beliefs that they were still safe drivers, together with fears of losing their independence were the primary reasons these seniors continued to drive despite pressure from others. As noted by the researcher, elders living in rural areas are particularly reliant on driving for both essential services (e.g., buying groceries, seeing their doctor) and social activities (e.g., going to church, visiting friends), although they must deal with the challenges of vast distances, mountainous terrain, and inclement weather especially during the winter (Johnson, 2002).

Rudman et al.'s (2006) model postulates that when drivers reach a personally unacceptable level of discomfort they will cease driving. However, as noted by Blanchard (2008), and supported by the work of Johnson (1999, 2002) and others, personal circumstances such as having no other alternatives for accessing services and social networks and others relying on them to drive, may compel some seniors to keep driving *despite* feelings of discomfort and pressure from others to stop.

2.2.2 Intrapersonal Factors

Examples of intrapersonal factors provided in Rudman et al.'s model include: self-perceived changes in driving-related abilities and importance of driving, which together with interpersonal and environmental factors, may influence comfort level and ensuing self-regulatory driving behaviour. Characteristics of the driver (e.g., age, gender, marital status and whether one is the primary driver in the household) should also be considered.

A number of studies (e.g., Dellinger et al., 2005; Macdonald et al., 2008; Marottoli & Richardson, 1998) support the premise that decisions regarding driving restriction and cessation may be based more on the appraisal of one's capabilities rather than medical diagnoses, objective driving related abilities or on-road performance scores. And there is some evidence that perceived importance of driving and barriers to driving reduction are related to self-regulatory practices (e.g., Baldock et al., 2006; Blanchard & Myers, 2010). Characteristics (particularly gender) have also been related to self-regulatory practices (e.g., Charlton et al., 2006; Kostyniuk & Molnar, 2008), however the latter study did not measure self-confidence. Charlton et al. (2006) found that inclusion of a confidence variable reduced the relative importance of other predictors of avoidance (such as female gender and not being the primary driver). Blanchard (2008) compared sole versus couple drivers and found that although sole drivers were significantly older and had lower comfort scores, they drove more often, longer distances and further from home than couple drivers, likely due to necessity.

Personal comfort level emerged as a key factor in self-regulation from the focus groups Rudman et al. (2006) conducted with both current and former senior drivers. As previously noted, comfort level has been associated with self-reported driving practices and avoidance (MacDonald et al., 2008; Myers et al., 2008a) and, more recently, with indicators of actual driving behaviour (Blanchard & Myers, 2010).

2.2.3 Environmental Factors

As shown in Figure 2.1, there are a host of environmental factors that can influence driving behaviour and decisions to restrict or stop driving, including: alternative transportation options (public transport and rides from others), licensing regulations, accident experience and environmental hazards. Where someone lives will influence several of these categories. Although two-thirds of Canadians live in urban areas (Andrey, 2010), people in smaller towns, rural and northern areas typically have fewer public transportation options. As noted in Chapter One, licensing regulations vary substantially across Canada and are under the control of each jurisdiction (province or territory). If one lives in Manitoba for instance, there are no age-based renewal requirements. However, if one lives in Ontario, they are subject to both the Senior Drivers Collision Program (anyone over age 70 who is in an at-fault collision must do a road test) and the Senior Driver Renewal Program (which applies to all drivers once they turn 80 and every two years thereafter).

Environmental hazards can include how well roads are maintained in one's area, the terrain (e.g., flat versus mountainous), as well as weather conditions. Kilpelainen and Summala (2007) looked at the effects of winter weather and forecasts on Finnish drivers. While only 16% of the sample reportedly acquired traffic-related weather information (from radio or TV) before their trip, acquisition of such information was associated with increasing age (> 60), female gender, low exposure (those driving < 5,000 km over the past year), the length of the trip in question (>100 km) and poor local conditions as perceived by the driver. Their sample (surveyed at service stations along the highway) comprised only drivers of passenger vehicles, traveling on weekdays and making trips ≥ 20 km. Of interest, drivers were more likely to rate driving conditions better than the forecast in the daylight, but had more negative perceptions in the dark. Not surprisingly, when the forecast was very bad, most trips were work- rather than leisure-related.

2.3 Self-regulatory Practices

Driving behaviour has been examined with respect to: (1) exposure (how much people drive); (2) patterns (when and where people drive); (3) context (geographical and seasonal considerations); and (4) problems or errors (such as turning maneuvers, failure to yield the right of way, failure to stop, etc.). While all four aspects are important with respect to investigating crash involvement (as discussed in Chapter One), this review focuses on self-regulation from a behavioural perspective. Exposure and patterns, for the most part, are under the direct control of driver (strategic decision-making). Drivers also have some control over context in terms of where they choose to live (what Eby & Molnar, 2009 refer to as lifestyle decisions) and whether they choose to drive under bad weather and road conditions.

2.3.1 Exposure

Exposure refers to the amount of driving, typically expressed in terms of distance driven--km per week or year, frequency of trips, or distance traveled per trip (e.g., Blanchard et al., 2010; Collia, Sharp & Giesbrecht, 2003; Huebner, Porter & Marshall, 2006; Marshall, Molnar, Man-Son-Hing, Wilson, Stiell & Porter, 2007). As discussed below (section 2.3.4), the majority of studies have relied on *self-reported estimates* of driving distance and frequency which may not be accurate.

Compared to younger drivers, older adults reportedly drive less often, shorter distances and closer to home (e.g., Burns, 1999; Collia et al., 2003; Davey & Nimmo, 2003; Keall & Firth, 2006). The tendency of older adults to drive fewer km is clearly associated with lower rates of full-time employment (Keall & Firth, 2006). Using national transportation survey data, Davey and Nimmo (2003) showed a gradual decline in number of trips by older drivers. Conversely, Hu and Reuscher (2004) found that the average number of trips for people 65+ increased from 2.4 in 1990 to 3.4 in 2001. Similarly, Collia et al., (2003) found that older drivers make an average of 3.4 trips per day.

Some studies suggest that older adults are more likely to break down long outings into several, shorter trips (e.g., Lerner-Frankiel, Vargas, Brown, Krusell & Schoneberger, 1990), while others show older drivers may prefer to combine several activities into a single trip, or “trip-chaining” (Blanchard, 2008; Burkhardt, 1999; Rosenbloom, 1999). For instance, Blanchard (2008) found that older adults made an average of 2 stops per trip.

While surveys have generally found that seniors report driving closer to home, only a few studies have actually examined radius or distance traveled away from home. Keall and Firth (2006) used two-day travel diaries in conjunction with digitized maps to calculate the distance between a person's residence and their reported destinations. Low mileage drivers, who tended to be older, were found to drive nearer the vicinity of their homes. Blanchard (2008) also assessed radius from home in older drivers using an in-vehicle GPS data logger, together with digitized maps (Goggle Earth). She found that average and maximum radius (distance from home) over the week was related to driving comfort scores at night and in good weather, as well as perceptions of their driving abilities (Blanchard & Myers, 2010). As reported in her dissertation, she also found that those with an average radius of ≤ 5 km over the week made fewer social but more medically-related trips (Blanchard, 2008).

2.3.2 Patterns

Driving patterns pertain to *when* (e.g., time of day) and *where* (e.g., roadways) people drive. For instance, national survey data has shown that the majority of trips by older drivers take place between 9 a.m. and 4 p.m. (Collia et al., 2003; Mollenkopf, Marcelli, Ruoppila, Szeman, Tacken & Wahl., 2004). Keall and Firth (2006) similarly found that older drivers do little of their driving after dark. Most of the literature on self-regulatory patterns in older drivers, however, has been based on examination of when and where older adults *do not* drive, namely driving situations they reportedly try to avoid. And only a few studies have examined reasons for driving (i.e., trip purposes).

As mentioned in Chapter One, there are numerous studies showing that older drivers in general, and women in particular, reportedly try to avoid driving at night, in bad weather, in unfamiliar areas, in heavy or rush hour traffic and on highways (e.g., Benekohal et al., 1994; Ball et al., 2006; Baldock et al., 2006; Charlton et al., 2006; Hakamies-Blomqvist & Wahlstrom, 1998; Kostyniuk & Molnar, 2005; Marottoli & Richardson, 1998). While some may adjust their driving to compensate for declining abilities, it is recognized that these patterns may also reflect preferences and lifestyles, such as less need to drive and more flexible schedules (e.g., Ball et al., 2006; Charlton et al., 2006; Blanchard & Myers, 2010).

As noted at the outset (Chapter One), however, Blanchard was the first to assess the actual driving *patterns* of older drivers through objective measures (in-vehicle devices). Driving behaviour over a one-week period was quite consistent with self-reports of usual practices with respect to time of day (day versus night) and where people tend to drive (e.g., residential, city or rural areas). However she found that overall the sample did not self-regulate as much as reportedly "usually doing" with respect to freeway or highway driving (Blanchard et al., 2010). The authors concluded that "circumstances (e.g., appointments, commitments) may dictate where and when people actually drive, even though they prefer not to (e.g., drive at night or on highways)" (p. 528). Social desirability (desire to present oneself favorably as a safe driver) must be considered when interpreting responses to surveys on self-regulatory practices such as avoidance (Blanchard et al., 2010).

To understand the driving patterns of older adults, reasons for driving (as well postponing or cancelling trips) must be considered. Trip purposes have been categorized as: essential versus non-essential, such as grocery shopping and medical appointments versus social (e.g., Bauer, Adler, Kuskowski & Adler, 2003); or basic versus optional (e.g., Heyl, Wahl & Mollenkopf, 2005). Some studies have found that older adults ranked social and recreational trips as the most important, followed by shopping, personal business, medical appointments, and accompanying others (Davey & Nimmo, 2003; Mollenkopf et al., 1997). Others have suggested that older adults may reduce recreational or social activities for more essential trips related to activities of daily living (Siren, Hakamies-Blomqvist & Lindeman, 2004). When Blanchard (2008) looked at out-of-home activities, she found that the decision to make or postpone a trip was highly dependent on the perceived level of commitment (i.e., discretionary versus obligatory).

2.3.3 Geographical and Seasonal Considerations

Where a person lives affects the conditions s/he must deal with, including seasonal changes in daylight and weather. As noted in Chapter One, inclement weather (particularly heavy precipitation) is an important environmental risk factor in collisions. Only a few studies, however, have looked at the impact on self-regulatory patterns of older drivers.

A study by Sabback and Mann (2005) compared the influences of climate and road conditions on the driving behaviour of older adults living in two very different regions: Western New York (WNY) versus Northern Florida (NF). As expected, the WNY sample reported driving less during the winter (with 55% saying they specifically avoided snow, sleet or icy conditions), while rain or fog was avoided by 35-55% of both groups. The WNY sample was slightly more likely to avoid night driving (70% versus 60%), while a slightly greater proportion of the NF sample (80% versus 70%) said they avoided certain road conditions (the list provided to respondents included roads that were windy, busy, dirt roads and those under construction). They were not specifically asked about slippery roads (due to rain, snow or ice). While interesting, these findings are based on self-report, as are the vast majority of studies on self-regulation patterns in older adults.

The only objective data on the seasonal effects on driving in older adults comes from pilot work by Huebner and Porter on older drivers in Winnipeg, Manitoba. Although the primary purpose of their study (Huebner et al., 2006) was to examine the accuracy of the CarChip (as monitored for one week between July and October), they also collected one-week of driving data on this sample of older drivers in the winter (January to March). Their findings (unpublished, and only on 9 subjects) showed a significant decrease in total distance, average maximum speed and hard decelerations in the winter. While their findings provide a basis of comparison, unfortunately trip purposes were not assessed.

2.3.4 Measurement Issues

As noted above, self-regulatory practices in older drivers have for the most part been assessed using self-report methods, whether self-completed questionnaires or interviews. Questionnaires pose little burden on participants, but are limited by reliability and accuracy of recall. As reported in Blanchard et al., 2010) self-estimated distance (km driven over the week) was found to be inaccurate compared to objectively measured CarChip data, replicating Huebner et al.'s earlier (2006) findings that older drivers both over- and under-estimated the distance traveled over a one-week monitoring period.

Trip logs or travel diaries, ranging from a few days (e.g., Keall & Firth, 2006) to a week or longer (e.g., Marshall et al., 2007) have also been used to document driving patterns and purposes, sometimes in combination with other methods. Only a few studies, however, have measured actual or naturalistic self-regulatory practices in older drivers using more objective methods such as in-vehicle devices. As these methods have been reviewed extensively elsewhere (Blanchard, 2008), this section will focus primarily on the advantages of in-vehicle devices. As will be noted, however, supplemental measures are still required to confirm who is driving on the vehicle on various trips, record trip purposes and obtain driver perceptions of weather or road conditions.

Similar to prior work by Porter and colleagues, and the study by Blanchard (2008), this study used two electronic devices, namely the CarChip and the Otto Driving Companion (or Otto) to monitor naturalistic driving behaviour. The specifications and installation process are described in the methods (Chapter Three). General advantages and support for the accuracy of these devices is reviewed here.

The primary advantage of electronic data loggers is that they are not obtrusive and require minimal or no effort from the drivers themselves. Once installed in the vehicle, both the CarChip and the Otto collect date- and time-stamped driving data (such as distance, duration, speed, stops) from the time the ignition is turned on until it is turned off. The Otto has the advantage of GPS capabilities which are needed to examine routes, roadways and distance from home (or radius) when paired with maps (Goggle Earth).

Huebner et al. (2006) examined the accuracy of the CarChip in measuring distance and velocity, compared to GPS technology. The sample (aged 60 to 86) was asked to drive two courses; a 1.8 km course and a 26 km route to assess short versus long distance validity, respectively. Little disparity was found between the CarChip and the GPS recordings showing that CarChip provides accurate measures of distance and velocity. The short distance assessment had a measurement error (ME) of 0.1 km, which was accounted for by rounding to the nearest 100 meters. The longer (26 km) course had an ME of 0.3 km. Velocity data from the CarChip was slightly lower than the GPS likely due to the higher sampling rate of GPS, i.e., every 0.88 seconds versus every second (Huebner et al., 2006).

Based on Heubner et al.'s (2006) findings, Blanchard (2008) used the CarChip as the primary tool for driving exposure and patterns, while the Otto (GPS receiver) was used only to examine roadways and radius. When data from the two devices were compared, the CarChip was found to record more km and stops (Blanchard, 2008), possibly due to the delay for the GPS to lock onto satellite signals (Huebner et al., 2008). Conversely, the Otto tended to record more hours, likely due to the "live" power socket in some vehicles continue to power the device whether the engine is on or off (Blanchard, 2008). Other issues with GPS devices (such as the Otto) are loss of data due to "cold starts" (i.e., delay locking onto satellites after being off for a period of time), as well as signal loss when traveling past tall buildings or under tunnels (Duncan et al., 2009; Grengs, Wang & Kostyniuk, 2008; Porter & Ash, 2008; Stopher et al., 2008).

Used together, the two devices overcome some of the limitations inherent in each. Both devices record time and date stamped data, allowing for analysis by weather and driving conditions (when such information is obtained from archives). However, as noted above, neither device provides contextual driving information (such as trip purposes or weather and road conditions. Similar to Blanchard et al. (2008), the present study employed multiple sources of data (two in-vehicle devices, as well as trip logs) and triangulated or cross-checked the data where possible to provide a more accurate and complete picture of self-regulatory driving practices.

2.4 Summary and Implications

As described above, in-vehicle devices, together with supplementary information, provide the opportunity to assess naturalistic driving behaviour in older adults more accurately than self-reports of exposure or patterns. And, as described in Chapter One, the DCSs and PDA scales provide conceptually based and psychometrically supported measures for examining the role of older driver perceptions in self-regulatory practices.

While two studies-- by Huebner et al. (2006) and Marshall et al. (2007), the latter which was conducted in winter in Ottawa-- have used in-vehicle devices to assess driving exposure in older adults, neither study assessed driving patterns or driver perceptions. The study by Blanchard was the first study to use in-vehicle devices to assess both driving exposure and patterns, and to relate these driving indicators to driver characteristics and perceptions. Although a great deal was learned from her study, driving was only monitored for one week from June and October. Winter conditions (reduced daylight, snow, sleet and icy roads) may have an important impact on the driving patterns of older adults living in northern regions, as reported by Sabback & Mann’s (2005) subjects. Thus, the aims of the present study were to replicate and extend the work by Blanchard and colleagues by using similar methods to examine winter driving behaviour of older adults living in the same region of SW Ontario, but assessed over the winter months.

Chapter 3 - Methods

This chapter presents the study objectives and a priori expectations. The second section describes ethics approval, consent, selection criteria and recruitment strategies. Then, study procedures, including the step-by-step protocol, materials and tools are described in detail. The final section outlines the handling and analysis of various sources of data.

3.1 Study Objectives and Expectations

Researchers are attempting to understand the decision-making processes leading to the adoption of self-regulatory practices (e.g., Eby & Molnar, 2009; Rudman et al., 2006) as well as the characteristics of self-regulators (e.g., Charlton et al., 2006; Kostyniuk & Molnar, 2008). As reviewed in Chapter Two, there are a host of interpersonal, intrapersonal and environmental factors that may influence self-regulation. Two components of particular interest in this thesis were intrapersonal factors (particularly driver perceptions) and environmental factors (particularly the influence of winter driving conditions).

As described in Chapter Two, only one study to date has examined the influence of driver perceptions on the self-regulatory practices of older drivers using *objective* measures of driving. Blanchard (2008) monitored the driving of 61 older adults from the Kitchener-Waterloo (K-W) region of SW Ontario, but only for a one-week period, from spring to fall.

The main purposes of this thesis were to replicate Blanchard's findings on the associations between driver perceptions and behaviour, and extend this area of investigation in two ways: 1) by increasing the monitoring period from one to two weeks, and 2) by examining driving patterns over the winter.

The specific objectives were to:

1. Examine the influence of winter conditions on the driving behaviour of older adults.
2. Examine the consistency of driving patterns over a two-week period.
3. Examine the associations between driver perceptions, self-reported regulatory practices and actual driving exposure and patterns.
4. Compare winter versus non-winter driving patterns (repeated measures).

Based on survey findings from Sabback and Mann (2005), it was expected that older Canadians may show more restricted driving behaviour in the winter (e.g., fewer trips, reduced distance and radius from home). Conducting the study in the winter allowed us to examine the influence of adverse weather and road conditions (e.g., snowfall and icy roads), as well as the influence of reduced daylight hours on driving exposure and patterns. By extending the monitoring period to 14 days we hoped to capture more variability in patterns, particularly night driving. Only 28% of Blanchard's sample drove at night, possibly due to more daylight over her study timeframe (June to October) and/or her short monitoring period (only 7 days).

With respect to the third objective, we expected to find similar associations between driver perceptions and usual self-regulatory practices as prior studies (e.g., MacDonald et al., 2008; Myers et al., 2008a; Blanchard et al., 2010). Specifically, we expected to find that comfort scores and perceived driving abilities, assessed by the DCS and PDA scales, would be positively related to frequency of driving in challenging situations (SDF scores) and inversely related to SDA (avoidance) scores (MacDonald et al., 2008; Myers et al., 2008a).

Based on Blanchard et al. (2010), we also expected to find significant associations between driver perceptions (particularly nighttime comfort scores) and actual driving exposure and patterns. It is possible that daytime driving comfort scores might show stronger association under winter driving conditions. In Blanchard's study, inclement weather (rain or fog) occurred on only 23% of her 148-day monitoring period. In addition to shorter daylight, Canadian winters entail snow and sleet which impair visibility, as well as icy roads which make vehicle handling more challenging (e.g., Andrey, 2010). Researchers have speculated that older drivers have more freedom to cancel or postpone trips when there is heavy snow or sleet (e.g., Cooper; 1990; Kipelainen & Summula, 2007; Zhang et al., 2000). Those with low comfort levels may be particularly likely not to drive on days with poor weather or road conditions.

With respect to the final objective, the intention was to conduct a preliminary examination of fall/spring versus winter driving exposure and patterns. We knew from the outset that we would only be able to access a fairly small sample that had taken part in Blanchard's spring to fall study and provided permission for further contact. We hoped that a sufficient number would agree to take part in the winter driving study to conduct repeat measures analyses. At best, this analysis was expected to be exploratory similar to that conducted by Huebner and Porter with data from older drivers in Winnipeg.

3.2 Ethics Approval and Consent

Recruitment materials (shown in **Appendix A**) and study materials (shown in Appendices B and C) were submitted to the Office of Research Ethics at the University of Waterloo for review. Ethics approval was obtained prior to recruitment. To ensure confidentiality, consent forms and all hard copies of the data were stored in a secure location (locked filing cabinet) and accessed only by the study researcher. Unique and confidential identification (ID) codes were assigned to each participant (in order of study entry). A master list of participant names, contact information and ID codes was developed as the study progressed and kept in a password protected file. None of the questionnaires or scales requested the respondent's name or other personal information (e.g., phone number).

3.3 Selection Criteria

Similar to the criteria used in Blanchard's study, eligibility was based on both driver characteristics and vehicle requirements. Each participant had to:

- Be a current driver, defined as holding a valid Ontario driver's license, and drove at least once a week during the winter season.
- Be at least 65 years of age or older.
- Reside in the Kitchener-Waterloo (K-W) region and expect to travel primarily in and around this area during the monitoring period.
- Own and operate a non-hybrid vehicle, 1996 or newer (for Carchip compatibility).

3.4 Recruitment

As described in the thesis proposal, the target was to recruit 30 new participants (i.e., those not previously involved in a driving study) and 15-20 participants with non-winter driving data. New participants were recruited from two sources, primarily from a lecture series for older adults as described below.

The Third Age Learning (TAL) group provides guest lectures on topics of interest to older adults. Attendees are primarily seniors from the K-W area. Arrangements were made for the researcher to make brief announcements at the beginning of two of their sessions. The week before, the organizers mentioned the study and left information letters, flyers and permission to contact forms (shown in **Appendix A**) for pickup by interested attendees.

There was also a small pool of two individuals from local sessions of the MTO (Ministry of Transportation of Ontario) Senior Driver Renewal Program (SDRP). These individuals had been previously recruited by Blanchard but had not taken part in her study for personal reasons such as driving a motorcycle or being out of town that summer. However, they had signed the consent form for permission to contact for future studies.

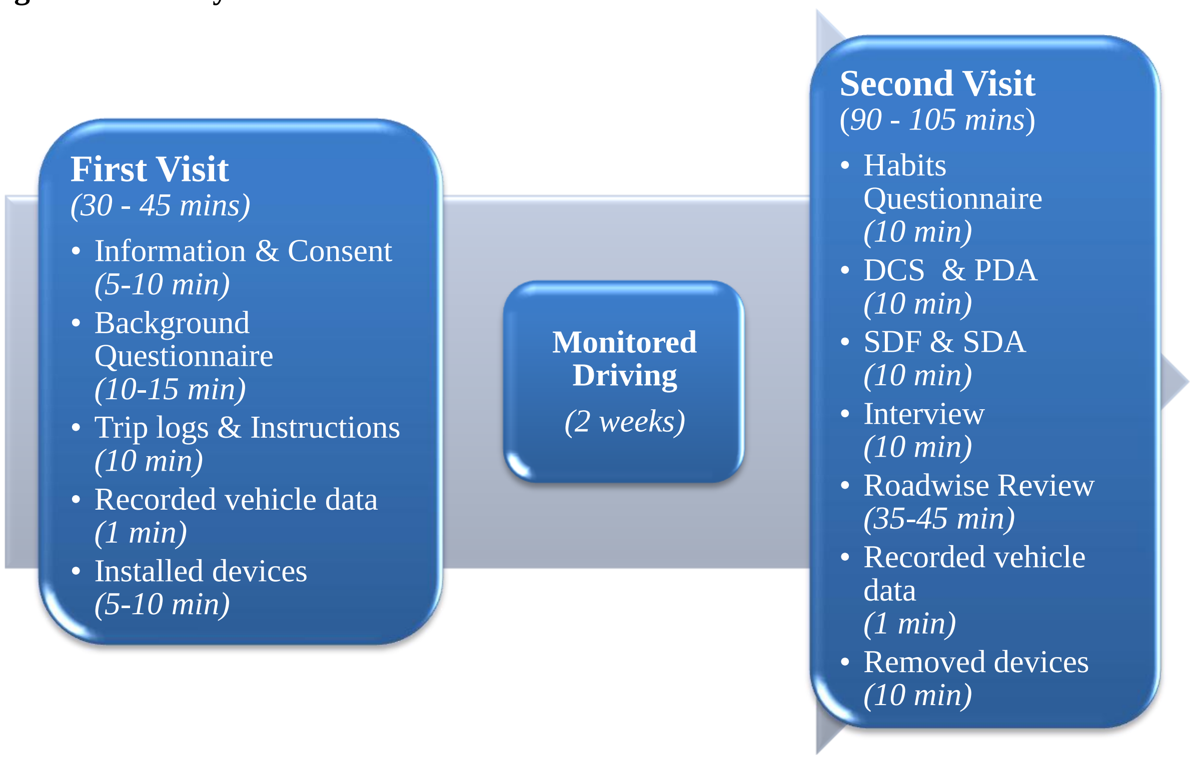
To address objective 4, individuals who had previously taken part in Blanchard's spring to fall study, and had provided permission, were contacted by phone. As explained in the proposal, a decision was made to contact only the most recent participants (i.e., the eight people assessed in October, 2007), as well as the 10 subjects recruited from the TAL and assessed by the present author in April and May, 2008 using Blanchard's protocol.

3.5 Procedures

Screening interviews (script in **Appendix A**) were conducted by phone with potential participants to explain the study, answer questions, determine eligibility and schedule appointments at their home or another location of their choosing. It was necessary to stagger appointments due to the availability of only 15 sets of in-vehicle devices. During the screening process, potential subjects were asked about the number of vehicles, automobile specifications and the number of drivers in their household. Drivers with multiple vehicles were asked to use only one over the study period. In cases where two older drivers lived together, both met the criteria, and were interested in participating, either separate or shared vehicles were acceptable. As described later, trip logs were used to identify the driver(s).

After confirming eligibility, two visits were scheduled. Everyone was agreeable to meeting at their homes. Couples enrolled together were scheduled consecutively on the same day for convenience but assessed separately. The study protocol is shown in Figure 3.1.

Figure 3.1. Study Protocol



Note: **DCS** = Driving Comfort Scales, **PDA** = Perceived Driving Abilities Scales, **SDF/SDA** = Situational Driving Frequencies/Avoidance Scales.

With a few exceptions, the protocol was identical to Blanchard's study (2008). The primary difference was that the present study involved a longer monitoring period. To reduce subject burden, a few tools (a balance confidence scale and partner comfort scales) were not administered, and participants were not asked to complete daily activity diaries regarding all modes of transportation. Similar to Porter, Irani and Mondor (2008), the AAA/CAA Roadwise Review (RWR) CD-ROM® battery was used to assess functional performance of driving-related abilities, rather than the Rapid Pace Walk (RPW) and UFOV (Useful Field of

View, subtest 2) used by Blanchard. Descriptions of the tools are provided following the protocol.

To ensure consistency of the process, the researcher used a check list for each visit. The checklist, as well as the full set of materials for the first visit can be found in **Appendix B**. The first visit (which took between 30 and 45 minutes) began with reviewing the study letter and obtaining written consent. After completing the background questionnaire, the trip logs were explained and participants received an instruction sheet, a set of 40 blank logs and an example. At the end of the visit, the two devices were temporarily installed in their vehicles, secured and tested by the researcher. Vehicle information (purchase date and odometer reading) was also recorded. All participants were instructed to drive as they normally would for the next two weeks, and if possible, to avoid taking their vehicles in for servicing (a precautionary measure to avoid improper re-installation of the CarChip). They were encouraged to contact the researcher if they experienced any difficulties or had inquiries.

Participants were contacted 1 to 2 days prior to their second visit to confirm appointments. The second visit was longer, generally lasting about an hour and a half (range 90 to105 minutes). All materials used in the second visit can be found in **Appendix C.** While subjects completed the Driving Habits Questionnaire, perception measures (DCS and PDA scales) and ratings of usual self-regulatory practices (the SDF and SDA scales), in order, the researcher reviewed their trip logs. Following a brief interview, participants were asked to complete the RWR with assistance from the researcher for cueing and scoring. The program was installed on the researcher's laptop prior to the visit and the researcher moved the mouse for consistency. Upon completion of the RWR, each person received a copy of their results and corresponding interpretation sheets. Subjects also completed a feedback questionnaire on the RWR. The in-vehicle devices were then removed and the odometer reading recorded. Finally, each person was given a pamphlet on winter driving tips from the Transportation Health and Safety Association of Ontario as a token of appreciation.

3.6 Instruments

In this section, the assessment tools listed in Figure 3.1 are described in detail. All tools were self-administered unless otherwise indicated.

3.6.1 Background and Driving Habits Questionnaires

The 24-item background questionnaire (BQ) consisted of three parts: (a) general information, e.g., age, gender and education level; (b) experience with common/household technology (e.g., adjusting a VCR/DVD player), based on a survey developed by Peter Pappas (2002); and (c) health-related information (e.g., diagnosed medical conditions). The Driving Habits Questionnaire (DHQ) comprised 25 items on driving history, preferences, and typical driving behaviour (e.g., time of day). Both questionnaires (shown in **Appendices B** and **C**, respectively) were modeled after Blanchard's (2008) study, with slight modifications.

3.6.2 Driving Comfort Scales

As described in Chapter One, the Driving Comfort Scales (DCSs) were developed systematically and have undergone extensive psychometric examination. The 13-item DCS-Day (DCS-D) and the 16-item DCS-Night (DCS-N) scales are found in **Appendix C**. Both scales were shown to be unidimensional and hierarchial with good person (DCS-D, .89; DCS-N, .96) and item reliabilities (DCS-D, .98; DCS-N, .97). Blanchard and Myers (2010) gathered additional psychometric evidence for the DCS-D and DCS-N with a new sample of 39 older drivers, also finding good test-retest reliability (ICC=.89, .92, respectively) over one week. The DCS day and night scales also have high internal consistency (.92 and .97) and good test-retest reliability over 7-16 days (ICC = .91 and .86), respectively (Myers et al., 2008a). Participants are instructed to consider their driving abilities, skills, as well as the driving situation when rating their level of comfort on a five-point scale (0%, 25%, 50%, 75%, 100%). Scores can range from 0% to 100% where higher scores reflect higher comfort (Myers et al., 2008a).

3.6.3 Perceived Driving Abilities

Also shown in **Appendix C**, two 15-item scales were used to assess perceptions of current driving abilities (PDA) and perceived change compared to 10 years ago (PDA Change). Perceived abilities were rated on a four-point scale ranging from “poor” to “very good” in the PDA, and “a lot worse” to “better” on the PDA change. Scores can range from 0 to 45 where higher scores indicate more positive perceptions (MacDonald et al., 2008). Psychometric properties of the PDA scales have been examined by MacDonald et al. (2008). Findings showed the PDA and PDA change have good internal consistency (α=.94, .87, respectively), person (.92, .82, respectively) and item reliabilities (.96, .90), respectively. Replication showed moderate test-retest reliability (ICC= .65, .66, respectively); and better internal consistency for the current PDA (α=.92) than the PDA change scale, α=.77 (Blanchard & Myers, 2010).

3.6.4 Self-reported Regulatory Practices

The Situational Driving Frequency (SDF) and Avoidance (SDA) scales (**Appendix C**) were used to assess usual driving regulatory practices. As explained in MacDonald et al. (2008), the 14-item SDF asks people how often they drive in various challenging situations using a five-point scale (from “never” to “very often: 4-7 days/week”). On the SDA, participants asked to check (from a 20 item list) the driving situations they try to avoid when possible. Scores can range from 0 to 56 on the SDF and from 0 to 20 on the SDA. Higher scores indicate greater frequency or avoidance of challenging driving situations, respectively. Scores on the SDF and SDA scales have demonstrated high internal consistency (α = .92, .87) and 7-14 day test-retest reliability (ICC= .89, .86), respectively (MacDonald et al., 2008). Additional psychometric evidence collected by Blanchard and Myers (2010), showed high internal consistency (α=.92, .87) and good test-retest reliability (ICC=.89, .86).

3.6.5 Measures of Driving Exposure and Patterns

To objectively measure driving, two electronic data loggers, the CarChip Pro and the Otto Driving Companion, were temporarily installed into each participating vehicle. Trip logs were used to identify the driver and obtain supplementary information, described below.

3.6.5.1 CarChip Pro

Shown in Figure 3.2, the CarChip Pro® (Model 8226; Davis Instruments, Hayward, CA) is a small (35mm x 48mm x 25mm), light-weight (25g) device which plugs into the vehicle’s on-board diagnostic (OBDII) system, typically under the steering wheel. They are only compatible with non-hybrid vehicles manufactured in 1996 or later. Similar to Huebner et al. (2006) and Blanchard (2008), the CarChips were used to record date and time-stamped information for each trip (i.e., duration, distance traveled). The device was set to record information in one-second intervals up to 300 hours, before overwriting previous data (Davis Instruments, 2008). Data logging automatically begins recording when the engine is turned on, and stops when the engine is turned off (Huebner et al., 2006). Data was uploaded directly from the device to a computer using the CarChip software, Version 2.3.

Figure 3.2. CarChip Pro
(Images from Davis Instruments)

3.6.5.2 Otto Driving Companion

Shown in Figure 3.3, the Otto Driving Companion® (Model PM2626; Persen Technologies, Winnipeg, MB) is a compact (12.8cm x 7.0cm x 3.2cm), light weight (320g without batteries) device, mounted on the vehicle's dash board (to pick up satellite signals) and powered through the vehicle's AC adapter. The Otto was set to record date and time-stamped trip information at one-second intervals, for up to 320 hours without overwriting. Unlike the CarChip, however, the Otto has GPS capabilities enabling examination of driving routes and roadways by combining data with digital maps, e.g., Google Earth. Although the Otto is equipped with auditory alerts to warn drivers of high potential risk areas (i.e., school zones) or situations (i.e., exceeding speed limit), these alerts were turned off for this study. However, two messages could not be disabled: (1) the power-on message (a tune followed by a verbal message, "logging enabled") that plays whenever the vehicle is turned on, and (2) a verbal message ("outside coverage area") should the driver go beyond the boundary of the preloaded map for K-W. Data was uploaded directly into the computer through the Otto website (www.myottomate.com), or when an internet connection was not available, through the Otto Configuration Software, version 1.03.

Figure 3.3. Otto Driving Companion
(From Persen Technologies Inc.)

3.6.5.3 Trip Logs

Forty trip logs (shown in **Appendix B**) were secured on each clipboard, and for convenience, remained in the vehicle. The trip logs were developed by combining and refining the activity diaries and trip logs used by Blanchard (2008). For each trip, drivers were asked to complete a log indicating the date and time, who was driving, number of passengers and their relationships to the driver (i.e., family member, friend), purpose of the trip, location of each stop, as well as weather and road conditions.

3.6.6 Roadwise Review Assessment

As noted earlier, the Roadwise Review® (RWR) was used to provide an indication of the sample's functional abilities. The RWR is a computerized self-assessment tool in CD-ROM format developed by the American/Canadian Automobile Association (AAA/CAA) specifically for older drivers (Staplin & Dinh-Zarr, 2006). The eight tests (and the abilities) assessed are listed in Table 3.1. The program took approximately 30 minutes to complete.

Table 3.1. Roadwise Review Tasks and Abilities

Task	Ability
1. 10 foot walk *	Leg strength and general mobility
2. Head/neck flexibility *	Head/neck flexibility
3. Visual acuity (condition 1) *	High-contrast visual acuity
4. Visual acuity (condition 2) *	Low-contrast visual acuity
5. Visual missing information	Visualizing missing information (MVPT)
6. Visual information processing speed	Visual information processing speed (UFOV)
7. Visual search	Visual search (Trail Making Test)
8. Working memory *	Delayed recall (3 items from the MMSE)

* Requires partner for cueing, timing or scoring.

The first task was a 10-foot walk test to evaluate mobility. The next three tasks required the participants to be seated 10 feet from the computer screen. In the head/neck flexibility task, subjects had their backs to the computer screen, and when prompted, were to turn their heads and upper bodies towards the computer screen and identify the displayed shape. For the visual acuity tasks, a row of 4 letter E's were shown and subjects were asked to identify the reversed "E" under high- (black letters on a white background), and low-contrast (gray letters on a white background) conditions. Next, memory was assessed based on delayed recall of three items from the Mini-Mental State Examination (MMSE). Task 5 used the visual closure subtest from the Motor-free Visual Perception Test (MVPT) to assess detection of visual missing information. Task 6 looked at visual information processing speed using the UFOV, subtest 2. Finally, the last task used the Trail-Making-Test (Trail A for practice and Trail B for performance) to examine visual search. As 5 of the 8 tasks require a partner for cueing, timing or scoring as noted in Table 3.1, the researcher provided this assistance.

After completing the program, raw scores and corresponding impairment levels (i.e., none, mild, or serious) are automatically generated (Staplin et al., 2006). Participants received a copy of their RWR scores and corresponding interpretation sheets (see **Appendix C**) which described their impairment levels, their performances relative to other drivers and what they should do if concerned about their abilities (Myers et al., 2008b).

3.7 Data Handling and Analysis

This section describes the handling and analysis of the multiple sources of data collected in this study: the questionnaires (BQ and DHQ), the driving data (CarChip, Otto, trip logs), the perception (DCS and PDA) and self-regulatory (SDF and SDA) scales, as well the interview, functional assessment (RWR), and weather and road information. The Statistical Package for the Social Sciences (SPSS) software, Version 18.0, was used for all quantitative data. Qualitative data (i.e., open-ended questions from the BQ and DHQ, the interview and trip logs) were subjected to content analysis, categorized, then transferred to the SPSS database.

Each variable was assessed for normality to determine the appropriate type of analysis (parametric or non-parametric). Examination entailed visual inspection of histograms, stem-and-leaf and probability plots, as well as statistical tests: Fisher and Pearson skewness and kurtosis, Kolmogrov-Smirnov and Shapiro-Wilks tests (Pett, 1997). Acceptable values were $\pm$1.96 for Fisher skewness and kurtosis, and $\pm$0.50 for Pearson skewness (Pett, 1997).

3.7.1 Driving Data

Although the CarChip and Otto collected similar date and time-stamped information, problems with the GPS such as cold starts at the beginning of trips and loss of satellite signals (i.e., travelling under bridges or past tall buildings) can result in missing or lost data. As noted earlier, the CarChip's accuracy in recording distance (km) was found to be better than a GPS device (Huebner et. al., 2006). Therefore, similar to Blanchard et al. (2010), the Otto GPS data was used only to calculate radius (distance from home), and as a reference when cleaning and checking the data. The CarChip data was used for all other indicators of driving (i.e. # of trips, distance, duration, average maximum speed, and so on).

All driving data were downloaded and 14 consecutive days of monitoring were inputted into Microsoft Excel starting with the day the devices were installed. The data was cleaned (e.g., removal of trips with 0.0 km and by non-participants) prior to entry into a SPSS database. CarChip trip **segments** (period of time the car is on) were cross-referenced with the trip logs and Otto data to derive **complete trips** (defined as those starting and ending at one's home). **Intermediate** or engine-running **stops** (e.g., when dropping off something), were counted in the total number of stops, but the final stop (at home) was not. Instances, duration and distance of night driving were determined by comparing date and time-stamped device data to online archives of local sunrise and sunset times (http://www.sunsetsunrise.com). **Night driving** was defined as the period of darkness (from sunset to sunrise) and included both complete and **partial night trips** (those beginning in daylight and completed in darkness or vice versa).

To examine radius, the Otto GPS data was merged with Google Earth to calculate the maximum and average driving distance from home. Radius was calculated by drawing a direct line from the person's home to the furthest point of the trip. When only a few segments were missing for a given trip, attempts were made to reconstruct routes by examining other, similar trips by the same individual.

3.7.2 Perceptions and Self-regulation Scales

All scales were scored accordingly to the developer's instructions. To calculate driving comfort scores, at least 75% of the items must be completed for the DCS-D (10/13) and the DCS-N (12/16) scales, respectively (Myers et al., 2008a). Missing values in the PDA, SDF and SDA were substituted with the sample's mean response or the participant's mean response to other scale items measuring the same construct (MacDonald et al., 2008).

3.7.3 Weather and Road Conditions

Daylight (hours**:** minutes) for each day of the study period were calculated using sunrise and sunset times for the K-W area, obtained from http://www.sunrisesunset.com. Hourly temperatures and weather descriptors for the region were retrieved from Environment Canada's, while daily snowfall was obtained from the University of Waterloo's weather station online archives. Additionally, weather advisories or alerts were retrieved from "The Record", a daily newspaper for Kitchener, Waterloo, Cambridge and surrounding region.

To organize this information, a database was created. As illustrated in the monthly calendars in **Appendix D,** descriptors for each day of the study included: hours of daylight, maximum temperature, cold days (min. temp. <-15ºC), advisories, snow depth (cm), type and time of precipitation (e.g., 2.5 cm snow overnight). Days with no precipitation were considered favourable or "clear". Roads, meanwhile, were analyzed separately, and as shown in the legend in **Appendix D**, were categorized as: dry/clear, wet/damp, icy, slush-covered or snow-covered.

Similar to Blanchard (2008), weather conditions were examined for the days in which subjects drove, as well as the days participants did not drive. In the present study, road conditions for each day of the study period were examined. However, we recognized that weather and road conditions are highly localized (e.g., it may be snowing in Cambridge, but not in Kitchener) and may change throughout the day. As noted by Blanchard (2008), regional forecasts did not always correspond to the conditions participants described in their trip logs. Similarly, Kilpelainen and Summala (2007) noted discrepancies between drivers reports (what they observed while driving) and traffic-related weather information. As the conditions people experience likely influence their driving behaviour, trip log reports were weighted more heavily than regional weather reports when there was a discrepancy between the two sources of information. Trip logs from other participants (driving on the same day) were cross-referenced whenever possible. In addition to examining the number of days with inclement weather and poor road conditions over the study period, the number of **instances** or opportunities for driving ("# of subjects" X "# of days of monitoring"), were also examined, similar to Blanchard (2008).

3.7.4 Descriptive and Comparative Analysis

Descriptive analyses for continuous variables consisted of measures of central tendency (mean, standard deviation and range) while categorical variables were examined via frequencies and percentages. Comparative analysis was used to examine gender and age group (< 80, ≥ 80) differences, as well as associations between driver perception scores, SDA, SDF scores, and driving indicators (i.e., distance, duration, number of trips, etc.). Depending on whether variables were normally distributed, either parametric (e.g., Pearson r, independent or paired *t*-tests, ANOVAs) or non-parametric equivalents (e.g., Spearman rho, Mann-Whitney U, Wilcoxin, Kruskal-Wallis or Frideman) were used. For dichotomous or categorical variables (e.g., men versus women, sole versus couple drivers), comparisons were examined using Chi-square. When expected values for a 2x2 table were less than 5 per cell, or the total sample was less than 20, as was the case when comparing the characteristics of the fall and spring repeat participants, Fisher's exact test was used (Pett, 1997). Similar to Blanchard, Kappa was used to look at agreement between situations reportedly avoided (based on SDA items) and whether or not they drove in those situations.

To assess consistency of driving over the two weeks, both paired *t*-tests (or Wilcoxin) and Intraclass Correlation Coefficients (ICCs) were examined. While the former is useful for detecting systematic differences between means, ICCs represent the ratio of variability between participants over total variability and is the preferred method for examining reproducibility, particularly when means are fairly similar but there is substantial heterogeneity in scores (Bédard, Martin, Krueger & Brazil, 2000). Based on Shrout and Fleiss (1979), ICC model (3,k) was selected based on the rationale that each subject was assessed by the same raters (i.e., the same driving devices) and these were fixed (versus random). Each indication represented an average (or k) over the seven days (or trials) for week 1 versus week 2. Fortunately, SPSS contains algorithms to produce ICCs (without having to first conduct ANOVA), and adjusts for variables that are not normally distributed.

Finally, it should be noted that not all the data collected in the present study (e.g., odometer readings, feedback on the RWR, etc.) was analyzed for the present thesis. Decisions regarding analyses that were beyond the scope of this project were made in collaboration with the supervisor and thesis committee members.

Chapter 4 – Results

This chapter presents the study findings, beginning with sample recruitment and data completeness. The next section presents the characteristics of the sample (demographics, driving experience and problems, health profile, functional abilities) and perception scores. Similar to Blanchard and Myers (2010), most of the results are examined for the sample as a whole, as well as by gender and age group (i.e., under age 80 versus age 80 and over).

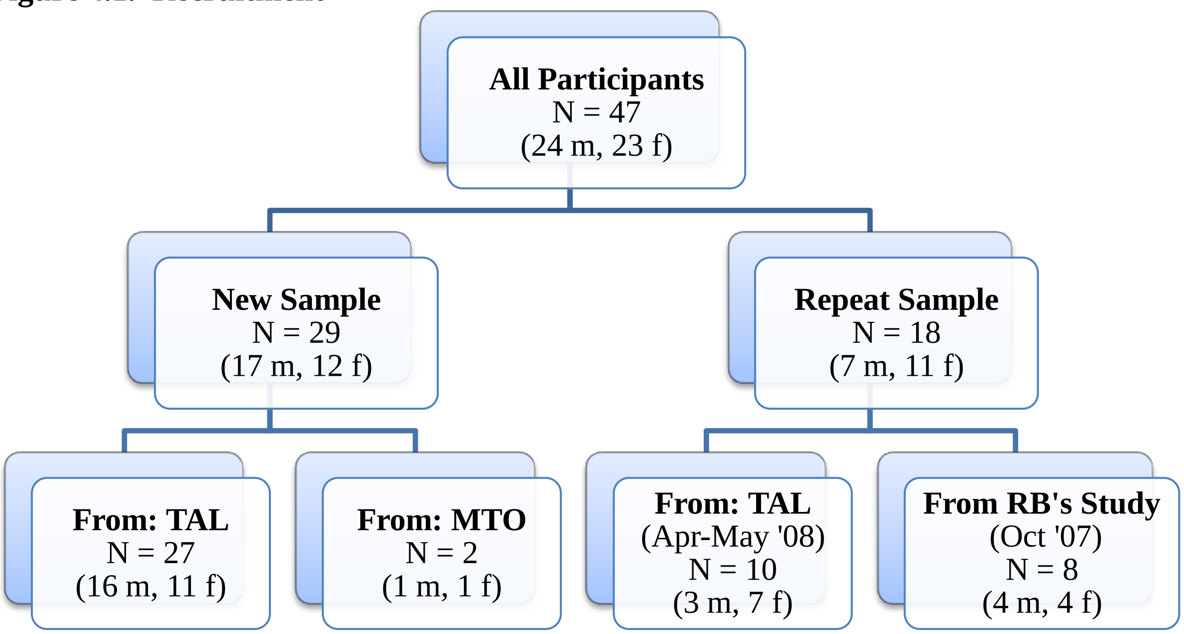
The next section addresses self-reported driving habits and self-regulatory patterns (i.e., situational frequency and avoidance ratings) as well as participant experiences over the monitoring period (obtained from the interview). Data on actual driving behaviour (exposure, patterns) is then presented, followed by weather and road conditions over the period. Finally, results pertaining to each of the study objectives are presented in the following order:

1. Influence of winter conditions on driving behaviour - days people did and did not drive over the monitoring period, as well as trip purposes and reasons for trip cancellation or postponement;
2. Consistency of driving over the two week period;
3. Associations between driver perceptions and driving behaviour; and lastly,
4. Seasonal comparisons (repeated measures).

4.1 Sample Recruitment

A convenience sample of 48 older drivers (30 new, 18 repeat) was recruited from Southwestern (SW) Ontario. One man (new participant, age 74) withdrew before the second visit and was removed from the study as trip logs were not recovered (precluding verification of the driver). Thus, the final sample consisted of 47 participants (29 new, 18 repeat), as shown in Figure 4.1. It should be noted that one of the repeat participants - an 87 y.o. (year old) man - also refused the second visit, however, as both devices and trip logs were recovered he was included in the sample for examination of actual driving behavior.

Figure 4.1. Recruitment



Note: **m** = male, **f** = female, **TAL** = Third Age Learning, **RB's Study** = Blanchard (2008), **MTO** = Ministry of Transportation of Ontario's Senior Driver Renewal Program

The majority of new participants (27/29) were recruited from the Third Age Learning (TAL) lecture series. The "repeat" subjects had previously participated in Blanchard's one week driving study in October, 2007 (n=8) or from April-May, 2008 (n=10).

Most lived in Kitchener or Waterloo (n=40, 85%). The remainder lived in the surrounding areas of Cambridge (n=5), St. Agatha and St. Clement. Only three individuals (6% of the sample, all men) could be considered rural dwellers; **rural** was defined as living in an area with less than 1,000 residents and situated over 5 km from services (Blanchard, 2008; Statistics Canada, 2006).

Data collection which began on November 24, 2008 and ended on March 25, 2009 was comprised of four consecutive waves of 10 to 13 subjects, as shown in Table 4.1. The total monitoring period (in which devices were installed in subject vehicles) was 94 days: seven days in November, 18 in December, 26 in January, 19 in February, and 24 in March. Although two people began the study in late November, their monitoring period extended into December. There were no gender or age group differences between the waves or cohorts.

Table 4.1. Consecutive Waves of Data Collection (N = 47)

Wave	Total Sample	New Subjects (n = 29)	Repeat Subjects (n = 18)
Wave 1: Nov-Dec/08	13 (27.7)	12 (41.4)	1 (5.6)
Wave 2: Jan/09	11 (23.4)	4 (13.8)	7 (38.9)
Wave 3: Feb/09	10 (21.3)	8 (27.6)	2 (11.1)
Wave 4: Mar/09	13 (27.7)	5 (17.2)	8 (44.4)

Note: Values presented are *frequencies (valid percent).*

4.2 Data Completeness

4.2.1 Questionnaires, Scales and Interviews

All 47 participants completed the background questionnaire (BQ). As noted above, one male refused the second assessment, thus, was missing the driving habits questionnaire (DHQ), perception (DCSs, PDA) and regulation (SDF and SDA) scales, the Roadwise Review (RWR), and the interview. With the exception of a few missed questions (items or tasks) all remaining 46 subjects had fairly complete data, including final interviews.

Everyone completed at least 75% of the items on the DCSs which permitted calculation of a total score. The few missing items on the PDA and SDF scales were handled using item or person mean substitution methods as instructed by the developers (MacDonald et al., 2008). The Roadwise Review (RWR) was completed by 44 participants; two chose not to complete the assessment, and one refused the second visit as noted above. One 87 y.o. man completed all the RWR tasks, except for the UFOV (Useful Field of View, subtest 2).

4.2.2 Driving Data

As described in Chapter Three, two electronic devices (CarChips and Ottos) were used to assess driving behaviour over the two-week period. Trip logs were used to provide supplementary information (i.e., driver verification, trip purposes, driving conditions). Usable CarChip data was retrieved for 46 subjects, while usable Otto data was retrieved for 44. Missing information is described below. Importantly, no one was missing both CarChip and Otto data, and trip logs were returned by all 47 subjects.

CarChip data was lost for 1/47, an 81 y.o. woman (new participant). The device was inadvertently removed during car servicing and improperly re-installed. Otto data, meanwhile, was lost for 3 people (all new participants: one woman aged 70; two men aged 73 and 74). Issues with the power source and settings caused the device to reach capacity before the end of the two-week period, thus only 3 to 5 days of driving was recorded. Although it was possible to distinguish trip segments by cross-referencing with the trip logs and CarChip data, a decision was made to exclude these three subjects from analysis requiring the Otto data (e.g., radius calculations) as a full week's data could not be recovered.

While 44 subjects had usable Otto data, some trip information (according to their CarChips and logs) was missing for 9 people (or 20% of the sample) due to various problems, mainly connection-related (Appendix E). When only a few segments were missing, attempts were made to reconstruct routes by examining the person's trip patterns using their logs and CarChip data. In consultation with the thesis committee, a decision was made to exclude four subjects (three men and one woman) who were missing a third or more of their trips. The remaining five subjects were included in radius analysis but a total of 11 of their trips were removed due to insufficient information. This reduced the total number of Otto-determined trips by 10.3% from 641 (44 subjects) to 575 (40 subjects).

As noted above, all 47 subjects completed their trip logs with few missing entries, indicating good compliance by both new and repeat participants. However, one of the new participants (73 y.o. man) admitted in the interview that he had forgotten the instruction to drive only one vehicle during the study and sometimes used his wife's car to avoid doing the logs. Despite using his wife's vehicle about a third of the time (his estimate), he still completed 28 trips with his own vehicle.

In an attempt to simplify the logs, passenger information was not requested from the first wave of participants (13/47 people or 28% of the sample). Passenger information was subsequently added to assist with interpretations (i.e., intermediate stops). The CarChip data yielded a total of 672 trips for examination; logs were completed for 99% of the trips (665/672). Trip purposes were missing for only 1% (29/2219) CarChip segments. Of the 665 CarChip trips with corresponding logs, 85% of the logs (565/665) contained participant descriptions of weather, while 41% (275/390) contained descriptions of road conditions.

In consultation with the committee, a decision was made to use the full sample (N = 47; 29 new and 18 repeat) to examine winter driving behaviour (objective 1), consistency over the two weeks (objective 2) and associations between driver perceptions and actual behaviour (objective 3). While inclusion of prior participants (18/47 or 38%) is recognized as a study limitation (addressed in Chapter Five), the two groups were equally compliant in completing the trip logs (noted above). As will be shown below, the groups were also quite comparable with respect to characteristics, perception scores and actual driving patterns.

4.3 Sample Characteristics

4.3.1 General and Health

As shown in Table 4.2, the sample ranged in age from 65 to 91 and was evenly split with respect to gender. Three-quarters had college or university education. One man (69 y.o.) still worked full-time, while another man (87 y.o.) was in a doctoral program. The older group, comprising 40% of the sample, was more likely to live alone ($\chi^2 = 8.34$, $p = .004$).

Four couples (8 individuals) enrolled in the study together; the remainder as singles. Half the sample were sole drivers (defined as the only driver in the household). Gender and age group differences emerged for both household driver status (gender: $\chi^2 = 6.17$, $p = .01$; age group: $\chi^2 = 14.02$, $p < .001$), and number of household vehicles (gender: $\chi^2 = 4.81$, $p = .03$; age group: $\chi^2 = 4.68$, $p = .03$), where women and older adults (80+) were more likely to be sole drivers and to own one vehicle. There were no significant differences in age, gender, or education between the new and repeat participants.

Selected health characteristics are shown in Table 4.3. Other descriptive results from the BQ can be found in **Appendix F**. Most rated their health as good or excellent and said they were able to walk a quarter of a mile. Half were enrolled in exercise classes and the sample as a whole reported being physically active on average 3.5±1.8 days a week.

Table 4.2. General Characteristics (N = 47)

Characteristics	Total Sample	Gender		Age Group	
		Male (n = 24)	Female (n = 23)	Under 80 (n = 28)	80 & Over (n = 19)
Gender					
Male	24 (51.1)	---	---	15 (53.6)	9 (47.4)
Female	23 (48.9)	---	---	13 (46.4)	10 (52.6)
Age	77.15±6.61 65 to 91	77.38±7.05 65 to 91	76.91±6.26 65 to 89	72.89±4.44 65 to 79	83.42±3.50 80 to 91
Education					
Less than High School	2 (4.3)	2 (8.3)	0	1 (3.6)	1 (5.3)
High School	9 (19.1)	2 (8.3)	7 (30.4)	3 (10.7)	6 (31.6)
College/University	36 (76.6)	20 (83.3)	16 (69.6)	24 (85.7)	12 (63.2)
Living arrangement [b]					
With Spouse/Partner	29 (61.7)	18 (75.0)	11 (47.8)	22 (78.6)	7 (36.8)
Alone	18 (38.3)	6 (25.0)	12 (52.2)	6 (21.4)	12 (63.2)
Sole driver [a,b]					
Yes	24 (51.1)	8 (33.3)	16 (69.6)	8 (28.6)	16 (84.2)
No	23 (48.9)	16 (66.7)	7 (30.4)	20 (71.4)	3 (15.8)
# Vehicles [a,b]					
One	34 (72.3)	14 (58.3)	20 (87.0)	17 (60.7)	17 (89.5)
Two	13 (27.7)	10 (41.7)	3 (13.0)	11 (39.3)	2 (10.5)

Note: Values presented as *frequencies (valid percent)*, or *Mean±S.D., range*.
[a] Gender difference; [b] Age group difference

Subjects had an average of 2.3±1.3 diagnosed conditions, ranging from 0 to 6. The most frequently reported conditions were: high blood pressure, cholesterol or heart-related (62%), vision disorders (45%), back problems (30%), hearing (28%), and arthritis, rheumatism or osteoporosis (26%). While a few people reported glaucoma (n =3) or macular degeneration (n=1), cataracts were the most common vision disorder (reported by 18 individuals, 14 of whom were 80 or older). Only 2% of the sample, however, rated their eyesight as worse than most. Overall, the older group reported significantly more health problems than their younger counterparts (t = -2.90, p = .006). The new and repeat sample did not differ on any of these above variables.

Table 4.3. Health Characteristics (N = 47)

Health Characteristics	Total Sample	Gender		Age Group	
		Male (n = 24)	Female (n = 23)	Under 80 (n = 28)	80 & Over (n = 19)
Self-rated health					
Excellent	13 (28.9)	5 (21.7)	8 (36.4)	8 (28.6)	5 (29.4)
Good	31 (68.9)	18 (78.3)	13 (59.1)	20 (71.4)	11 (64.7)
Fair	1 (2.2)	0	1 (4.5)	0	1 (5.9)
Missing	2	1	1	0	2
Use cane/walker					
Yes	7 (15.6)	5 (21.7)	2 (9.1)	4 (14.3)	3 (17.6)
No	38 (84.4)	18 (78.3)	20 (90.9)	24 (85.7)	14 (82.4)
Missing	2	1	1	0	2
Walk a 1/4 of a mile					
Yes	42 (93.3)	22 (95.7)	20 (90.9)	26 (92.9)	16 (84.2)
No	3 (6.7)	1 (4.3)	2 (9.1)	2 (7.1)	1 (5.3)
Missing	2	1	1	0	2
Diagnosed conditions [a,b]					
Mean±S.D.	2.34±1.27	2.21±1.32	2.48±1.24	1.93±0.98	2.95±1.43
Range	0 to 6	0 to 6	0 to 5	0 to 3	0 to 6
Difficulties					
Mean±S.D.	0.95±1.28	0.83±1.30	1.10±1.26	0.67±1.04	1.41±1.50
Range	0 to 5	0 to 4	0 to 5	0 to 4	0 to 5
Missing	3	1	2	1	2
Cataract surgery [a]					
Yes	18 (38.3)	8 (33.3)	10 (43.5)	4 (14.3)	14 (73.7)
Perceived eyesight					
Better than most	17 (37.0)	8 (34.8)	9 (39.1)	9 (32.1)	8 (44.4)
About the same	28 (60.9)	15 (65.2)	13 (56.5)	19 (67.9)	9 (50.0)
Worse than most	1 (2.2)	0	1 (4.3)	0	1 (5.6)
Missing	1	1	0	0	1
Medications					
Mean±S.D.	2.65±1.77	2.89±1.91	2.42±1.64	2.62±1.75	2.69±1.85
Range	1 to 8	1 to 8	1 to 6	1 to 8	1 to 7
Missing	1	0	1	0	1

Note: Values presented as *frequencies (valid percent)*, or *Mean±S.D., range.*
[a] Age group difference; [b] Gender difference

When asked whether they experienced various difficulties (that could affect driving), the most often reported was stiffness in the back or neck (23%), followed by maintaining balance (19%), limited strength or movement (15%) and staying awake or alert (11%). Those in the older group reported more difficulty with balance ($\chi^2 = 3.75$, $p = .05$), while younger subjects experienced more stiffness in their necks and backs ($\chi^2 = 3.67$, $p = .05$). In general, however, the sample experienced few difficulties (on average less than 1, ranging 0 to 5).

4.3.2 Driving Experience and Preferences

Everyone had over 30 years of driving experience, and 8 people (mostly men) had held another class of license. A driving problem score was calculated based on reported incidents over the past year (i.e., crashes involving another vehicle, near misses, backing into objects, driving over curbs/medians, getting lost, and traffic violations with demerit points). Overall, the sample reported few problems (less than 1 on average, range 0 to 3), the most common being getting lost (15%) and driving over curbs/medians (15%). Six had a near miss while three reported being involved in a collision

The vast majority preferred to drive themselves (94%), rather then rely on others to drive. Additionally, 41% of the sample (mostly the younger group) said that others rely on them to drive. Given a situation where subjects were unable to drive themselves or did not feel like driving, 61% (n=28) said that they would find family or friends to drive them, 35% (n=16) would take a taxi and 28% (n=13) would take public transportation (i.e., bus). On a scale from 0 (not that important) to 4 (extremely important), most felt that continuing to drive was personally important ($M = 3.4 \pm 0.7$, range 1 to 4). Among the reasons for continuing to drive, subjects rated maintaining current lifestyle as the most important ($M = 3.31 \pm 1.15$, out of 4.0), followed by getting to shops and services ($M = 2.97 \pm 1.20$), and being able to meet commitments ($M = 2.52 \pm 1.52$).

Over half the sample (54%) reported driving less now than 10 years ago; 44% said they drove about the same, while only 1% said they drove more. Almost half the sample (47%) had discussed their driving with an eye care professional, 31% has talked to family members, and 24% to friends. When asked if others have suggested they limit or stop driving, all subjects replied no. Despite this, eight had seriously considered reducing the amount they drove, while one (81 y.o. woman) had thought of quitting due to poor vision. Further results from the DHQ are reported below and the rest can be found in **Appendix G**.

4.3.3 Functional Driving-related Abilities

Forty-four participants (94%) completed the Roadwise Review (RWR) battery, although one man (87 y.o.) was unable to do the UFOV after 5 attempts. He was assigned a serious impairment for this task. Results are shown in Tables 4.4.

Overall, the sample had few impairments ($M = 1.8 \pm 1.2$, range 0 to 4), however the older group (80+) had a higher number of impairments than the younger group ($p = .02$). Participants had the most difficulty with the head/neck flexibility task, with 41% being assigned a serious impairment by the program. A quarter of the sample was considered mildly impaired on the Trails B, while 16% had problems with the MVPT task. While there were no significant gender differences, the older group performed significantly worse on the Trails B ($t = -3.17$, $p = .003$) and the UFOV ($z = -2.95$, $p = .003$).

Table 4.4. Roadwise Review Scores and Impairment Levels (N = 44)

Tasks	Raw Score	RWR Battery		
		No Impairment	Mild	Serious
Leg strength & mobility (sec) *Cut-points*	5.5±1.3 3 to 11	n=42 (95.5) 5.3±0.9 3 to 7 *0-7.5*	n=1 (2.3) 8.0±0 8 *≥7.5*	n=1 (2.3) 11.0±0 11 *≥9*
Head/Neck flexibility	Correct (1) or limited (0)	n=26 (59.1)	---	n=18 (40.9)
High contrast acuity *Cut-points*	Not explicit	n=43 (97.7) *20/40 or better*	n=1 (2.3) *20/40 to 20/80*	0 *Worse than 20/80*
Low contrast acuity *Cut-points*	Not explicit	n=39 (88.6) *20/40 or better*	n=5 (11.4) *20/40 to 20/80*	0 *Worse than 20/80*
MVPT: Visualizing missing information Correct/Possible 0-11 *Cut-points*	1.5±1.0 0 to 3	n=37 (84.1) 1.2±0.7 1 to 2 incorrect *0-2 incorrect*	n=7 (15.9) 3.1±0.4 3 incorrect *3-4 incorrect*	0 *≥5 incorrect*
UFOV(msec)***** *Cut-points*	149.2±97.9 100 to 430	n=35 (79.5) 106.4±26.3 100 to 213 *0-225*	n=3 (6.8) 271.3±29.8 237 to 290 *>225*	n=6 (13.6) 376.0±52.1 310-430 *>300*
Trail Making B: Visual search (sec)***** *Cut-points*	102.4±30.6 46 to 179	n=11 (25) 65.7±9.9 46 to 76 *20-80*	n=33 (75) 114.6±24.8 83-179 *>80*	0 *>180*
Working memory (3 words) *Cut-points*	0.2±0.5 0 to 2	n =37 (84.1) *0 incorrect*	n=5 (11.4) *1 incorrect*	n=2 (4.5) *2-3 incorrect*

Note: Classification cut-points (as reported in Myers et al., 2008b) are italicized.
***** Age group difference.

4.4 Driver Perceptions

Table 4.5 shows the sample scores on the perception measures. All scores were normally distributed, except for the DCS-D and DCS-N item#1 (comfort driving at night in good weather and traffic conditions). As DCS scores can range from 0 to 100%, the sample had fairly high comfort levels in the daytime, but significantly lower scores for night driving (t = 6.95, p< .001). The sample also had fairly high perceptions of their driving abilities, and reported little change in relation to 10 years ago. Men had higher DCS-D (p = .02) and DCS-N (p = .003) scores than women, and perceived more change in their driving abilities (p = .03). Adults 80+, meanwhile, rated their driving abilities poorer than under 80 (p = .01).

Table 4.5. **Perception Scores (N = 46)**

	Total Sample	Gender		Age	
		Male (n = 23)	**Female (n = 23)**	**Under 80 (n = 28)**	**80 and Over (n = 18)**
DCS-D					
M±SD	70.61±17.11	76.25±15.98	64.97±16.63	72.32±16.09	67.95±18.74
Range	36.5 to 100	44.23 to 100	36.54 to 88.46	36.54 to 100	38.46 to 96.15
t(p) or *z(p)*		*z* = -2.35 (.02)		*z* = -0.60 (.55)	
DCS-N					
M±SD	58.14±23.04	68.05±19.26	48.22±22.58	62.26±19.36	51.72±27.18
Range	18.75 to 100	35.94 to 100	18.75 to 84.38	21.88 to 100	18.75 to 92.19
t(p) or *z(p)*		*t* = 3.21 (.003)		*t* = 1.43 (.16)	
DCS-N #1					
M±SD	86.41±20.21	93.48±13.52	79.35±23.42	90.18±17.13	80.56±23.57
Range	25 to 100	50 to 100	25 to 100	50 to 100	25 to 100
t(p) or *z(p)*		*z* = -2.30 (.02)		*z* = -1.52 (.13)	
PDA					
M±SD	32.46±6.48	34.22±55.5	30.79±6.99	34.44±5.79	29.50±6.48
Range	21 to 42	25 to 42	21 to 42	24 to 42	21 to 41
t(p) or *z(p)*		*t* =1.84 (.07)		*t* = -2.63 (.01)	
PDA (Ch)					
M±SD	26.0±4.20	27.38±3.64	24.80±4.24	25.98±3.65	26.26±4.87
Range	14 to 37	20 to 37	14 to 32	14 to 30	20 to 37
t(p) or *z(p)*		*t* = 2.21 (.03)		*t* = -0.22 (.83)	

Note: Comparisons are independent t-test, *t(p)* or Mann-Whitney U test, *z(p)*.

Similar to Blanchard (2008), sole and couple drivers were also compared and presented in Table 4.6. Couple drivers had significantly higher DCS-D, DCS-N, DCS-N#1 and PDA (p< .05) scores, as well as lower SDA scores (p = .005). No significant differences in perception scores were found for the new versus the repeat samples. Perceived comfort and abilities scores were significantly related as shown in Table 4.7.

Table 4.6. **Perceptions and Self-restrictions by Household Driver Status (N = 46)**

Scores and Ratings	Sole Driver (n = 23)	Couple Driver (n = 23)	Comparison(*p*)
DCS-D	64.72±17.98 36.54 to 92.31	76.51±14.24 44.23 to 100	z = -2.23 (.03)
DCS-N	49.52±25.13 18.75 to 90.63	66.76±17.29 37.5 to 100	t = 2.71 (.01)
DCS-N#1	79.35±23.42 25 to 100	93.48±13.52 50 to 100	z = -2.30 (.02)
PDA	30.10±6.50 21 to 42	34.91±5.61 25 to 42	t = 2.69 (.01)
SDF	32.09±6.31 19 to 47	35.18±6.59 24 to 51	t = 1.63 (.11)
SDA	7.96±4.16 0 to 16	4.70±3.35 0 to 10	t = -2.93 (.005)

Note: Values are *Mean±S.D.*, *range*. Comparison are independent *t*-test, *t(p)*, and Mann-Whitney U test, *z(p)*. Scores/ratings missing for 87 y.o. man.

Table 4.7. Correlations between Perception Scores (N = 46)

Tools	DCS-D	DCS-N	DCS-N#1	PDA	PDA Change
DCS-D		.86***	.55***	.64***	.38**
DCS-N	.86***		.75***	.69***	.41**
DCS-N#1	.55***	.75***		.70***	.51***
PDA	.64***	.69***	.70***		.41**
PDA Change	.38**	.41**	.51***	.41**	

Note: Correlations are Pearson r(*p*), or Spearman Rank rho (*p*) for DCS-D and DCS-N# 1. Scales missing for one male. * *p* <.05; ** *p* <.01; *** *p* <.001

4.5 Self-reported Driving Behaviour

Self-reported driving behaviour was assessed via the DHQ, interview and the SDF and SDA scales. As shown in Table 4.8, participants reported driving on average marginally less in the winter. Younger (versus older) and the new (versus repeat) subjects reported driving significantly more days in the winter (z = -1.96, p = .05 and z = -2.01, p = .04, respectively). Actual winter driving patterns, however, did not differ significantly for new versus repeat participants. The younger group was also more likely to change to snow tires during the winter (*p*=.003), although only a third of the sample reported this practice.

Table 4.8. Usual Driving Patterns (N = 46)

	Total Sample	Gender		Age Group	
		Male (n = 23)	Female (n = 23)	Under 80 (n = 28)	80 & Over (n = 18)
Days driven/wk					
Winter [a]	5.13±1.50 2 to 7	5.57±1.24 3 to 7	4.68±1.64 2 to 7	5.50±1.26 3 to 7	4.53±1.70 2 to 7
Missing	1	0	1	0	1
Spring-fall	5.70±1.38 2 to 7	5.95±1.20 3 to 7	5.42±1.54 2 to 7	5.78±1.45 2 to 7	5.54±1.27 3 to 7
Missing	5	1	4	1	4
Trip length (1 way)					
Less than 15 min	10 (21.7)	3 (13.0)	7 (30.4)	6 (21.4)	4 (22.2)
15 to 30 min	28 (60.9)	16 (69.6)	12 (52.2)	16 (57.1)	12 (66.7)
30 to 60 min	4 (8.7)	3 (13.0)	1 (4.3)	3 (10.7)	1 (5.6)
Over 60 min	4 (8.7)	1 (4.3)	3 (13.0)	3 (10.7)	1 (5.6)
Types of Roads [c]					
Residential Streets	45 (97.8)	22 (95.7)	23 (100)	27 (96.4)	18 (100)
Main City Streets	44 (95.7)	22 (95.7)	22 (95.7)	27 (96.4)	17 (94.4)
Highways	36 (78.3)	19 (82.6)	17 (73.9)	23 (82.1)	13 (72.2)
Freeways [b]	35 (76.1)	22 (95.7)	13 (56.5)	21 (75.0)	14 (30.4)
Rural Roads	27 (58.7)	16 (69.6)	11 (47.8)	16 (57.1)	11 (61.1)
Time of day [c]					
Morning driving	44 (95.7)	23 (100)	21 (91.3)	27 (96.4)	17 (94.4)
Afternoon driving	44 (95.7)	21 (91.3)	23 (100)	27 (96.4)	17 (94.4)
Evening driving	42 (91.3)	21 (91.3)	21 (91.3)	26 (92.9)	16 (88.9)
Night driving	31 (67.4)	18 (78.3)	13 (56.5)	20 (71.4)	11 (61.1)

Note: Values are presented as *frequency (valid percent)*, or *Mean±S.D., range*. Comparisons are Chi-square test, $\chi^2(p)$, independent *t*-test, *t(p),* or Mann-Whitney U, *z(p)*. Data missing for an 87 y.o. man. [a] Age difference; [b] Gender difference; [c] More than 1 possible response/person.

Most (96%) drove at various times of the day (morning, afternoon and evening), but only 67% said that they usually drove at night. Primarily, subjects drove on residential (98%) and main city streets (96%), with trips typically lasting 15 to 30 minutes each way (61%). Men were more likely to report driving on freeways (*p* = .002).

Self-reported restrictions scores, measured by the Situational Driving Frequency (SDF) and Avoidance (SDA) scales are presented in Table 4.9. Women reported driving less often in challenging situations (significantly lower SDF scores; $t = 5.03$, $p < .001$) and greater avoidance (higher SDA scores, $t = -4.18$, $p < .001$) than men. The older age group had lower SDF and higher SDA scores, although differences were not significant. Concerning the new and repeat sub-groups, SDA scores were comparable but the new sample had significantly higher SDF scores ($t = -2.01$, $p = .04$). The self-regulatory measures were also examined with the perception tools. Scores on the SDF were positively related to DCS and PDA scores, and inversely related to SDA scores as shown in Table 4.10.

Table 4.9. Situational Driving Frequency and Avoidance Scores (N = 46)

	Total Sample	Gender		Age	
		Male (n = 23)	Female (n = 23)	Under 80 (n = 28)	80 & Over (n = 18)
SDF					
M±SD	33.52±6.54	37.56±5.48	29.71±5.10	34.90±6.05	31.67±7.03
Range	19 to 51	30 to 51	19 to 41	24 to 51	19 to 47
t(p)		5.03 (*p* < .001)		1.61 (.12)	
SDA					
M±SD	6.33±4.08	4.17±2.99	8.48±3.93	5.46±3.71	7.67±4.38
Range	0 to 16	0 to 10	0 to 16	0 to 11	0 to 16
t(p)		-4.18 (*p* < .001)		-1.77 (.09)	

Note: Comparisons are independent t-test, *t(p)*. Data missing for an 87 y.o. man.

Table 4.10. Correlations between Perception and Restriction Scores (N = 46)

Tools	DCS-D	DCS-N	DCS-N#1	PDA	PDA (Change)	SDF	SDA
SDF	.44**	.53***	.37*	.34*	.24		-.52***
SDA	-.65***	-.66***	-.55***	-.63***	-.32*	-.52***	

Note: Correlations are Pearson r(p). Scales missing for one man.**p*<.05; ***p*<.01; ****p*<.001

4.6 Participant Experiences

Before presenting findings on actual driving behaviour, it is important to consider the sample's experiences. During the interview, each person was asked if the devices affected their driving. As shown in Table 4.11, everyone said no, although several mentioned that the messages from the Otto (“on/off” and “outside coverage area”) were annoying. Three people had car problems over the period (two had flat tires and one had a dead battery), while four reported driving problems (three had near misses and one got lost due to a detour).

The majority (80%, both new and repeat subjects) said their driving was typical over the two-week period. Five said they drove less, four said more, and one did not provide further explanation. About a third of the sample (37%,) reported special circumstances, primarily out-of-town trips (n=9), event such as funerals (n=7) and driving family or friends (n=5). One-fifth said that they did not take a planned trip due to an event being canceled (n=5), poor driving conditions (n=2) or a change in priorities (n=1). Notwithstanding, everyone in the sample said they still did their scheduled weekly activities. Additional results from the interview can be found in **Appendix H**.

Table 4.11. Reported Study Experiences (N = 46)

Interview Questions	Total Sample	Gender		Age Group	
		Male (n = 23)	Female (n = 23)	Under 80 (n = 28)	80 & Over (n =18)
A1. Devices affect driving?					
Yes	0	0	0	0	0
No	46 (100)	23 (100)	23 (100)	28 (100)	18 (100)
A3. Car/driving problems?					
Yes	7 (15.2)	3 (13.0)	4 (17.4)	2 (7.1)	5 (27.8)
No	39 (84.8)	20 (87.0)	19 (82.6)	26 (92.9)	13 (72.2)
A4. Last 2 weeks typical?					
Yes	37(80.4)	18 (78.3)	19 (82.6)	23 (82.1)	14 (77.8)
No	9 (19.6)	5 (21.7)	4 (17.4)	5 (17.9)	4 (22.2)
If no, what was different?					
Drove less	5	2	3	2	3
Drove more	3	3	0	3	0
Missing	1	0	1	0	1
A5. Special circumstances?					
No	29 (63.0)	15 (65.2)	14 (60.9)	20 (71.4)	9 (50.0)
Yes	17 (37.0)	8 (34.8)	9 (39.1)	8 (28.6)	9 (50.0)
If yes, specify					
Outside K-W (i.e.,Toronto)	9	5	4	7	2
One-time events (i.e., funeral)	7	3	4	3	4
Drove family/friends	5	0	5	2	3
Medical emergency	1	0	1	0	1
Loan car	1	1	0	1	0
Drop-off/Stored car	1	0	1	0	1
Vehicle servicing	1	1	0	1	0
A6. Scheduled activities?					
Yes	46 (100)	23 (100)	23 (100)	28 (100)	18 (100)
No	0	0	0	0	0
A7. Any trips not taken?					
No	37 (80.4)	19 (82.6)	18 (78.3)	21 (75.0)	16 (88.9)
Yes	9 (19.6)	4 (17.4)	5 (21.7)	7 (25.0)	2 (11.1)
If yes, reasons					
Event cancelled	5	1	4	5	0
Poor conditions	2	1	1	1	1
Change of priorities	1	1	0	0	1
Missing	1	1	0	1	0

Note: Values are presented as *frequency (valid percent)*, or *Mean±S.D., range*.

4.7 Actual Driving Behaviour

As previously noted, Otto data was used to calculate radius from home while the CarChip was used to examine all other driving indicators. Missing data was described in section 4.2. Except for distance and radius, all other indicators were normally distributed. In order to compare the findings to prior (one-week) studies (Blanchard's and Porter's), driving data was averaged over the two weeks, unless otherwise indicated.

As shown in Table 4.12, participants drove on average 5 days per week, making about 1.5 trips per day and 2.3 stops per trip. The longest trip was 385 km taking 5 hr and 14 min, while the trip with the longest duration was 5 hr 52 min (248.7 km). The average radius (distance from home) of trips was 7 km, ranging from 1.9 to 26.5 km.

Men drove more days (t = -2.31, p = .02), took more trips (t = 3.40, p = .001) and made more stops (t = 3.47, p = .001) than women. They also drove greater distance (z = -4.31, p < .001), duration (z = 4.96, p < .001), and further from home (average radius: z = -2.70, p = .007, maximum radius: z = -2.53, p = .007). No significant differences between the age groups or new versus repeat participants emerged.

Weekday and weekend driving patterns are presented in Table 4.13. The sample drove more km on weekends than weekdays (z = -1.99, p = .05, when adjusted for number of days), particularly Saturdays (M = 23.8±44.4 km). The least amount of driving was on Mondays (M = 15.9±18 km). Distance driven by day of week (i.e., Monday to Sunday) can be found in **Appendix I** along with other additional driving results (e.g., for each day and two-week cumulative data).

Table 4.12. Selected Driving Results

Indicators	Total Sample	Gender		Age Group	
		Male (n = 24)	Female (n = 22)	< 80 (n = 28)	80 & Over (n = 18)
#Days	4.88±1.48 1.5 to 7	5.38±1.23 3 to 7	4.34±1.56 1.5 to 7	4.88±1.46 1.5 to 7	4.89±1.54 1.5 to 7
#Trips	7.30±3.42 1.5 to 14	8.77±3.41 3 to 14	5.70±2.67 1.5 to 11.5	7:55±3.42 1.5 to 14	6.92±3.47 1.5 to 13
#Segments	24.12±11.66 4 to 54	29.40±11.49 11 to 54	18.36±8.96 4 to 33	25.04±11.85 4 to 54	22.69±11.55 4 to 43
#Stops	16.52±8.25 2.5 to 40	20.15±8.40 6.5 to 40	12.57±6.11 2.5 to 24	17.18±8.33 2.5 to 40	15.50±8.26 2.5 to 29.5
Distance (km)	156.64±108.84 22.65 to 466.05	217.86±112.68 44.20 to 466.05	89.85±50.19 22.65 to 188.20	164.79±106.74 28.05 to 466.05	143.96±113.93 22.65 to 463.45
Duration (hr:min)	4:30±2:29 0:52 to 10:15	5:53±2:24 1:27 to 10:15	2:59±1:30 0:52 to 5:49	4:42±2:25 0:52 to 10:15	4:11±2:37 1:02 to 9:37
Radius (Avg)	6.95±5.74 1.89 to 26.46	8.56±5.92 2.97 to 20.49	5.50±5.29 1.89 to 26.46	7.28±5.80 2.90 to 26.46	6.47±5.80 1.89 to 20.49
Radius (Max)	18.04±18.33 2.42 to 80.78	24.91±21.45 6.45 to 80.78	11.83 to 12.46 2.42 to 49.48	21.16±21.14 3.76 to 80.78	13.36±12.21 2.42 to 42.52

Note: Values presented are *Mean±S.D.*, *range*. Comparisons are independent *t*-tests, *t(p)*, or Mann-Whitney U, *z(p)*. Data based on N=46, except for radii (N = 40). Gender differences found for all indicators.

Table 4.13. Driving Patterns by Weekday and Weekend (N = 46)

When	Total Sample	Gender		Age Group	
		Male (n = 24)	Female (n = 22)	< 80 (n = 28)	80 & Over (n = 18)
Weekday					
Trips/day [a,b]	1.12±0.92 0 to 4	1.38±0.97 0 to 4	0.85±0.77 0 to 4	1.22±0.92 0 to 4	0.94±0.88 0 to 4
Distance[a,b] (km)	21.81±27.83 0 to 248.7	30.55±32.81 0 to 248.7	12.27±16.54 0 to 113.1	25.77±30.64 0 to 248.70	14.37±19.64 0 to 136.3
Duration[a,b] (hr:min)	0:40±0:41 0 to 5:52	0:52±0:46 0 to 5:52	0:26±0:28 0 to 1:59	0:45±0:44 0 to 5:52	0:29±0:31 0 to 2:24
Weekend					
Trips/day [a]	0.84±0.81 0 to 3	0.95±0.87 0 to 3	0.72±0.72 0 to 2	0.83±0.81 0 to 3	0.86±0.80 0 to 3
Distance [a,b] (km)	23.80±44.43 0 to 385.4	32.57±51.73 0 to 385.4	14.24±32.47 0 to 218.3	24.47±47.85 0 to 385.4	22.55±37.53 0 to 173.1
Duration [a] (hr:min)	0:34±0:44 0 to 5:14	0:45±0:48 0 to 5:14	0:23±0:35 0 to 3:51	0:35±0:46 0 to 5:14	0:34±0:40 0 to 2:37

Note: Values are *Mean±S.D., range*. Comparisons are Mann-Whitney U test, *z(p)* for distance and independent *t*-test, *t(p)*, for trips/day and duration. Data missing for an 81 y.o. woman. [a] Gender difference; [b] Age difference.

Participants were also categorized based on their average driving distance over the two weeks into low- (<57.7km), middle- (57.7 to 269.2 km) or high-mileage (> 269.2 km) groups, similar to Blanchard (2008). Only 20% (n=9) were low-mileage drivers. The majority (67% or n=31) fell into the middle category, while the remaining 13% (n=6) fell into the high-mileage group. Interestingly, the high-mileage drivers were all men while the low-mileage were mainly women (p = .01).

Indicators of driving exposure were also examined by household driver status, as shown in Table 4.14. Couples drove slightly more than sole drivers although differences were not significant.

Table 4.14. Driving Indicators by Household Driver Status

Indicators	Sole (n = 23)	Couple (n = 23)	Comparison(*p*)
#Day of driven	4.83±1.56 1.5 to 7	4.93±1.42 1.5 to 7	*t* = -0.25 (.81)
#Trips	6.52±3.17 1.5 to 13	8.09±3.55 1.5 to 14	*t* = -1.58 (.12)
#Stops	14.80±7.44 2.5 to 29.5	18.24±8.82 2.5 to 40	*t* = -1.43 (.16)
Distance (km)	137.91±101.99 22.65 to 463.45	175.37±114.43 28.05 to 466.05	*z* = -1.24 (.22)
Duration (hr:min)	04:04±02:17 01:02 to 09:37	04:56 ±02:39 0:52 to 10:15	*t* = -1.07 (.29)
Radius (Avg)	6.15±5.24 1.89 to 20.49	7.93±6.31 3.03 to 26.46	*z* = 0.12 (-1.56)
Radius (Max)	13.73±13.37 2.42 to 49.48	23.32±22.27 4.21 to 80.78	*z* = 0.12 (.13)

Note: Values presented are *Mean±S.D.*, *range*. Comparisons are independent *t*-tests, *t(p)*, or Mann-Whitney U, *z(p)*. Data based on N=46 (missing CarChip for an 81 y.o. woman), except for radius (N=40; sole=22, couple=18).

4.8 Weather during the Study Period

4.8.1 Descriptive Information

As shown in Table 4.15, average daylight was shortest in the month of December and longest in March. January had the greatest number of cold days (13/20 or 65%) and received the most snow (62 cm). Although inclusion of the fourth wave (i.e., March) significantly increased the average amount of daylight by 25 minutes, March still exhibited winter characteristics (i.e., snowfall and cold temperatures). Of the 94-day study period, 20 were categorized as very cold (when temperature dropped to -15^{o}C or lower), while 17 had weather advisories for extreme conditions (e.g., snowstorms). Table 4.16 shows the total number of days with inclement weather and poor road conditions for each month. Conditions can also be viewed by monthly calendars (**Appendix D**).

Table 4.15. Daylight and Weather by Month

Month	Average Daylight (hr:min:sec)	# Cold Days (≤ -15°C)	Accumulated Snow (cm)	Weather Advisories
Nov/08	9:18:26	0	8.50	3
Dec/08	9:02:22	1	34.30	3
Jan/09	9:25:13	13	62.00	9
Feb/09	10:17:32	3	17.50	2
Mar/09	11:48:23	3	0.60	0
Total	**N/A**	**20**	**122.9**	**17 days**
Average	**9:58:23**	**4**	**24.6**	**3.4**

Note: Days with no monitoring (i.e., between waves) were excluded.

Table 4.16. Days with Inclement Weather and Poor Road Conditions

Conditions	Number of Days of Monitoring per Month				
	Nov/08 (7 days)	Dec/08 (18 days)	Jan/09 (26 days)	Feb/09 (19 days)	Mar/09 (24 days)
Weather					
Inclement	**7**	**14**	**18**	**7**	**7**
Snow	5	12	18	4	2
Rain	2	2	0	2	4
Fog & Rain	0	0	0	1	1
Clear	**0**	**4**	**8**	**12**	**17**
Roads					
Poor	**7**	**16**	**21**	**12**	**7**
Snow-covered	3	6	14	1	0
Slush-covered	0	3	3	0	0
Wet/damp	2	1	0	0	1
Icy	2	6	4	11	6
Clear/dry	**0**	**2**	**5**	**7**	**17**

Note: Data excludes days with no monitoring (i.e., between waves).

4.8.2 Influence of Winter Conditions on Driving

Of the 94-day study period, 53 days (or 56%) had inclement weather. More specifically, it snowed on 41 days (77%), rained on 10 (19%), and there was rain and fog on 2 days (4%). Poor road conditions occurred on 63 (67%) of the 94-day study period.

As there were 46 subjects in the sample, each with 14 days of monitoring, there were 644 days or opportunities (46 x 14) for people to either drive or not drive. Approximately half

(297 or 46%) of these instances had clear weather, while the other half (347 or 54%) had inclement weather, predominantly snowfall (264/644 or 41% of total instances). As shown in Table 4.17, participants were more likely to drive (69% of the time) than not drive (31% of the time) on the days with poor weather. Conversely, on days with favorable weather, the sample drove 71% of the time and did not drive 29% of the time. Chi-square comparisons were not significant. Also shown in the table are instances of weather advisories and cold days. Participants drove on 67% of the instances with advisories and 23% (i.e., 149/644) of cold days. Although chi-square analyses were not significant, generally the sample was more likely to drive than not drive on bad days.

Women were more likely to drive on cold days ($\chi^2 = 4.71$, $p = .03$), and days with advisories ($\chi^2 = 4.56$, $p = .03$) than men. However, they were less likely to drive on days with snow or rain (not significant). Adults 80+ were also more likely to drive on cold days ($\chi^2 = 4.51$, $p = .03$), compared to their younger counterparts.

As shown in Table 4.18, almost 70% of the period had poor road conditions (447/644 instances). Poor conditions comprised wet or damp (38% or 245/644), snow-covered (22% or 141/644), slush-covered (7% or 44/644) and icy (3% or 17/644) roads. Similar to the findings with weather, participants were more likely to drive (70%), than not drive (30%) on days with poor road conditions. However, the older group drove significantly less on poor roads ($\chi2 = 6.63$, p = .01), and did more of their driving on clear roads ($\chi2 = 6.63$, p = .01). No significant gender differences emerged.

Table 4.17. Days Driven and Not Driven by Weather Conditions

Weather	Opportunities (644 total)	Gender		Age Group	
		Male (n = 24)	Female (n = 22)	Under 80 (n = 28)	80 & Over (n = 18)
Inclement	**347/644 (53.9)**	**184/347 (53.0)**	**163/347 (47.0)**	**243/347 (70.0)**	**104/347 (30.0)**
Drove	**240/347 (69.2)**	**140/184 (76.1)**	**100/163 (61.3)**	**172/243 (70.8)**	**68/104 (65.4)**
Snow	189/264 (71.6)	109/189 (57.7)	80/189 (42.3)	136/191 (71.2)	53/73 (72.6)
Rain	39/62 (62.9)	26/39 (66.7)	13/39 (33.3)	26/39 (66.7)	13/23 (56.5)
Fog	12/21 (57.1)	5/12 (41.7)	7/12 (58.3)	10/13 (76.9)	2/8 (25)
Did not drive	**107/347 (30.8)**	**44/184 (23.9)**	**63/163 (38.7)**	**71/243 (29.2)**	**36/104 (34.6)**
Snow	75/264 (28.4)	29/75 (38.7)	46/75 (61.3)	55/191 (28.8)	20/73 (27.4)
Rain	23/62 (37.1)	9/23 (39.1)	14/23 (60.9)	13/39 (33.3)	10/23 (43.5)
Fog	9/21 (42.9)	6/9 (66.7)	3/9 (33.3)	3/13 (23.1)	6/8 (75)
Favourable	**297/644 (46.1)**	**152/297 (51.2)**	**145/297 (48.8)**	**177/297 (59.6)**	**120/297 (40.4)**
Drove	210/297 (70.7)	119/152 (78.3)	91/145 (62.8)	128/177 (72.3)	81/120 (67.5)
Did not drive	87/297 (29.3)	33/152 (21.7)	54/145 (37.2)	49/177 (27.7)	39/120 (32.5)
Advisory	**99/644 (15.4)**	**42/99 (42.4)**	**57/99 (57.6)**	**61/99 (61.6)**	**38/99 (38.4)**
Drove [a]	66/99 (66.7)	30/66 (45.5)	36/66 (54.5)	44/66 (66.7)	22/66 (33.3)
Did not drive	33/99 (33.3)	12/33 (36.4)	21/33 (63.6)	17/33 (51.5)	16/33 (48.5)
Cold Days	**149/644 (23.1)**	**62/149 (41.6)**	**87/149 (58.4)**	**89/149 (59.7)**	**60/149 (40.3)**
Drove [a, b]	100/149 (67.1)	48/100 (48.0)	52/100 (52.0)	58/100 (58.0)	42/100 (42.0)
Did not drive	49/149 (32.9)	14/49 (28.6)	35/49 (71.4)	31/49 (63.3)	18/49 (36.7)

Note: Values are instances of driving or no driving, presented as *Frequencies (valid percent)*. Missing driving data for an 81 y.o. woman. [a] Gender difference; [b] Age difference.

Table 4.18. Days Driven and Not Driven by Road Conditions

Road Conditions	Instances in Study Period (644 total)	Gender		Age Group	
		Male (n = 24)	Female (n = 22)	Under 80 (n = 28)	80 & Over (n = 18)
Poor conditions	**447/644 (69.4)**	**229/447 (51.2)**	**218/447 (48.8)**	**308/447 (68.9)**	**139/447 (31.1)**
Drove	**311/447 (69.6)**	**175/229 (76.4)**	**136/218 (62.3)**	**219/308 (71.1)**	**91/139 (65.5)**
Snow	91/141 (64.5)	46/91 (50.5)	45/91 (49.5)	61/91 (67.0)	30/91 (33.0)
*Slush**	33/44 (75.0)	19/33 (57.6)	14/33 (42.4)	27/33 (81.8)	6/33 (18.2)
Icy	11/17 (64.7)	8/11 (72.7)	3/11 (27.3)	9/11 (81.8)	2/11 (18.2)
Wet/Damp	176/245 (71.8)	102/176 (58.0)	74/176 (42.0)	123/176 (69.9)	53/176 (30.1)
Did not	**136/447 (30.4)**	**54/229 (23.6)**	**82/218 (37.6)**	**89/308 (28.9)**	**48/139 (34.5)**
Snow	50/141 (35.5)	20/50 (40.0)	30/50 (60.0)	35/50 (70.0)	15/50 (30.0)
Slush	11/44 (25.0)	4/11 (36.4)	7/11 (63.6)	8/11 (72.7)	3/11 (27.3)
Icy	6/17 (35.3)	3/6 (50.0)	3/6 (50.0)	3/6 (50.0)	3/6 (50.0)
Wet/Damp	69/245 (28.2)	27/69 (39.1)	42/69 (60.9)	42/69 (60.9)	27/69 (39.1)
Clear/Dry	**197/644 (30.6)**	**107/197 (54.3)**	**90/197 (45.7)**	**112/197 (56.9)**	**85/197 (43.1)**
Drove [a]	139/197 (70.6)	84/107 (78.5)	55/90 (61.1)	81/112 (72.3)	58/85 (68.2)
Did not	58/197 (29.4)	23/107 (21.5)	35/90 (38.9)	31/112 (27.7)	27/85 (31.8)

Note: Values are instances of driving or no driving, presented as *Frequencies (valid percent)*. Missing driving data for an 81 y.o. woman. * Significant age group difference.

4.8.3 Night Driving

As previously shown (Table 4.15), December had the least amount of daylight (average 9 hours), while March had the most (nearly 12 hours). To examine the influence of restricted daylight on night driving, the average distance (km) driven at night was compared by month. As shown in Table 4.19, participants drove the most at night in December and the least in March. The overall Kruskal-wallis comparison was significant (p = .05). Two pairwise comparisons approached significance (α=.01): December versus March (z = 34, p = .02), and February versus March (z = 38, p = .03).

Table 4.19. Night Kilometers by Study Period Month (N = 46)

	December (n = 12)	**January (n = 9)**	**February (n = 12)**	**March (n = 13)**
Night distance				
Mean±S.D.	49.56±58.50	22.69±24.80	39.00±37.92	12.74±14.81
Range	4.65 to 215.85	3.34 to 76.55	2.67 to 112.60	0 to 42.25

Note: Comparison was Kruskal-wallis: H=8.05 (p=.05)

As shown in Table 4.20, the sample drove on average about one trip, twice a week. Comparatively, women and the older group drove less at night. One significant difference emerged: men drove more km at night than women (t = -2.20, p = .03). Night driving indicators were also examined by household driver status. As shown in Table 4.21, sole and couple drivers had comparable night driving patterns.

Table 4.20. Night Driving Exposure (N = 46)

Night Indicators	Total Sample	Gender		Age Group	
		Male (n = 24)	Female (n = 22)	Under 80 (n = 28)	80 & Over (n = 18)
#Nights	1.85±1.49 0 to 6	2.19±1.47 0 to 6	1.48±1.45 0 to 4.5	1.98±1.42 0 to 4.5	1.64±1.60 0 to 6
#Trips	1.93±1.61 0 to 6.5	2.25±1.57 0 to 6.5	1.59±1.61 0 to 5	2.09±1.56 0 to 5	1.69±1.69 0 to 6.5
Distance [a] **(km)**	31.15±39.68 0 to 215.85	40.34±45.54 0 to 215.85	21.11±30.01 0 to 112.6	31.92±29.40 0 to 112.6	29.94±52.86 0 to 215.85
Duration (hr:min)	0:51±0:54 0 to 4:33	1:03±1:00 0 to 4:33	0:38±0:44 0 to 2:20	0:54±0:44 0 to 2:22	0:46±1:08 0 to 4:33

Note: Values presented as *frequencies (valid percent)*, or M*ean±S.D., range*. Data missing for an 81 y.o. woman. [a] Gender difference: independent *t*-test = -2.20, $p = .03$

Table 4.21. Selected Driving Indicators (N = 46)

Night Indicators	Sole Driver (n = 23)	Couple Driver (n = 23)	Comparison(*p*)
#Nights	1.85±1.77 0 to 6	1.85±1.18 0 to 4	z = -0.71 (.48)
#Trips	1.96±1.92 0 to 6.5	1.91±1.26 0 to 4.5	z = -0.70 (.49)
Distance (km)	30.79±49.37 0 to 215.85	31.50±28.00 0 to 112.6	z = -1.51 (.13)
Duration (hr:min)	0:52±01:07 0 to 4:33	0:50±0:38 0 to 02:22	z = -1.02 (.31)

Note: Values presented are *Mean±S.D., range*. Comparisons are independent *t*-tests, *t(p)*, or Mann-Whitney U, *z(p)*. Data missing for an 81 y.o. woman.

4.8.4 Reported versus Actual Avoidance

In Table 4.22, reported avoidance of certain driving situations (SDA items) is compared to whether they actually drove or not in the corresponding situation. Comparisons were only possible for 45 people (i.e., as one subject had no driving data, while another was missing the SDA). Forty people drove at night, although 28% of them said they tried to avoid night driving (SDA item#1). The majority of those who drove during poor weather (i.e., bad weather, fog, bad weather at night) reported avoiding such conditions as part of their usual practices. Kappa, used to calculate agreement, was insignificant for all four comparisons.

Table 4.22. Self-reported versus Actual Instances of Situational Avoidance

Driving Situation	Self-report (try to avoid)	Actual Behaviour		Kappa(*p*)
		Did not drive	Drove	
SDA#1: Night	No = 32	3	29	.04 (.56)
(n=45)	Yes = 13	2	11	
		5	*40*	
SDA#3: Bad weather *	No = 11	1	10	-.06 (.67)
(n=32)	Yes = 21	3	18	
		4	*28*	
SDA#5: Fog	No = 6	2	4	-.15 (.49)
(n=20)	Yes = 14	7	7	
		9	*11*	
SDA#6: Bad weather at night*	No = 11	2	9	-.11 (.46)
(n=45)	Yes = 34	10	24	
		12	*33*	

Note: Data exclude subjects who did not have driving opportunities in the given conditions (e.g., Item#5: excluded 25 subjects who did not have driving opportunities in fog). *****Self-report compared to actual driving behaviour on days with weather advisories (for item#3) and all inclement weather at night (for item#6).

4.8.5 Trip Purposes and Cancellations

Trip purposes, as described in the logs, were grouped into 10 categories similar to Blanchard (2008), as shown in Table 4.23. The "other" category comprised activities that appear to have a higher level of commitment such as driving someone to the hospital, funerals, and visiting an ill relative or friend. Instances with no trip purposes recorded (n = 29) were grouped into the "missing" category. When examined by driving instances, half of the trips were for shopping and running errands (50%), followed by social and entertainment (33%) and helping others (15%), e.g., picking up someone.

Table 4.23. Driven Trip Purposes (N = 46)

Categories	Inclusions	Instances* (Total=644)
Shopping and errands	Grocery or other type of shopping, banking,, pharmacy, gas, banking, haircut, etc.	327 (50.3)
Social and entertainment	Movies, visiting others, coffee or eating with others, eating out alone, plays, movies, playing cards, gallery, shopping as a social event (with others), club meetings, video store, library, events (i.e., showers, weddings).	211 (32.8)
Helping others	Take someone shopping or shopped for others, ran errands for others, drove to appointment or hospital, picked up/dropped off someone, house-sitting or maintenance.	97 (15.1)
Active leisure	Fitness classes, gym, hockey, hiking, skiing, bowling.	57 (8.9)
Religious	Going to church, bible studies, church choir.	44 (6.8)
Paid work or classes	Full- or part-time paid work, school or lecture series (term registration).	40 (6.2)
Medical	For self or spouse: doctor, optometrist/eye, physiotherapist, chiropractor, dentist, massage.	38 (5.9)
Volunteer work	Organized work done for others that was unpaid, including meetings.	34 (5.3)
Other	Funerals, cemetery visit, nursing home visits, car emergency (i.e., flat tire), visiting an ill relative/friend (in hospital, nursing home), vote.	23 (3.6)
Out-of-town trips	Trips outside town of residence.	20 (4.4)
Missing	CarChip data with no corresponding log entry for trip purpose. Round trips with no stops (i.e., forgot item at home).	29 (4.5)

Note: Values presented are *Frequencies (valid percent)*. Data missing for an 81 y.o. woman. *Number of instances with trip purposes (multiple responses possible).

When asked in the interview if there were any activities over the period they felt compelled to do (even though they may not have felt like doing so), only four people said yes. Two mentioned helping others (delivering groceries and giving rides), one said attending a family event, and the last said buying groceries. When asked why they might cancel or postpone driving, 85% said poor weather, while 37% said if they were not feeling well. Other reasons for cancelling or postponing were: scheduling conflicts (13%), emergencies (4%), and car problems (2%). Two subjects (i.e., 91 y.o. man and 77 y.o. woman, both sole drivers) said that there was nothing that would persuade them to cancel or postpone planned trips.

Finally, trip purposes were each examined by weather and road conditions. The sample as a whole were more likely to take trips related to social and entertainment on days with clear weather (χ^2 = 9.18, p = .002) and out-of-town trips on days with favourable road conditions (χ^2 = 5.70, p = .02). Driving on days with weather advisories was less likely for social and entertainment (χ^2 = 8.32, p = .004), but more likely for work (χ^2 = 5.78, p = .02).

4.9 Consistency of Driving Over the Two Weeks

Consistency of driving was similar for many driving indicators as shown in Table 4.24. Paired *t*-tests showed no systematic differences between the weeks. The ICC's supported these results. A high level of consistency (ICC $\geq$.70) emerged for all variables, except night distance and radius. Values .70 and greater are generally considered evidence of good reliability (Bédard et al., 2000).

Although the mean number of nights driven was not significantly different between weeks 1 and 2, 10 people did not drive at night at all in their first week, while 15 did not do so in their second week. However, only 5 people (~ 11% of the sample) did not drive at least once at night over the full two-week monitoring period, as shown in **Appendix I**.

Table 4.24. Comparison of Week 1 and Week 2 Driving Data

Indicators	N	Week 1	Week 2	Paired *t(p)* or Wilcoxin *z(p)*	ICC's (3,k)
# Days	46	4.89±1.40 2 to 7	4.87±1.89 0 to 7	*t*=.096 (.92)	**.73**
Distance (km) *	46	146.30±107.11 25.5 to 477.5	168.84±146.75 0 to 554.6	*z*=-1.043 (.29)	**.73**
Duration hr:min:sec	46	4:21:59±2:22:44 0:53:59 to 10:14:23	4:38:44±3:07:10 0 to 12:46:12	*t*=.-.770 (.45)	**.76**
#Trips	46	7.27±3.18 2 to 15	7.34±4.02 0 to 15	*t*=.-.183 (.86)	**.88**
#Segments	46	23.72±11.07 5 to 57	24.52±13.87 0 to 51	*t*=.-.587 (.56)	**.84**
#Stops	46	16.09±8.15 3 to 41	16.96±9.75 0 to 39	*t*=.-.832 (.41)	**.82**
#Nights*	46	1.89±1.59 0 to 6	1.80±1.77 0 to 6	*z*=-.308 (.76)	**.72**
Night km*	46	30.70±45.67 0 to 249.99	31.59±46.58 0 to 225.2	*z*=-.965 (.33)	.65
Night Duration*	46	0:51:19±1:01:59 0 to 5:17:35	0:51:15±0:59:48 0 to 3:48:25	*z*=-.693 (.49)	**.75**
Night Trips*	46	2.02±1.77 0 to 7	1.85±1.84 0 to 6	*z*=-.757 (.45)	**.74**
Radius Ave*	40	15.65±18.55 2.43 to 95.56	20.43±30.87 0 to 128.26	*z*=-.551 (.58)	.07
Radius Max*	40	6.16±5.38 1.52 to 24.38	7.27±8.40 0 to 44.19	*z*=-.229 (.82)	.28

Note: Values presented as *Mean±S.D., ranges*.
*****Not normally distributed (Spearman Rho versus Pearson used here).

4.10 Associations between Perceptions and Driving Behaviour

As shown in Table 4.25, DCS-N scores were significantly associated with all driving exposure variables (except days driven) suggesting night comfort is predictive of driving behaviour (i.e., more trips, greater distance and duration, increased radius and more night driving). Additionally, distance driven from home (including at night) and radius (i.e., average and max) was significantly associated with perceived abilities and night driving comfort in good weather and road conditions (DCS-N#1). Additionally, self-reported driving frequency was positively associated with all driving indicators, while self-reported driving avoidance was negatively associated with all driving indicators.

Table 4.25. Associations between Perceptions, Usual Restrictions and Actual Driving

Indicators	DCS-D	DCS-N	DCS-N#1	PDA	SDF	SDA
Days driven	.22	.28	.15	.15	.49 ***	-.16
# Trips	.30 *	.36 *	.22	.22	.49 ***	-.43 **
# Stops	.28	.35 *	.25	.22	.49 ***	-.35 *
Distance (km)	.27	.43 **	.39 **	.30 *	.59 ***	-.48 ***
Duration	.33 *	.42 **	.30 *	.29	.66 ***	-.43 **
Radius (max)	.24	.36 *	.36 *	.42 **	.38 *	-.58 ***
Radius (avg)	.16	.35 *	.33 *	.36 *	.36 *	-.51 ***
Nights driven	.26	.30 *	.13	.12	.32 *	-.39 **
Night (# trips)	.28	.31 *	.15	.14	.32 *	-.41 **
Night (km)	.32 *	.44 **	.30 *	.26	.31 *	-.50 ***
Night (duration)	.24	.35 *	.21	.38	.29 *	-.42 **

Note: Missing scores/ratings for an 87 y.o. man and driving data for an 81 y.o. woman, thus, indicators based on N=45, except radii (N=39). All values are Spearman ρ except for days driven, trips, stops, segments, duration, DCS-N, PDA, SDF, and SDA (Pearson r).
*****$p < .05$; ******$p < .01$; *******$p < .001$

To further examine the influence of comfort level, the sample was divided at the midpoint (above and below 50%) of DCS scores, as shown in **Appendix J**. Those above the midpoint had higher scores on all driving variables, however, differences were not significant. Driven instances by weather and road conditions were also compared by DCS scores (Table

4.26). As shown in Table 4.26, participants with lower daytime DCS scores was more likely to drive in good versus poor weather conditions (χ^2 = 4.57, p = .03), however, there was no difference with respect to non-driving days. No differences were found for night DCS scores. All subjects, regardless of DCS scores, were more likely to drive than not drive on poor roads.

Table 4.26. Patterns of Driven Instances by Driving Comfort (N=45)

	DCS - Daytime Scores		**DCS – Nighttime Scores**	
	≤ 50% (n = 7)	**> 50% (n = 38)**	**≤ 50% (n = 16)**	**> 50% (n = 29)**
Inclement Weather				
No	47 (57.3)	163 (44.3)	71 (49.0)	139 (45.6)
Yes	35 (42.7)	205 (55.7)	74 (51.0)	166 (54.4)
Poor Roads				
No	29 (35.4)	110 (29.9)	42 (29.0)	97 (31.8)
Yes	53 (64.6)	258 (70.1)	103 (71.0)	305 (68.2)

Note: Values are *Frequencies (valid percent).* Chi-square test, $\chi^2(p)$, was used for comparisons. Missing scores/ratings for one man and driving data for one woman.

4.11 Comparison of Seasonal Driving Patterns

As described earlier, the repeat sample consisted of two groups: 8 who were first assessed in the fall (October, 2007) and 10 who were assessed in the spring (April to May, 2008). One 69 y.o. woman (from the spring group) was excluded as she did not drive at all over the initial one-week period. Thus, the spring sample consisted of 9 participants (all but one of whom had DCS scores and interview data). Additionally, radius could not be calculated for 4 people due to missing Otto trip data.

Table 4.27 shows the length of time between assessments. The average duration between initial and follow-up assessments for the spring sample was 8.6±1.1 months (range 7 to 10). For the fall group, the duration was 16.5±0.8 months (range 15 to 17). Given this difference, the two groups were examined separately.

Table 4.27. Duration between Initial and Follow-up Assessments (N = 17)

	Winter Follow-up			
Initial Assessment	Dec/2008	Jan/2009	Feb/2009	Mar/2009
Oct/2007	---	15 months **1 subject:** 1 male 0 female	16 months **2 subjects:** 0 male 2 female	17 months **5 subjects:** 3 male 2 female
Apr-May 2008	7 months **1 subject:** 0 male 1 female	8 months **5 subjects:** 1 male 4 female	9 months **0 subjects**	10 months **3 subjects:** 2 male 1 female

Tables 4.28 and 4.29 show the sample characteristics and perception scores. The only significant difference was that the fall sample was older (t = 3.29, p = .006). Both samples were predominantly sole drivers and owned one household vehicle (fall: 75%, spring: 78%). Two couples (4 individuals) enrolled together in the study; one in each period. There were no significant differences in perception scores or reported regulatory practices. In both groups, comfort level declined at follow-up (winter), although change was not significant

As driving was initially monitored for only one week, the winter driving data was averaged over the two weeks for comparison. Tables 4.30 and 4.31 show the comparisons between fall versus winter and spring versus winter driving, respectively. No significant seasonal differences emerged for the fall sample. Although average distance was 127 km lower in the winter, divided by 7 days, this amounts to approximately 18 km per day.

In contrast, driving distance actually increased in the winter for the second group (by approximately 50 km on average, amounting to only 7 km per day). Three significant differences emerged, namely: average maximum speed significantly decreased in the winter (p = .03), while distance (p = .02) and duration of night driving (p = .03) both increased.

Table 4.28. Characteristics of the Fall and Spring Groups

Variables	Fall Group (n=8)		Spring Group (n=9)	
	Initial	Follow-up	Initial	Follow-up
Gender				
Male	4 (50.0)		3 (33.3)	
Female	4 (50.0)		6 (66.7)	
Age [a]	82.38±4.03 78 to 88	83.50±3.93 79 to 89	72.78±7.29 64 to 85	73.78±7.21 65 to 86
Driver Status				
Sole drivers	6 (75.0)		7 (77.8)	
Couple drivers	2 (25.0)		2 (22.2)	
Health				
Excellent/Good	7 (87.5)	8 (100)	8 (88.8)	8 (88.9)
Fair	1 (12.5)	0	1 (11.1)	1 (11.1)
Perceived eyesight [b]				
Better than most	4 (66.7)	4 (66.7)	3 (37.5)	2 (25.0)
About the same	2 (33.3)	2 (33.3)	5 (62.5)	6 (75.0)
Diagnosis score	3.00±1.41 1 to 5	2.00±1.69 0 to 5	1.44±1.13 0 to 3	2.11±1.36 1 to 5

Note: Values are *frequencies (valid percent)* or *Mean±S.D., range.*
[a] Mean age at initial assessment: z = -2.77, p = .006 (Mann-Whitney test)
[b] Data removed for 2 fall and 1 spring subject because data missing for one assessment.

Table 4.29. Perceptions and Restrictions for the Fall and Spring Groups

Variables	Fall Group (n=7)*		Spring Group (n=9)	
	Initial	Follow-up	Initial	Follow-up
DCS-D	71.43±21.28 44.23 to 98.08	66.76±25.24 38.46 to 96.15	70.56±18.38 34.62 to 94.23	66.45±16.80 40.38 to 84.62
DCS-N	59.32±26.66 21.81 to 92.19	49.96±32.13 20 to 92.19	56.08±22.57 23.44 to 87.50	51.22±22.29 21.88 to 84.38
PDA	32.29±7.45 19 to 41	32.43±8.40 21 to 42	35.67±4.47 29 to 42	33.44±6.71 24 to 42
SDF	32.29±7.97 24 to 46	29.29±5.47 2 to 15	32.91±3.31 27 to 38	32.35±3.84 29 to 40.92
SDA	8.57±4.86 2 to 15	7.00±5.74 0 to 16	5.89±3.82 0 to 12	6.44±4.13 0 to 11

Note: Values are *Mean±S.D.*, range. *87 y.o. male, fall participant was excluded due to missing perception scores and reported restriction ratings

As can be seen from both tables, there was tremendous variability (standard deviations and ranges) in both samples for many of the driving indicators, particularly distance. In keeping with the exploratory nature of this examination, each of the 17 participants were looked at individually, i.e., on a case-by-case basis, as shown in **Appendix K**. Characteristics (gender, age, sole versus couple driver), distance driven in each period, weather conditions and comfort scores were examined. Reported reasons for departures from usual routines (such as illness or out-of-town trips) were also examined as possible explanations of variation from period to period. In several cases, one or two out-of-town trips taken or not taken (i.e., postponed or cancelled) explained the discrepancies. Illness, family visits, special events and other personal experiences were also influential on the driving patterns over the short periods.

Table 4.30. Comparison of Fall versus Winter Driving (N = 8)

Indicators	Fall Driving	Winter Driving	Comparison(*p*)
# Days of driving	4.50±1.93 1 to 7	4.38±1.38 2.5 to 7	t = 0.22 (.83)
# Trips	6.19±4.61 0.5 to 16	5.94±3.50 2.5 to 13	z = -0.56 (.57)
# Trips/day [a]	1.18±0.54 0.5 to 2.29	1.28±0.38 0.86 to 1.86	z = 0 (1.00)
# Segments [a]	21.25±18.08 2 to 60	18.56±9.80 5.5 to 38.50	t = 0.67 (.53)
# Segments/day [a]	4.10±2.07 2 to 8.57	4.03±1.03 2.2 to 5.5	t = 0.11 (.91)
Distance (km)	237.46±248.95 8.53 to 633.28	110.14±69.13 29.55 to 191.75	z = 1.40 (.16)
Distance/segment [a]	10.32±8.05 3.58 to 23.45	6.53±4.35 1.74 to 14.20	z = -1.54 (.12)
Radius (max) [b]	43.53±44.18 3.2 to 93.66	21.45±28.15 2.43 to 70.63	z = -1.21 (.23)
Radius (avg) [b]	14.40±17.54 2.37 to 45.06	6.46±7.27 1.89 to 19.24	z = -1.21 (.23)
Duration (hr:min:sec)	4:54:54 to 4:22:23 0:22:36 to 13:20:33	3:08:48±1:40:05 1:02:38 to 6:06:39	t = 1.50 (.18)
Avg Max Speed (kph)	63.58±8.46 53.32 to 78.04	61.21±7.05 50.60 to 72.72	t = -0.82 (.44)
# Nights of driving	0.50±0.53 0 to 1	0.69±0.59 0 to 1.50	z = -0.60 (.55)
Night distance (km)	16.83±45.51 0 to 129.39	7.25±7.59 0 to 21.32	z = -1.01 (.31)
Night duration	0:16:04±0:28:47 0 to 1:23:01	0:12:02±0:11:42 0 to 0:33:06	z = -0.33 (.74)

Notes: Values are *Mean±S.D., range*. Comparisons are paired *t*-test, *t(p),* or Wilcoxin signed ranks test, *z(p)*. [a] Variables included for comparison with Huebner & Porter's data.
[b] N=5 for radius data since 3 participants had insufficient usable winter (otto) trip data.

Table 4.31. Comparison of Spring versus Winter Driving (N = 9)

Indicators	Spring Driving	Winter Driving	Comparison(*p*)
# Days of driving	5.11±1.54 2 to 7	5.17±1.87 2 to 7	t = -0.16 (.87)
# Trips	7.63±3.68 3 to 13	8.22±4.37 2 to 14	t = -0.80 (.45)
# Trips/day [a]	1.42±0.31 1 to 1.86	1.52±0.41 1 to 2.15	t = -0.90 (.39)
# Segments [a]	24.11±14.55 10 to 52	27.28±14.98 5.5 to 54	t = -1.00 (.35)
# Segments/day [a]	4.56±1.71 2.5 to 7.43	5.03±1.61 2.75 to 8.31	t = -0.79 (.45)
Distance (km)	111.11±87.16 42.70 to 270.20	161.26±122.72 38.85 to 382.70	z = -1.13 (.26)
Distance/segment [a]	4.62±1.84 2.46 to 7.15	5.91±2.85 2.78 to 10.75	t = -1.23 (.25)
Radius (max)	9.03±5.60 3.37 to 19.91	41.43±48.09 3.76 to 115.92	z = -1.60 (.11)
Radius (avg)	4.40±2.01 2.12 to 7.63	5.49±3.22 2.90 to 12.58	z = -0.65 (.52)
Duration (hr:min:sec)	3:31:48±2:05:30 1:37:34 to 6:59:45	4:42:51±2:49:23 1:07:19 to 10:15:24	z = -1.24 (.21)
Avg Max Speed (kph)	77.39±13.25 62.51 to 94.75	63.67±12.66 51.36 to 90.55	t = -4.15 (.003)
# Nights of driving	1.44±1.23 0 to 4	2.28±1.44 0 to 4	t = -1.83 (.11)
Night distance (km)	8.83±12.38 0 to 36.10	29.71±30.62 0 to 83.86	z = 5.44 (.02)
Night duration	0:18:53±0:21:55 0 to 0:59:25	1:00:49±0:52:35 0 to 2:22:41	z = 2.19 (.03)

Notes: Values are *Mean±S.D., range*. Comparisons are paired *t*-test, *t(p),* or Wilcoxin signed ranks test, *z(p)*. [a] Variables included for comparison with Huebner & Porter's data.

Chapter 5 - Discussion

5.1 Introduction

The majority of studies on the self-regulatory driving practices of older adults have relied on self-reported data which is subject to recall and social desirability bias (Lajunen and Summula (2003). Blanchard's study was the first to examine driving exposure and patterns in older adults using more objective methods (in-vehicle devices) and investigate possible determinants of self-regulatory behaviour. In addition to supporting earlier findings by Huebner et al. (2006) that self-estimates of exposure (km driven) are inaccurate, her results indicated that older drivers may not regulate as much as they say they do (Blanchard et al., 2010). She also showed that perceptions of driving comfort and abilities were significantly associated with multiple indicators of driving behaviour (Myers & Blanchard, 2010). The aims of this study were to: 1) replicate her findings on the associations between driver perceptions, self-regulatory practices and actual driving; and 2) extend her work by examining driving over a longer (two weeks versus one) monitoring period during the winter (versus spring to fall).

To our knowledge, only two prior studies have used electronic devices to assess older drivers in the winter. Marshall et al. (2007) monitored the driving of 20 Ottawa seniors in February. However, the purpose of their study was to examine correspondence between measures (diaries, CarChip and GPS devices; with each device installed for a week) in recording distance (km); driving patterns were not reported. The unpublished CarChip data collected by Huebner and Porter on nine older Winnipeg drivers is the only direct comparison of winter and non-winter driving. Our repeated measures analyses must also be considered exploratory given the small sample sizes and duration between assessments.

This chapter begins by addressing the primary limitation of the present study (namely, sample size and representativeness), as well as technical difficulties with the devices. Further limitations are noted subsequently when discussing each of the study objectives. The last section presents overall conclusions and suggestions for further research.

5.2 Study Limitations

5.2.1 Sample Size and Representativeness

The relatively small sample (N = 47) was reduced further due to missing CarChip (n=46) and Otto (n=40) data. The average age was 77, which is somewhat younger than Blanchard's (2008) sample (mean age 80), reflecting the lower age criteria employed (65 versus 70 in her study). While there was proportional representation of men and women and sole versus couple drivers, rural drivers (only 6% of the sample) were not well represented. Considering that only about 40% of Canadian seniors have completed high school (Rudman et al., 2006), the sample was highly educated (76% having completed college or university), not surprisingly as most were recruited from a learning series for older adults.

Generally, the sample appeared to be in good health, physically active, and mobile (only 15% used a cane or walker). Using the Roadwise Review (RWR) as an indicator of driving-related functional abilities, the average number of impairments was low ($M = 1.8 \pm 1.2$, out of 8 tasks), although those 80+ had more impairments. Compared to Porter et al.'s (2008) sample of older drivers (n=14; age 76.6 ± 4.3), average scores were similar for most tasks. The one exception was the Trails B in which their sample took longer (mean 125.3±71.6 versus 102.4±30.6 seconds).

Therefore, generalizability of the findings is limited to urban dwelling, English-speaking, well-educated and healthy older drivers from SW Ontario. Moreover, 47% had successfully completed Ontario's renewal requirements for senior drivers (age 80+) and 38% had taken part in prior driving studies conducted by the University of Waterloo.

Older drivers with previous (non-winter) driving data were purposefully recruited for seasonal comparisons (repeated measures analysis). However, as we did not achieve our target of 40 *new* participants, the decision was made to employ the total sample (i.e., 29 new and 18 repeat subjects) for analyses pertaining to objectives 1 to 3. As noted throughout Chapter Four, the two groups were comparable with respect to characteristics, perception scores and driving behaviour. There was no evidence that they were differentially affected by the devices or more compliant in completing the trip logs. Nonetheless, it is acknowledged that inclusion of individuals with prior study experience constitutes a study limitation.

5.2.2 Technical Difficulties

Others who have used electronic data loggers (particularly GPS) have also reported technical difficulties such as cold starts or signal loss leading to partial or complete loss of data (e.g., Grengs et al., 2008; Myers & Blanchard, 2010). What was unanticipated was that certain vehicles (e.g., Ford Focus, Ford Fusion and Cadillac TCS) had a "live socket" meaning that power is supplied to the recording device (in this case the Otto) even when the ignition is turned off. Although the Otto can store up to 320 hours of driving data (recorded at one-second intervals), in such vehicles the capacity was exceeded well before the end of the

14-day monitoring period. As a result, Otto data was lost for three subjects in the first wave. This problem was discovered during the interview when some people reported hearing messages that the Otto was full. To prevent further data lost, Otto settings were subsequently adjusted to automatically turn off after 10 minutes of idling.

While the CarChip fits into the OBDII port, the Otto is mounted on the dashboard and attached via cables to the vehicle's power source. During installation, cables were wound and secured to the console with tape. Nonetheless, cables sometimes were dislodged through repeated incidental contact, resulting in complete or partial loss of data. Four subjects had to be excluded from radius analyses as over a third of their trip data was missing. The longer monitoring period, combined with colder temperatures (possibly making the cables stiffer), may have contributed to this problem. Future studies should consider using batteries as a back-up power supply, as well as settings for automatic shut-off, to prevent loss of GPS data.

At the end of the first visit, participants were encouraged to contact the researcher if they had any technical difficulties. Unfortunately, most did not report problems until the final interview, and some tried to resolve these themselves. Future studies should consider a maintenance check midway through the study, as well as warning participants in advance. For instance, in a subsequent driving study, the student researcher is giving participants a "troubleshooting sheet" to identify and deal with issues such as loose connections.

5.3 Winter Driving

To assess winter driving, each participant was monitored for 14 consecutive days using the electronic devices between late November, 2008 and late March of 2009. Although the original intent was to complete data collection by February, the study was extended into

March to increase the sample size. Despite relatively warmer temperatures, March still exhibited winter characteristics (i.e., days with snow). And the longer daylight period was useful for monthly comparisons of distance driven at night.

As previously mentioned, CarChip data was used for all analyses, with the exception of radius which required the GPS data from the Otto. The majority of CarChip trips (99% or 665/672) had corresponding logs, which was slightly higher than in Blanchard's study (91%). Lower compliance in her study may be a result of requesting participants to complete daily activity diaries (concerning various modes of transportation), in addition to the logs.

In order to compare the findings to prior studies, the two week data was averaged. Total driving distance (km) by our sample (157±109) was quite similar to Blanchard's (164±158 km), despite the fact that her sample was monitored at a different time of year (June to October). Both samples from SW Ontario had relatively low exposure compared to Huebner et al's (2006) Winnipeg drivers (340±159; also based on CarChip data). However, their sample (N=20) was younger (mean age 73).

Comparatively, Marshall et al.'s (2007) Ottawa sample of 20 older drivers (mean age 78), drove 185 ± 82 km *over one week in February* (as measured by CarChips), but substantially more over the subsequent week (215±145), as measured by a GPS device. Some of these differences may be explained by the higher proportion of men in the Winnipeg (70%) and Ottawa (75%) studies, compared to Blanchard's (41%) and ours (51%). We found that men drove significantly more than women, while in Blanchard's study gender difference in total average distance approached significance.

With respect to other driving indicators (i.e., number of days of driving, trips, stops, duration and average and maximum radius), findings were quite similar to Blanchard's

(2008). Age group differences (< 80 versus 80+) did not emerge in either study. However, only 28% of her sample drove at night, compared to 89% of the present sample.

Blanchard (2008) did not find any difference in km driven at night by month of study participation (June to October), while we found our subjects drove substantially more at night in December (average ~ 50 km) versus March (average of only 13 km). This finding supported our expectation that seasonal variation in daylight (December having the shortest period in Canada), may influence night driving patterns. A longer monitoring period is also more likely to capture night driving as discussed below. Similar to Blanchard (2008), night driving was defined as any trip that was taken during darkness (from sunset to sunrise) even if trips started or ended in daylight. Blanchard et al. (2010) found significant agreement between reported and actual avoidance of night driving, contrary to the present findings (Kappa was non-significant). Specifically, 40/45 of our subjects drove at least one night over the 14 days, including 11/13 who said that they usually tried to avoid driving at night if possible. Night driving may simply be harder to avoid in the winter as the sun sets earlier.

5.3.1 Influence of Winter Conditions on Driving

Our sample also did not appear to regulate their driving behaviour based on adverse weather or winter road conditions. Overall, they were more likely to *drive* (than *not drive*) on days with inclement weather or poor road conditions. The older group (80+), however, was less likely to drive on days with poor road conditions than the younger group.

Consistent with Blanchard et al.'s (2010) findings, the sample did not restrict their driving as much as they say they do (based on SDA ratings). However, in Blanchard's study inclement weather occurred on only 34 days (or 23%) of the 148-day monitoring period.

Although it rained on 27 days, only 8 had heavy rain or thundershowers. Comparatively, in this study, over half the 94-day monitoring period had inclement weather, while 67% of the period had poor road conditions. All 46 participants drove at least once in bad weather over the 14-day period, and 73% (33/45) did so at night.

Similar to Blanchard (2008), the influence of weather on driving restriction was examined by comparing the instances participants drove (or did not drive) by weather conditions (inclement versus good). Admittedly, this was a crude determination derived from descriptions in participant trip logs (subject observations) and Environment Canada archives (which did not always correspond). This was expected as regional forecasts often differ from local conditions. Trip logs from several participants were compared when possible (i.e., more than one subject drove on a particular day) and study period days were categorized according to the most frequent descriptors, or if equivalent the most severe. Although we considered weather alerts (from the local newspaper), we did not have precise indicators of severity.

We also did not examine the additive effects of poor weather, road conditions and time of day. Kilpelainen & Summala (2007), for instance, found that drivers were more likely to rate driving conditions better than the forecast in daylight and worse when dark. In hindsight, we should have asked our sample whether they had accessed traffic-related weather information (from television, radio or newspapers) *prior* to their trips or *on-route* (via radio). Further analysis of the data may reveal regulatory strategies such as shorter trips (fewer km) or changes in routes (roadways driven) on days with poor weather. In SW Ontario, conditions are highly variable and frequently change throughout the day. Without extremely detailed weather and road data for the specific areas in which people drove (including outside the K-W area), it is impossible to make these fine distinctions.

Similar to Blanchard's findings, poor weather was mentioned as one of the main reasons for possibly cancelling or postponing trips. Two of our subjects, however, were adamant that they would not cancel a trip under any conditions. The results showed that the sample was more likely to drive on days with clear weather for social and entertainment reasons, and less likely to drive on days with weather advisories for these purposes. Out-of-town trips, meanwhile, most often took place on days with favorable road conditions.

5.4 Consistency between Weeks One and Two

Contrary to speculation (e.g., Blanchard et al., 2010; Grengs et al., 2008), driving behaviour did not change much from one week to the next. While the sample drove ~ 20 km more on average in the second week, this amounted to a difference of less than 3 km/day. None of the paired comparisons were significant indicating that there were no systematic differences in driving behaviour (for any of the indices) between the two weeks.

The ICCs (> .70) showed good consistency or reliability for all the indicators, except for night km, average and maximum radius. The interval between assessments is an important consideration when interpreting reliability estimates (Bédard et al., 2000). In this study, the same devices were used to record driving data and there was no interval between assessments (i.e., two consecutive weeks of driving were monitored).

Given the time required to clean, triangulate and analyze driving data, in conjunction with weather data, the issue is whether an additional week of monitoring was worth the effort. As noted above (section 5.2.2.), longer monitoring periods increase the possibility of technical problems with the devices and loss of data. Participant burden is also increased when asked to commit to a long period and complete logs for each and every driving trip.

Had data not been collected for the second week, however, we would have missed several instances of night driving behaviour. Although we have yet to examine additional data from the Otto (such as actual highway driving, out-of-town trips or driving in unfamiliar areas), judging by Blanchard et al.'s (2010) findings, such instances do not occur that frequently. For instance, in her sample of 55 drivers with useable Otto data, only 5 drove in unfamiliar areas (e.g., detours) and only 6 on three-lane highways over the week. A two-week period may be better able to capture these practices especially in less active drivers. An additional week or more may be particularly important for certain populations (such as drivers with Parkinson's Disease who may drive less overall due to fatigue) or if weather conditions are extreme and there are road closures for several, consecutive days.

Weighing the pros and cons, this researcher contends that the extended monitoring period was justified and better able to capture winter driving behaviour, particularly in SW Ontario when the conditions vary substantially from day to day and week to week. For example, participants monitored between January 13th and 26th encountered quite different conditions during their first week (snow on every day but one; four days with snow advisories), compared to their second week of monitoring (4 totally clear days and only trace amounts of snowfall, mostly overnight).

5.5 Associations with Perceptions and Reported Practices

Consistent with prior studies (Blanchard & Myers, 2010; Myers et al., 2008a; MacDonald et al., 2008), perception scores (DCS-D, DCS-N and PDA) were significantly correlated with each other and with scores on the SDF and SDA (self-reported regulatory practices) in the expected directions. Night driving comfort scores were also significantly lower than daytime driving comfort scores, as found in the prior studies.

Mean DCS-D and DCS-N scores were slightly higher than Blanchard et al.'s sample (71% versus 69%, and 58% versus 54%, respectively), which may be due to the greater proportion of men (51% versus 41%) in the present study. In both studies, men had higher comfort and perceived abilities scores, although not significantly greater than women. Women, meanwhile, had significantly lower SDF scores and higher SDA scores.

Confidence may explain the gender effect often found in studies on self-regulatory practices (e.g., Kostyniuk & Molnar, 2008). In a regression analysis, Charlton et al. (2006) found confidence was more important than other variables (including gender) in characterizing self-regulators. In her dissertation, Blanchard (2008) argued that whether one is a sole driver, or part of a driving couple, may be more important than gender. In support of her argument she found that despite being older and having lower comfort and PDA scores, sole drivers drove significantly more often, likely due to necessity. In the present study, sole drivers were also more likely to be women and older, with lower comfort and PDA scores, and higher SDF scores than couple drivers. However, no significant differences emerged with respect to driving exposure or patterns.

Scores on the DCS-N scale were positively and significantly related to most of the indicators of driving behaviour, replicating the findings of Blanchard & Myers (2010). Number of days driven was not associated with DCS-N scores in either study. The only discrepancy between the two studies was that DCS-N scores were significantly associated with number of trips in the present study but not in Blanchard's study. Also consistent with their findings, scores on Item 1 of the DCS-N (driving at night in good weather and traffic conditions) were significantly related to distance (km) overall and at night, duration and radius (both average and maximum). Scores on the DCS-D (which were relatively high in both samples) were significantly related to duration, number of trips and km at night in the present study; but only with distance and duration at night in Blanchard's study. In both studies, perceived driving abilities (PDA scores) were significantly associated with distance overall and maximum radius. Additionally, PDA scores were significantly related to duration, average radius and night distance in the present study. Conversely, PDA scores were significantly related to duration in Blanchard's study. While there were some inconsistencies as noted above, overall the findings were quite similar in the two studies.

Additionally, Blanchard & Myers (2010) found that those with low DCS-D and DCS-N scores (below the midpoint of 50) drove significantly less overall and at night, closer to home, and less often in challenging situations. A Frequency Index was created to assess actual driving in the situations depicted in the SDF Scale (e.g., in bad weather, at night, on highways); item 7 (winter driving) could not be assessed as data was collected spring to fall. As a starting point we examined some of the situations depicted on both the SDF and SDA scales (e.g., driving in bad weather or bad weather at night), and found that the vast majority of the sample drove in these situations whether they reportedly tried to avoid doing so or not.

Similar to Blanchard & Myers (2010), confidence scores were divided at the midpoint in this case specifically to examine whether those with high comfort scores (> 50%) were more likely than those with low comfort scores (≤50 %) to drive in inclement winter conditions. One significant finding emerged: those who higher daytime comfort scores drove more on days with inclement weather. While instances of driving on poor roads were also greater in the in those with higher DCS-D scores, the difference was not significant.

5.6 Comparison of Seasonal Driving

The final study objective was to compare seasonal driving patterns. The fall group, on average, drove *less* in the winter (110±69 versus237±249 km), this difference was not significant, nor were any of the other comparisons. Conversely, the spring group drove *more* in the winter (161±123 versus 111±87 km). Average maximum speed was significantly lower in the winter, while night distance and duration were higher (possibly due to less daylight).

Although Sabback & Mann (2005) found older drivers in western NY reduced their driving exposure in the winter, their findings were based on self-reports. The only other study on seasonal comparisons of older drivers to our knowledge was the pilot study conducted by Huebner and Porter in which nine, Winnipeg older drivers with one-week CarChip data from (July to October) were re-assessed from January to March (4 to 8 months later). Their data (unpublished) showed significant decreases in total distance (from 358±168 to 217±115 km), average maximum speed and total hard decelerations in the winter. As described by Dr. Porter (personal communication, March 2, 2010), these drivers were highly reliant on their vehicles and many were cottage owners which may explain their high mileage in summer and fall. While interesting, the findings must be interpreted with extreme caution in both studies due to the small sample size and duration between assessments in our study. Case by case examination showed that discrepancies (e.g., differences in km) could often be explained by a single out-of-town trip either taken or not taken in one period or the other.

5.7 Summary and Conclusions

This study examined actual, winter driving behaviour in older adults. Self-reports of exposure (distance driven) are inaccurate (Huebner et al., 2006; Blanchard et al., 2010), calling into question the reliability and validity of other self-reported regulatory practices (namely avoidance ratings). Given the desire to retain one's license and the fear of being reported to authorities, it is not surprising that older drivers want to present themselves favorably. The use of multiple methods (devices, logs and archival data) enabled a more real and comprehensive depiction of driving behaviour, including an examination of environmental or contextual factors (such as daylight, weather and road conditions).

The results were consistent with Blanchard's (2008) findings that driver perceptions (particularly comfort driving at night) are strongly associated with actual behaviour, regardless of the season. Further, both studies indicate that older drivers may not self-regulate as much as they say they do. In fact, everyone drove at least once during inclement weather and on poor roads. In comparison to Blanchard's sample, participants drove more at night in response to shorter daylight hours in winter. In countries such as Canada and Finland people may simply become accustomed to winter driving (Kilpelainen & Summala (2007), confident that if authorities keep roads open and maintained, roads are safe to drive. The fact that only 30% of our sample changed to snow tires may further indicate that they were not overly concerned about winter driving. The sample, however, was highly active (for instance, over half were in exercise classes and most attended lecture series), and certainly may not be representative of older drivers in general.

This study used a longer monitoring period and found driving patterns were quite consistent over the two weeks. While two weeks of monitoring was more likely to capture instances of night driving, two weeks may not be representative of driving behaviour in general. Much longer studies, such as the Candrive cohort study which is monitoring older drivers for five consecutive years, are required to answer this question. In any case, the present study, similar to Blanchard's, provides only a *snapshot* of driving behaviour.

As illustrated by Rudman et al.'s model (2006), multiple intrapersonal, interpersonal and environmental factors impact on decisions to self-regulate. While confidence may be an important determinant of self-regulation, future research with larger samples (permitting regression analyses) is required, as are longitudinal studies to examine directionality. As noted by Blanchard (2008) and in line with Bandura's (1997) theory, there is likely a reciprocal relationship between driving experience and comfort level.

Seasonal and geographical considerations are important when studying driving behaviour, particularly self-regulatory practices. Future studies on the influence of weather, however, need to consider severity of conditions and acquisition of weather and traffic information to better understand tactical and strategic decisions made by older drivers.

References

Andrey, J. (2010). Long-term trends in weather-related crash risks. *Journal of Transport Geography, 18*, 247-258.

Baldock, M.R.J., Mathias, J.L., McLean, A.J., & Berndt, A. (2006). Self-regulation and its relationship to driving ability among older adults. *Accident Analysis & Prevention, 38*(5), 1038-1045.

Ball, K.K., Roenker, D.L., Wadley, V.G., Edwards, J.D., Roth, D.L., McGwin Jr., G., et al. (2006). Can high-risk older drivers be identified through performance-based measurements in a Department of Motor Vehicles setting? *Journal of the American Geriatrics Society, 54*, 77-84.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioural change. *Psychological Review, 84*(2), 191-215.

Bauer, M.J., Adler, G., Kuskowski, M., & Rottunda. (2003). The influence of age and gender on the driving patterns of older adults. *Journal of Women & Aging, 15*(4), 3-16.

Bédard, M., Martin, N.J., Krueger, P., & Brazil, K. (2000). Assessing reproducibility of data obtained with instruments based on continuous measures. *Experimental Aging Research, 26*, 353-365.

Bédard, M., Stones, M.J., Guyatt, G.H., & Hirdes, J.P. (2001). Traffic-related fatalities among older drivers and passengers: Past and future trends. *The Gerontologist,* 41, 751-756.

Benekohal, R. F., Michaels, R. M., Shim, E., & Resende, P. T. (1994). Effects of aging on older drivers' travel characteristics. *Transportation Research Record, 1438,* 91-98.

Blanchard, R. (2008). Examination of older driver perceptions and actual behaviour in sole household drivers and driving couples. Unpublished doctoral dissertation, University of Waterloo, Waterloo, Ontario, Canada.

Blanchard, R.A., Myers, A.M., & Porter, M.M. (2010). Correspondence between self-reported and objective measures of driving exposure and patterns in older drivers. *Accident Analysis and Prevention, 42*, 523-529.

Blanchard, R.A., & Myers, A.M. (2010). Examination of driving comfort and self-regulatory practices in older adults using in-vehicle devices to assess natural driving patterns. *Accident Analysis and Prevention, 42,* 1213-1219.

Burkhardt, J.E. (1999). Mobility changes: Their nature, effects and meaning for elders who reduce or cease driving. *Transportation Research Record, 1671*, 11-18.

Burkhardt, J.E., & McGavock, A.T. (1999). Tomorrow's older drivers: Who? how many? what impacts? *Transportation Research Record, 1693*, 62-70.

Burns, P.C. (1999) Navigation and the mobility of older adults. *Journal of Gerontology: Psychological Sciences and Social Sciences, 54B*, S49-S55.

Chaparro, A., Wood, J.M., & Carberry, T. (2005). Effects of age and auditory and visual dual tasks on closed-road driving performance. *Optometry and Vision Science, 82*, 747-754.

Charlton, J.L., Oxley, J., Fildes, B., Oxley, P., Newstead, S., Koppel, S., et al. (2006). Characteristics of older drivers who adopt self-regulatory driving behaviours. *Transportation Research Part F 9*(5), 363-373.

Collia, D.V., Sharp, J., & Giesbrecht, L. (2003). The 2001 national household travel survey: A look into the travel patterns of older Americans. *Journal of Safety Research, 34,* 461-470.

Cooper, P.J. (1990). Elderly drivers' views of self and driving in relation to the evidence of accident data. *Journal of Safety Research, 21*(3), 103-113.

Davey J., & Nimmo, K. (2003). Older People and Transport. Scoping paper. Prepared under contract between Victoria Link Ltd and the Land Transport Safety Authority, the Ministry of Transport and the Office for Senior Citizens, pp.1-18.

Davis Instruments. (2008). Retrieved on September 2008, from http://www.davisnet.com/drive/products/drive_product.asp?pnum=08226

Dellinger, A.M., Sehgal, M., Sleet, D.A., & Barrett-Connor, E. (2001). Driving cessation: What older former drivers tell us. *Journal of the American Geriatrics Society, 49,* 431-435.

Dickerson, A.E., Molnar, L.J., Eby, D.W., Adler, G., Bédard, M., Berg-Weger, M., et al. (2007). Transportation and aging: A research agenda for advancing safe mobility. *The Gerontologist, 5,* 578-590.

Dobbs, B.M. (2008). Aging baby boomers – A blessing or challenge for driver licensing authorities. Traffic Injury Prevention, 9, 379-386.

Duncan, M.J., & Badland, H.M., & Mummery, W.K. (2009). Applying GPS to enhance understanding of transport-related physical activity. *Journal of Science and Medicine in Sport, 12,* 549–556.

Eberhard, J.W. (1996). Safe Mobility for Senior Citizens. *International Association of Traffic and Safety Sciences Research, 20*, 29-37.

Eby, D.W., & Molnar, L.J. (2009). Older adult safety and mobility: Issues and research needs. *Public Works Management & Policy, 13*(4), 2009.

Eisenberg, D., & Warner, K.E. (2005). Effects of snowfalls on motor vehicle collisions, injuries, and fatalities. *American Journal of Public Health, 95*(1), 120-124.

Fonda, S.J., Wallace, R.B., & Herzog, A.R. (2001). Changes in driving patterns and worsening depressive symptoms among older adults. *Journal of Gerontology, 56B*(6), S343-S351.

George, S., Clark, M., & Crotty, M. (2007). Development of the Adelaide Driving Self-Efficacy scale. *Clinical Rehabilitation, 21*, 56-61.

Goggin, N.L., & Keller, M.J. (1996). Older drivers: A closer look. *Educational Gerontology, 22*, 245-256.

Grabowski, D.C., Campbell, C.M., & Morrisey, M.A. (2004). Elderly licensure laws and motor vehicle fatalities. *Journal of the American Medical Association, 291*(23), 2840-2846.

Grengs, J., Wang, X., & Kostyniuk, L. (*2008*). Using GPS data to understand driving behavior. *Journal of Urban Technology, 15*(2), 33-53.

Hakamies-Blomqvist, L., Raitanen, T., & O'Neill, D. (2002). Driver ageing does not cause higher accident rates per km, *Transportation Research Part F, 5*, 271-274.

Hakamies-Blomqvist, L., & Wahlstrom, B. (1998). Why do older drivers give up driving? *Accident Analysis & Prevention, 30*(3), 305-312.

Hopkins, R.W., Kilik, L., Day, D., Rows, C., & Tseng, H. (2004). Driving and dementia in Ontario: A quantitative assessment of the problem. *The Canadian Journal of Psychiatry, 49*, 424-438.

Heyl, V., Wahl, H.-W., & Mollenkopf, H. (2005). Visual capacity, out-of-home activities and emotional well-being in old age: Basic relations and contextual variation. *Social Indicators Research, 74*, 159-189.

Hu, P.S., & Reuscher, T.R. (2004). Summary of travel trends: 2001 national household travel survey. *U.S. Department of Transportation Federal Highway Administration*. Retrieved from <http://nhts.ornl.gov/2001/pub/STT.pdf>

Huebner, K., Porter, M.M., & Marshall, S.C. (2006). Validation of an electronic device for measuring driving exposure. *Traffic Injury Prevention,* 7, 76-80.

Janke, M.K. (1991). Accidents, mileage, and the exaggeration of risk. *Accident Analysis & Prevention, 23* (2/3), 183-188.

Johnson, E.J. (1999). Urban older adults and the forfeiture of a driver's license. *Journal of Gerontological Nursing*, Dec, 12-18.

Johnson, J.E. (2002). Why rural elders drive against advice. *Journal of Community Health Nursing*, 19(4), 237-244.

Keall, M.D., & Frith, W.J. (2004). Older driver crash rates in relation to type and quantity of travel. *Traffic Injury Prevention, 5,* 26-36.

Keall, M.D., & Frith, W.J. (2006). Characteristics and risks of drivers with low annual distance driven. *Traffic Injury Prevention, 7*(3), 248-255.

Kilpelainen, M., & Summala, H. (2007). Effects of weather and weather forecasts on driver behaviour. *Transportation Research, Part F,* 288-299.

Kostyniuk, L.P., & Molnar, L.J. (2008). Self-regulatory driving practices among older adults: Health, age and sex effects. *Accident Analysis and Prevention, 40,* 1576-1580.

Lajunen, T., & Summala, H. (2003). Can we trust self-reports of driving? Effects of impression management on driver behaviour questionnaire responses, *Transportation Research F* 6, 97–107.

Langford, J., Koppel, S., McCarthy, D. & Srinivasan, S., In defense of the 'low mileage bias', *Accident Analysis & Prevention, 40,* 1996–1999.

Langford, J., Methorst, R., & Hakamies-Blomqvist, L. (2006). Older drivers do not have a high crash risk – A replication of low mileage bias. *Accident Analysis & Prevention, 38*, 574-578.

Lerner-Frankiel, M.B., Vargas, S., Brown, M., Krusell, L., & Schoneberger, W. (1990). Functional community ambulation: What are your criteria? *Clinical Management*, *6*, 12-15.

Lyman, S., Ferguson, S.A., Braver, E.R., & Williams, A.F. (2002). Older driver involvements in police reported crashes and fatal crashes: trends and projections. *Injury Prevention, 8*, 116-120.

MacDonald, L.M., Myers, A.M., & Blanchard, R.A. (2008). Correspondence among older drivers' perceptions, abilities, and behaviors. *Topics of Geriatric Rehabilitation, 24*(3), 239-252.

Marshall, S.C., Molnar, F.M., Man-Son-Hing, M., Wilson, K.G., Stiell, I., & Porter, M.M. (2007). Measurement of driving patterns of older adults using data logging devices with and without global positioning system capability. *Traffic Injury Prevention, 8(3),* 260-266.

Marottoli, R.A., Mendes de Leon, C.F., Glass, T.A., Williams, C.S., Cooney, L.M., Berkman, L.F., et al. (1997). Driving cessation and increased depressive symptoms: Prospective evidence from the New Haven EPESE. *Journal of the American Geriatrics Society, 45,* 202-206.

Marottoli, R.A., Mendes de Leon, C.F., Glass, T.A., Williams, C.S., Cooney, L.M., & Berkman, L.F. (2000). Consequences of driving cessation: Decreased out-of-home activity levels. *Journal of Gerontology, 55B(6),* S334-S340.

Marottoli, R.A., & Richardson, E.D. (1998). Confidence in, and self-rating of, driving ability among older drivers. *Accident Analysis & Prevention, 30*(3), 331-336.

Mollenkopf, H., Marcelli, F., Ruoppila, I., Flaschentrager, P., Gagliardi, C., & Spazzafumo L. (1997). Outdoor mobility and social relationships of elderly people. *Archives of Gerontology & Geriatrics, 24*, 295-310.

Mollenkopf, H, Marcelli, F, Ruoppila, I, Szeman, Z, Tacken, M & Wahl H.W. (2004). Social and behavioural science perspectives on out-of-home mobility in later life: Findings from the European project MOBILATE. *European Journal on Ageing*, *1,* 45-53.

Ministry of Transportation of Ontario. (2003). Request for proposals for review of group education session for drivers aged 80 and over. Ontario: Queen's Printer.

Myers, A.M., Paradis, J., & Blanchard, R. (2008a). Conceptualizing and measuring driving confidence in older adults. *Archives of Physical Medicine and Rehabilitation*, *89,* 630-640.

Myers, A.M, Blanchard, R.A., MacDonald, L.M., & Porter, M.M. (2008b). Process evaluation of the American Automobile Association Roadwise Review CD-ROM. *Topics in Geriatric Rehabilitation, 24*(3), 224-238.

Owens, D.A., Wood, J.M., & Owens, J.M. (2007). Effects of age and illumination on night driving: a road test. *Human Factors, 49*(6), 1115-1131.

Owsley, C., Stalvey, B., Wells, J., & Sloane, M.E. (1999). Older drivers and cataract: Driving habits and crash risk. *Journal of Gerontology A: Biological Sciences and Medical Sciences, 54*, 203-211.

Pappas, P. (2002). Snap Shot Technology Use Survey. Retrieved from http://www.peterpappas.com.

Parker, D., MacDonald, L., Rabbitt, P., & Sutcliffe, P. (2000). Elderly drivers and their accidents: the Aging Driver Questionnaire. *Accident Analysis & Prevention, 32*, 751-759.

Parker, D., MacDonald, L., Sutcliffe, P, & Rabbitt, P. (2001). Confidence and the older driver. *Ageing and Society, 21*, 169-182.

Persen Technologies (2008). Retrieved June, 2008, from www.myottomate.com.

Pett, M. A. (1997). *Nonparametric statistics for health care research*. Thousand Oaks, CA: Sage.

Porter, M.M., & Ash, H. (2008). *The effect of a new road safety device with auditory alerts on older drivers.* Proceedings of the 18th Canadian Multidisciplinary Road Safety Conference, Whistler, B.C., June 8-11, pp. 1-13.

Porter, M.M., Irani, P., & Mondor, T.A. (2008). The effect of auditory alerts on brake response times in younger and older male drivers - a simulator study. *Transportation Research Record, 2069,* 41-47.

Preusser, D.F., Williams, A.F., Ferguson, S.A., Ulmer, R.G., & Weinstein, H.B. (1998). Fatal crash risk for older drivers at intersections. *Accident Analysis & Prevention, 30*, 151-159.

Richardson, E.D., & Marottoli, R.A. (2003). Visual attention and driving behaviors among community-living older persons. *The Journals of Gerontology, Series A, 58*(9), 832-837.

Rosenbloom, S. (1999). The mobility of the elderly: there's good news and bad news. Paper presented at the conference on transportation in an aging society: A decade of experience, Transportation Research Board, Maryland, USA.

Rudman, D., Friedland, J., Chipman, M., & Sciortino, P. (2006) Holding on and letting go: The perspectives of pre-seniors and seniors on driving self-regulation in later life. *Canadian Journal on Aging, 25*(1), 65-76.

Ryan, G.A, Legge, M., & Rosman, D. (1998). Age related changes in drivers' crash risk and crash type. *Accident Analysis & Prevention,* 30, 379-387.

Sabback, F., & Mann, W.C. (2005). The influence of climate and road conditions on driving patterns in the elderly population. *Physical & Occupational Therapy in Geriatrics, 23*(2/3), 63-74.

Satariano, W.A., MacLeod, K.E., Cohn, T.E., & Ragland, D.R. (2004). Problems with vision associated with limitations or avoidance of driving in older populations. *Journal of Gerontology: Social Sciences, 59(5)*, S281-S286.

Shrout, P.E., & Fleiss, J.L. (1979). Intraclass correlations: Uses in assessing rater reliability. *Psychological Bulletin, 86*, 420-428.

Siren, A., Hakamies-Blomqvist, L., & Lindeman, M. (2004). Driving Cessation and Health in Older Women. *Journal of Applied Gerontology*, 23:58-69.

Staplin, L., Dinh-Zarr, B. (2006). Promoting rehabilitation of safe driving abilities through computer-based clinical and personal screening techniques. *Topics in Geriatric Rehabilitation, 22*(2), 129-138.

Staplin, L., Gish, K., Joyce, J. (2008). "Low mileage bias" and related policy implications – a cautionary note. *Accident Analysis and Prevention, 40*, 1249-1252.

Staplin, L., Lococo, K., Gish, K., & Decina, L. (2003). *Model DriverScreening and Evaluation Program Final TechnicalReport, Volume 2: Maryland Pilot Older DriverStudy*. (No. DOT HS 809 583).Washington, DC: National Highway Traffic Safety Administration.

Statistics Canada (2006). More information on rural area (RA). Ottawa, ON. Retrieved from http://www12.statcan.ca/english/census06/reference/dictionary/geo042a.cfm

Stelmach, G.E., & Nahom, A. (1992). Cognitive-motor abilities of the elderly driver. *Human Factors, 24*(1), 53-65.

Stopher, P., Fitzgerald, C., & Zhang, J. (2008). Search for a global positioning system device to measure person travel, *Transportation Research C* 16, 350–369.

Turcotte, M. (2006). Seniors' access to transportation. *Canadian Social Trends, 82*, 43-50.

Zhang, J., Lindsay, J., Clarke, K., Robbins, G., & Mao, Y. (2000). Factors affecting the severity of motor vehicle crashes involving elderly drivers in Ontario. *Accident Analysis & Prevention, 32*, 117-125.

Appendix A: Recruitment and Screening Materials

UNIVERSITY OF Waterloo

VOLUNTEERS WANTED FOR DRIVING STUDIES

By Dr. Anita Myers and her graduate students

Department of Health Studies & Gerontology

New Study on the utility of road safety devices, beginning November 2008

We want your feedback on:

- **AAA/CAA's Roadwise Review** (education and self-assessment tool).
- The **Otto Driving Companion** (an in-vehicle, road safety device).

Volunteers will get to try these for **free** and receive a pamphlet on "winterizing" your car and winter driving tips.

This study involves:

- 2 meetings at your convenience
- 2 weeks of normal driving with the devices

Confidentiality of all information assured.

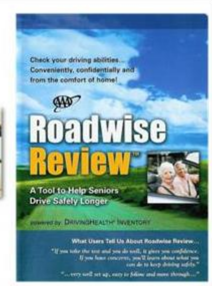
For this study, participants must be:

- Current drivers, aged 67 years or older
- Live in Kitchener-Waterloo Region
- Available for a 2-week period

To receive more information, please sign a permission form or call:

Aileen Trang
519-888-4567, ext. 37031

Otto Driving Companion



Future Studies: If you would like to receive information on other studies we will be conducting with former drivers, as well as current drivers (in and outside the K-W Region), please fill out the general permission to contact form.

Top images from: Highway Safety Research Center (left) and Aileen Trang (center, right).

Permission to Contact for K-W Driving Study

Note: 14 pt font was used for the actual form.

We are looking for volunteers to take part in a study being conducted by Ms. Aileen Trang for her Master's thesis, under the supervision of Dr. Anita Myers in the Department of Health Studies & Gerontology, University of Waterloo.

The purposes of this study are to examine winter driving patterns and obtain feedback on a 30 minute, interactive education and self-assessment video called the *Roadwise Review*, developed by the American Automobile Association. You will get to try this <u>for free</u> and receive a guide with helpful tips on winter driving.

For this study, we are looking for drivers **aged 67 or older** who are **residents of Kitchener Waterloo** and available over a <u>two week period</u>, sometime between November, 2008 and March, 2009.

The researcher (Aileen Trang) will arrange meetings at your convenience before and after electronic devices are installed in your vehicle for 2 weeks to get some background, let you try *Roadwise Review*, and obtain your feedback. In-between visits, you simply drive as usual (you don't have to do anything with the devices).

Next spring we will be conducting a further study to obtain feedback on the auditory alert features of the Otto Driving Companion, one of the devices that will be installed in your vehicle. The Otto safety device is mapped for the K-W area using GPS (Global Positioning System) and alerts drivers, for instance when they are approaching crosswalks or hazardous intersections. Our aim is to find out whether older drivers consider these alerts helpful. You can take part in one or both of these studies if you are interested and available.

I give my permission for Aileen Trang to contact me about these studies. I understand that I am under no obligation to participate and all information will be kept totally confidential and not be given to anyone or used for any other purpose.

Name (print):___________________ Signature:_______________ Date:_________

Phone number:_______________________ Age:________

Gender: ____Male ____Female Current Driver? ___Yes ___No

Screening Interview Script

Name: ________________________________ Date: ____________________________

Phone #: _____________________________

Recruited from: ______________________________ by: ___Flyer ___Consent form

If by flyer, did person called about the study? ___No ___Yes

Prior participant? ___No ___Yes Past Study ID#_____

From which sample?

___RB Original 2007 ___RB 3rdAge ___RB Inelig 3rdAge

___RB MTO ___AT 3rdAge

If applicable (RB sample), followed-up on (date): ________ or ___ still needed (Oct grp)

**If follow-up needed, <u>start interview by asking if the person is still driving</u>*

*(refer to **Part D**)*

Consent for Contact Forms Obtained: ___RB study ___AT study ___Future studies

Consenting couple? ___No ___Yes *(i.e., both provided permission to contact for study)*

If yes, Partner's name: ____________________________ ID#: ___________________

Notes (re: any other useful info from consent form to keep in mind for the interview):

____

<u>Attempts to Contact:</u> If **someone else answers**, ask for a good time to call back to reach person. If **answering service,** leave message (name, calling from UW, purpose of call) and say you will call back, or they can call you (number) with the best times to reach them.

1. Date: _________________ Time: ______________

   Reached: ___Subject ___Other Note: _______________________________

2. Date: _________________ Time: ______________

   Reached: ___Subject ___Other Note: _______________________________

3. Date: _________________ Time: ______________

   Reached: ___Subject ___Other Note: _______________________________

4. Date: _________________ Time: ______________

   Reached: ___Subject ___Other Note: _______________________________

5. Date: _________________ Time: ______________

   Reached: ___Subject ___Other Note: ______________________________

Script

Hello [*Participant's name*], my name is Aileen Trang and I am a graduate student at the University of Waterloo, working with Dr. Anita Myers.

Note: *If scheduled for follow-up, go to Part D. If person is still driving and gave their consent for future contact, tell them about current study.*

On [*date*], I came to talk to your [*Name of Group or Centre*] about our driving study. I'm calling with your permission to tell you more about the study and to answer any questions you might have. If you're still interested, I'll ask you a couple of questions to see if you're eligible and available for this particular study and we can schedule a meeting. This will take ~ **20 minutes**. Is this a good time? ___No ___Yes

(If no)*…*I can call back later. When is a **better time**?________________________________
Thank you and I look forward to talking with you then.

(If yes)*…* From now until **March 2009**, I am doing a study for my Master's thesis to look at factors affecting older people's **car use and driving patterns in the winter**. The second purpose of the study is to obtain people's feedback on the ***Roadwise Review,*** an interactive video program, developed by the American and Canadian Automobile Associations specifically for older drivers**.** This program was designed to improve driving awareness and safety by assessing driving-related abilities. You will get to try this **for free** and you will receive a copy of your scores. Feedback from you and other older drivers is important to modify this program, if needed (that is to make it more useful). You will also receive a color guide and helpful tip sheet on winter driving from the Transportation Health & Safety Association of Ontario.

If you agree to participate, I will make an **appointment** to come to your home or another convenient location of your choice (such as a recreation centre). I will then explain the study, ask you to complete a short background questionnaire, and show you how to fill out the activity trip logs (which I will explain in a moment). This should take no longer than **30 minutes**.

With your permission, I will also **install two removable devices in your car**. One is a **CarChip** that plugs into a port usually under your steering wheel. The other is a Global Positioning System (GPS) unit called the **Otto Driving Companion**. The Otto can fit into the palm of your hand and will be mounted on your dashboard in an unobtrusive spot. Together, these devices store data from your car's computer from the time the car is turned on such as date and time, distance traveled, and locations (using the GPS system and local maps). We will use this data to **compare winter driving patterns** with summer driving patterns obtained from previous samples of other K-W drivers. You will not have to do anything with these devices. The devices will not interfere with your car's function nor damage your car. And don't worry; we will not report any speeding or other infractions.

Then we will ask you to drive as usual over the next **two weeks**, and fill out an activity trip logs (like a checklist) to assist us in examining the vehicle information (e.g. # trips with and without passengers). I will explain these during our first meeting.
(*If past participant*): If you remember, in the last study you completed both daily activity diaries (where you recorded out-of-home activities) and car trip logs. For my study, these have been combined and simplified. Each entry will take only 15-30 seconds (< five minutes a day).

A **final meeting** will be arranged to collect these trip logs and ask you to complete a few short questionnaires on your usual driving habits and comfort level and ask about your driving experience over the past two weeks. At this time, you will have the opportunity to try the *Roadwise Review*. The program takes **about 30 minutes**, guides you through tasks to assess your driving-related abilities, and gives you feedback on how you did relative to other older drivers. For this study, you don't need any **computer skills**. I will bring my own laptop, install the program (on CD-ROM) and go through it with you. Then we will talk about your experience. This product is available at some, but not all CAA stores, with discounts for CAA members **(~ $35).** This visit will take **45 to 75 minutes**, depending on whether you choose to do the 30 min. *Roadwise Review*.
(*If past participant:* Won't need to do some of these questionnaires again).

Participation in this study is completely **voluntary** and will in no way affect your license renewal now or in the future. **None of the information** you provide or which is recorded by the electronic devices **will be shared** with any driving authorities. You **may decide** whether you want to complete any aspect of the study or withdraw at any time. **Your name** will only appear on the consent forms, which will be kept in a locked cabinet and separate from the data, and used only to contact you with your permission. All consent forms, electronic, and paper data will be kept secure and confidential and destroyed five years after the study has ended. **To maintain confidentiality**, no individual will be identified by name in my thesis or resulting publications. Results will be summarized across all the study participants to help us and other researchers to better understand issues important to older drivers and the potential utility of road safety tools.
When we meet, I will give you a **letter with all the information on this study for you to keep.**

Do you have any questions at this point?

Are you still **interested in participating**? ___No ___Yes

(If no)… Reason: ____

(If no)… Would you like to **hear about** any of our studies in the future? ___No ___Yes

If so, do we have **your permission** to contact you about these studies? ___No ___Yes

(If yes) Great. Now, a few questions to **make sure you are eligible for this particular study.**

1. How **old** are you? ______ **Birthdate** (dd/mm/yy)? _________________
2. Do you live in the **K-W region**? ___No ___Yes In K-W specifically? ____

If not… What area (city) do you live in? ___________________________________

3. Are you a **current driver**? ___No ___Yes
4. Just to confirm, you have a **valid Ontario driver's license**? ___No ___Yes

   G class licenses are for passenger vehicles. Do you have another type of license (e.g., R-W, motorcycle)? ____
5. Do you **drive <u>at least once a week</u>** during the winter season? ___No ___Yes

Not eligible** if: < **67+**, **no license** or drive < **once/week
Ask permission to continue with interview for potential eligibility for future studies.

6. a) Do you have any **vision problems** that make it difficult for you to drive in certain conditions? ___No ___Yes: If so, what sort of problems?_____________________

   ____

   b) In what sorts of **conditions do you find it hard to see** when driving? ____

7. Have you had or are scheduled to have **cataract surgery**? ___No ___Yes

   If yes, when? In first/one eye (date): ___________________________

   In second eye (date): ____________________________
8. Does **anyone else in your household currently drive**? ___No ___Yes

   What is your relationship with this person(s)? ______________________________
9. Just to confirm, does s/he have a valid Ontario driver's license? ___No ___Yes
10. How old is s/he? __________
11. Does s/he have his/her **<u>own</u> vehicle**? ___No ___Yes
12. Does s/he drive **at least once a week** during the winter season? ___No ___Yes

***<u>Interviewer note</u>**: partner eligible for study?* ___Yes ***(* 67+;** *drive* **once/week)** OR ___No

If yes, *ask if they might be interested, later in the interview*

13. **How many vehicles** do you have? _______ Please describe.

Vehicle 1: Make ________________ Model ________________ Year_________

Hybrid? ___No ___Yes Car ____ or Other _________________

Vehicle 2: Make ________________ Model ________________ Year_________

Hybrid? ___No ___Yes Car ____ or Other _________________

Vehicle 3: Make ________________ Model ________________ Year_________

Hybrid? ___No ___Yes Car ____ or Other _________________

Note: *Primary vehicle must be a* ***car*** *(not a truck),* ***1996*** *or newer,* ***non hybrid.***

Does anyone beside you drive this (or these) cars?

Vehicle 1: ___No ___Yes

If yes, who else drives this vehicle? ________________________

How often?_______________________________________

Who is the primary driver of this vehicle?____________________________

Vehicle 2: ___No ___Yes

If yes, who else drives this vehicle? ________________________

How often?_______________________________________

Who is the primary driver of this vehicle?____________________________

Vehicle 3: ___No ___Yes

If yes, who else drives this vehicle? ________________________

How often?_______________________________________

Who is the primary driver of this vehicle?_____________________________

Note: ***If > one car, ask if person would be willing to drive one car (that's eligible) over the two week study period. Explain we only have 15 sets of equipment.***

Explanation note: I needed to ask those questions as the data loggers do not work in some vehicles. Your vehicle is fine for this study, which is great.

Part B: ***If other household driver eligible and did not fill in consent…***

I also notice that your [relationship: partner, brother, etc.] is also eligible for the study. Do you think s/he might also be interested in participating? ___No ___Yes

If yes, are they there now? ___ No ___ Yes. May I speak with him/her?
(Start new interview with that person)
If not there or not a good time, can you tell him/her about the study and have them call me? Or I can call back at a more convenient time. Note good times to call:

____

Part C: Scheduling

Now let's try and arrange a meeting.

As mentioned, my study will run from now until March. We need to schedule two meetings (over a consecutive two-week) period when people will be in the K-W area. And we need to stagger appointments as we have only 15 sets of devices and I have to meet with people.

Which months are good for you? **Do you plan to be away at any particular times? Notes:**

November____

December____

January____

February____

March____

If not available *till later months, ask when would be a good time to call back*______________

If available now, schedule:

First meeting: Date _________________________ Time ____________

Second meeting: Date _________________________ Time ____________

Interviewer's Note: *if both partners (couple) have consented and are eligible (both need screening interview) try and arrange back to back meeting times on the same date.*

Now, **where would you like to meet**? As I mentioned I can come to your home to make it more convenient for you or we can arrange to meet at another location (e.g., library, recreation center).

Where would you like to meet? ___________________________________

Address of meeting place:____

Note: if meeting away from home, they must come in their car to be used in the study.

I will give you my **number** later (if don't have the flyer), in case you need to call me to change the appointment.

And we usually call people to **remind** them the day before, is that okay? ___ Yes ___ No

Part D. If prior participant from October 2007 → administer annual follow-up interview.

Main issue: **Are they still driving**? ___No ___Yes
*If **so**, do screening interview for eligibility for this study, then the basic follow-up interview (not the DCS if take part in your study).*
*If **no longer driving**, proceed with follow-up interview.*

__Completed or Rescheduled for: ____

Part E. For those who picked up the flyer and ask about the Otto alerts aspect, and/or are not available for my study (away all winter), tell them about our upcoming study.

In my study (Nov to March) we are using the Otto (GPS) device to gather data on winter driving with the auditory alerts feature turned off, as it has been on our prior studies on summer driving. We need to do the study the same way to compare summer and winter driving patterns.

Next spring and summer, we will be doing a **further study** where participants will get to **experience these alerts** (features turned on). There are several different alerts on the Otto to warn people ahead of time, for instance, when approaching pedestrian crosswalks, hazardous intersections, school zones, if there are red light cameras, or if they exceed the speed limit. This requires local GPS maps and municipal statistics, which is currently available for only a few cities in Canada (K-W is one of these). The purpose of this study will be to obtain feedback from older drivers on these safety alerts to determine if people find these helpful.

Would you like to receive more information about this study closer to the time? __No __Yes

If yes, can we have your mailing address? ____
____

Do you also have an e-mail address? ___No ___Yes: ______________________________
____

This concludes our telephone interview.
I look forward to seeing you on __________________[*date*].

Let me give you my number (if don't have the flyer), in case you need to call me to change the appointment. And again, we usually call people to remind them the day before.

Thank you so much for taking the time to answer these questions and your willingness to participate. Have a great day.

Appendix B: First Visit Materials and Tools

Study Check List

Prior to First Visit

- ☐ Program devices
- ☐ Confirmation call

First Visit: ***Materials***

- ☐ **Equipment Set:**
    - ☐ Otto Driving Companion and extra
    - ☐ Otto cable and extra
    - ☐ Otto AC adaptor and extra
    - ☐ Otto jelly pad (to mount Otto on dashboard)
    - ☐ CarChip Pro and extra
    - ☐ Copy of RWR case (with manual) to show them
- ☐ **Activity Trip Log Set**:
    - ☐ Activity trip logs (20 per vehicle) attached to clipboard with pen
    - ☐ Activity trip log instructions and example
- ☐ **Participant's folder**
    - ☐ Study information letter
    - ☐ Consent to participate form
    - ☐ Background questionnaire
- ☐ **Researcher's Folder and Clipboard**
    - ☐ Vehicle Recording Sheet
    - ☐ Protocol sheet
- ☐ Business card

First Visit: ***Protocol***

- ☐ Study letter
- ☐ Consent form
- ☐ BQ
- ☐ Prep devices + record device #s
- ☐ Activity trip log set (instructions, example, logs)
- ☐ CarChip & Otto (2 alerts on) – logging enabled, out of coverage area
- ☐ Vehicle recording sheet
- ☐ Missing info?
- ☐ Troubleshooting (contact info)
- ☐ Questions? Next visit reminder (confirmation call)
- ☐ Install devices (bring logs)
- ☐ Odometer

Devices

Otto	_____
Otto Cable	_____
Otto Adaptor	_____
CarChip	_____
Jelly Pad	_____

Name:___________________________

Researcher's Recording Sheet on Vehicle Information

Name of Driver 1: ______________________________ ID#: ________

Name of Driver 2: ______________________________ ID#: ________

	Make	Model	Year	Purchase Date (Mth/Yr)	Purchased New/Used?	If Used Vehicle: Odometer when Purchased
Vehicle 1						
Vehicle 2						

Vehicle 1: Primary driver ________________________ Note (re: shared vehicle & trips)________________________

Vehicle 2: Primary driver ________________________ Note (re: shared vehicle & trips)________________________

At Initial Visit: Estimated #km driven…

Per week: Driver 1 __________ (Can't estimate ___)

Driver 2 __________ (Can't estimate ___)

Annual: Driver 1 __________ (Can't estimate ___)

Driver 2 __________ (Can't estimate ___)

Odometer Reading	First Visit	Second Visit
Date:		
Vehicle 1		
Vehicle 2		

Letter of Study Information

Note: 13 pt font was used for the actual letter

Dear Driver,

My name is Aileen Trang and I am a graduate student in the Department of Health Studies at the University of Waterloo. This study is for my Master's thesis, under the supervision of Professor Anita Myers. The purposes of this study are to examine factors affecting car use and driving patterns in the winter, and obtain feedback on the *Roadwise Review*.

You will have the opportunity to try the AAA/CAA's *Roadwise Review* interactive educational and self-assessment video for senior drivers for free. At the end of the study, we will also give you a pamphlet on winter driving and car preparation tips.

We are looking for volunteers who live in Kitchener-Waterloo (K-W) Region, are aged 67 or older and drive at least once a week. Participation in this study involves a two- week commitment, with two visits scheduled at your convenience.

Basically, the study involves three parts:

1. A brief initial meeting to obtain background information and install the temporary electronic devices, described below, in your car (this will take about 30 minutes).
2. Driving as usual for two weeks and completing a brief checklist for each trip.
3. A final visit to do a brief interview and some driving-related questionnaires. At this time, you have the opportunity to try the *Roadwise Review* and provide feedback on this program (this visit will take 45 to 75 minutes).

If you agree to participate, I will make an appointment to come to your home or, if you prefer, meet with you at another convenient location (such as a recreation centre). I will then explain the study, show you how to complete the activity trip logs and do a short background interview. This should take no longer than **30 minutes**.

With your permission, I will also install two removable devices in your car. One is a CarChip which is a small device that plugs into a port under your steering wheel. The other is a Global Positioning System (GPS) unit (called the Otto Driving Companion) which fits into the palm of your hand and will be mounted on your dashboard (but will not block your vision). These devices store data from your car's computer, such as days and times the car is turned on, distance traveled, speeds and roadways (using the GPS system and local maps). We will use this data to compare winter driving patterns (e.g., number of trips) with summer driving patterns (from prior studies with other older drivers from the Waterloo region). You will not have to do anything with these devices, nor will they damage your car in any way. And don't worry; we will not report any speeding or other infractions.

Over the two weeks, we will ask you to drive as you normally would. To supplement the information from your car's on-board computer and weather reports, I will ask you to complete an activity trip logs over the two week period. I will explain these and give you a set of logs (like a checklist) on a clipboard to leave in your car. Each log (one per trip) should only take **15-30 seconds** at most to complete.

I will then arrange a final meeting to collect the devices and logs. I will then ask you to complete a few short questionnaires on your usual driving habits and comfort level, and discuss your experience in the past two weeks. You will also have an opportunity to do the AAA/CAA's *Roadwise Review* education and self-assessment video program which I will guide you through on my computer. You will be given a copy of your results (how you score compared to a large sample of senior drivers) and asked about your experience doing the *Roadwise Review*. You will also receive a colored booklet and a helpful tip sheet on winter driving developed by Transportation Health & Safety Association of Ontario (THSAO). This visit will take between **45 to 75 minutes**.

Participation in this study is completely voluntary and will, in no way, affect your license renewal now or in the future. None of the information you provide or which is recorded by the electronic devices will be shared with any driving authorities. You may decide whether you want to complete any aspect of the study or withdraw at any time. Your name will only appear on the consent forms, which will be kept in a locked cabinet, separate from the data, and used only to contact you with your permission. All consent forms, electronic and paper data will be kept secure, confidential, and will be destroyed five years after the study has ended. To maintain confidentiality, no individual will be identified by name in my thesis or resulting publications. Results will be summarized across all the study participants to help us and other researchers to better understand the driving patterns of older adults in different seasons and regions and to help make programs like Roadwise Review as useful as possible.

Your written consent to participate is required. This project has been reviewed and has received ethics clearance from the Office of Research Ethics at the University of Waterloo. Keep this letter and if you have any questions please contact me at 519-888-4567, extension 37031.

Sincerely,

Aileen Trang (Master's Student)
Department of Health Studies and Gerontology
University of Waterloo

If you have concerns about your participation in this study, you can also contact the Office of Research Ethics at the University of Waterloo at 519-888-4567, extension 36005.

Consent for Participation

Ms. Trang's Master thesis study has been explained to my satisfaction and I have had the opportunity to ask questions. I was informed that my participation is totally voluntary and will in no way affect my license renewal now or in the future and that I may withdraw from the study at any time. I choose whether or not to complete the questionnaires, activity trip logs, interview and Roadwise Review.

I was informed that all information collected will be kept totally confidential by the researcher. I also understand that the results will be summarized across all older drivers who have taken part in this study. No individual will ever be identified by name and any quotes used in reports will be anonymous. Consent forms will be kept secure (in a locked cabinet), separate from the data. All consent forms and questionnaires will be destroyed five years after the study has ended.

I was informed that this project was reviewed by and received ethics clearance from the Office of Research Ethics at the University of Waterloo. If I have any questions or concerns regarding my involvement, I know that I can contact the researchers or the Office of Research (numbers provided in the letter of information I have been given).

Participant's name (please print): ____

Participant's signature: ____________________________ Date: ________________

Researcher's signature: ___________________________ Date: _________________

Background Questionnaire

<u>Part A.</u> Please tell us about yourself.

1. Are you? ____Male ____Female

2. Your **age**: _____

3. Did you **complete**: High School? ___No ___Yes
   College or University? ___No ___Yes

4. Do you **live in**? ____ A private home ____ Apartment/condo
   ____ A retirement or seniors' complex

5. Do you live? ___ Alone ___ With spouse or partner
   ___ With family members ___With roommates (not related)

6. Are you **currently employed** (including self-employment)? ___No ___Yes
   If yes, are you employed ___ Full time or ___ Part time?

7. How would you describe your **financial situation**? (Choose one)
   __ I can meet my needs and still have enough money left to do most things I want
   __ I have enough money to do many things I want if I budget carefully
   __ I have enough to meet my needs but have little left for extras
   __ I can barely meet my needs and have nothing left for extras

<u>Part B.</u> Please tell us about your experience with technology.

1. Do you use any of the following? (Check all that apply)

   ___ Computer ___ E-mail ___ Internet searches
   ___ Cell phone
   ___ Digital camera
   ___ VCR/DVD
   ___ ATM/Bank machine

2. Would you describe yourself as comfortable with household technology (e.g., programming a VCR/DVD)? ___No ___Yes

3. Have you ever used an in-car navigational device (e.g., Garmin, TomTom, onStar)?
___No ___Yes

If no, please go to **Part C**.
If yes, is it in your car now? ___No ___Yes
Do you use this?
___All the time ___Mostly for out-of-town trips ___For new locations

How would you rate your comfort level programming and using these navigational devices from **1** (not at all comfortable) to **5** (extremely comfortable): ______

<u>Part C.</u> Now, please answer a few questions about your health and activities.

1. **Overall,** would you say your health is:
   ___Excellent ___Good ___Fair ___Poor

2. Do you **ever use** a cane or walker outdoors? ___No ___Yes

3. Are you **able to walk a quarter of a mile**? ___No ___Yes

4. How many days in an **average week** do you do at least 30 minutes of moderate **physical activity** (e.g., a brisk walk)? _______ (# of days)

5. Are you in any organized **exercise** classes or activities (such as curling, golfing or bowling)? ___No ___Yes (# days/week ______)

6. In the past year, have you fallen (ended up on the ground or floor)? __No __Yes

If yes, have you fallen more than once? ___No ___Yes
were you injured as a result of the fall(s)? ___No ___Yes
did you have trouble getting up? ___No ___Yes

7. Have you been **diagnosed** with any of the following? (Check all that apply)

____ Arthritis, Rheumatism or Osteoporosis
____ Parkinson's, Multiple Sclerosis, Stroke (**Circle which ones**)
____ High blood pressure, Cholesterol or Heart problems
____ Diabetes
____ Asthma or other breathing problems
____ Back problems or ___ Foot problems
____ Hearing problems

____ Cataracts, Glaucoma, Macular Degeneration, Diabetic Retinopathy (**Circle which ones**)
____ Sleeping disorders (e.g., Insomnia, Sleep apnea, Restless leg syndrome)
____ Other(s) (Specify: ____)

8. Do you **experience any of the following difficulties**? (Check all that apply)
Staying awake or remaining alert? ___No ___Yes
Keeping your balance? ___No ___Yes
Initiating movement? ___No ___Yes
Persistent pain? ___No ___Yes
Limited strength or movement? ___In torso/hips ___In legs/feet
Lack of feeling or sensation? ___Upper body ___Lower body
Stiffness? ___In your neck ___In your spine/back
Involuntary movement (e.g., shaking/twitches)? ___Upper body ___Lower body

9. Have you ever had **cataract surgery**? ___No ___Yes
If yes, on: ___One eye ___Both eyes
How long ago was this surgery?
First eye: ___ Within past year ___ Over a year ago
Second eye (if applicable): ___ Within past year ___ Over a year ago

10. Do you wear **prescription glasses or contacts for driving**?
___ All the time ___ Sometimes ___ Never

11. Compared to others your age, **would you say that your eyesight is**:
___ Better than most ___ About the same ___ Worse than most

12. Do you wear a hearing aid when driving?
___No ___ Some of the time ___ Most of the time

13. Are you currently taking **any prescribed medications**?
___No ___Yes (Specify how many: _______)

14. When did you **last visit a physician**?
___Within past 6 months ___Past year ___More than a year ago

Thank you for completing this questionnaire.

Please let me know if any of the questions are unclear.

University of Waterloo Driving Study
Activity Trip Log

Note: 13 pt font was used for the actual document

Please leave these logs in **this** vehicle and fill out a separate one after **each** driving trip. In addition to the date and time you left home, we need the following information.

Driver: Please identify whether **you or someone else** drove the vehicle for each trip (e.g., me, partner or other). If "other", just put in **NP** (non-participant) and note the time of day. The rest of the log does not have to be completed.

More than one driver on the trip: Please indicate whether you drove the entire way or shared the driving. If someone else drove part of the way, indicate **your relationship** to this person.

Number and Type of Passengers: Indicate the number of different passengers you had in your car **at any point** on the trip. For example, if you left home with your partner, dropped him/her off and then picked up your grandchild before returning home, you had two passengers in your car.

Weather conditions: Please describe the weather and road conditions during the trip as best as you can.

Number of stops: Please check the # of stops you made on the trip (from the time you left home until you returned). Consider the return home as the last stop.

Please note **all the places you went** (e.g., grocery store), approximate **time of arrival** to each place, and general **locations** (e.g., streets, intersection). **An example is provided.**

If you have any questions or problems filling this out, please call me at the numbers below. If I am not there, please leave a message and I will return your call as soon as I can.

Aileen Trang

Office: 519-888-4567, extension 37031
Cell phone: 519-998-7827

University of Waterloo:
Activity Trip Log EXAMPLE

Note: 13 pt font was used for the actual form

Date: October 6, 2008 **Time of Day:** 9:24 **am** / **pm** (circle one)

Driver: Me (If **not** in the study, note "NP")

I drove (check one): ☐ The entire trip √☐ Only the way there ☐ Only the way home

If applicable, **who else** drove on this trip? (e.g., spouse, son) friend

Number of Passengers: ☐ 0 √☐ 1 ☐ 2 ☐ 3 ☐ 4

Type of Passenger(s): ☐Partner √☐Friend ☐Grandchild ☐Other relative ☐Other

Describe the weather on your trip (e.g. sunny, foggy) and road conditions (if not good).

Overcast when left, heavy rain on the way home and slippery road

Check each stop made and **note** the time, purpose and location. Consider home the last stop.

Stops	Arrival Time	Purpose	Location
√☐ 1	9:30	Grocery shopping	Sobey's @ Highland & Belmont
√☐ 2	9:50	Pharmacy	Shoppers @ Highland & Westmount
√☐ 3	10:05	Rent video	Blockbuster @ Fischer-Hallman & Highland
√☐ 4	10:15	Home	
☐ 5			
☐ 6			
☐ 7			
☐ 8			

Appendix C: Second Visit Materials and Tools

Study Check List

<u>Prior to Final Visit (In between visits)</u>

- ☐ Input background questionnaire data (check for completion)
- ☐ File consent form and background questionnaire
- ☐ Confirmation call (ask to bring activity trip logs inside that day)
- ☐ Record daily road and weather conditions

<u>2nd Visit:</u> ***Materials***

- ☐ **Questionnaires/scales for participants:**
  - ☐ Driving Habits Questionnaire
  - ☐ Driving Comfort Scales (Day and Night)
  - ☐ Perceived Driving Abilities Scales (current & 10 yr)
  - ☐ Situational Driving Frequency & Avoidance (SDF & SDA)
  - ☐ RWR Feedback Questionnaire
  - ☐ THSAO Winter guide & 2 sided Helpful Tips sheet
- ☐ **Roadwise Review Set:**
  - ☐ CD-ROM (updated version for assessment)
  - ☐ Original RWR case (for show)
  - ☐ Laptop and power cord
  - ☐ Mouse and mouse pad
  - ☐ Measuring tape and masking tape (for walk test)
  - ☐ Blank RWR Results Sheet (2 copies: 1 for driver and 1 for researcher)
  - ☐ AAA's RWR cut-points (if participants ask)
  - ☐ Interpretation sheets (2-3 levels for all 8 tasks)
- ☐ **Researcher's Folder and Clipboard**:
  - ☐ Vehicle Recording Sheet
  - ☐ Future contact consent form
  - ☐ Interview script
  - ☐ Protocol sheet

<u>2nd Visit: Protocol</u>

- ☐ Missing info?
- ☐ DHQ, DCSs, PDAs, SDF, SDA
  - ☐ Check logs
  - ☐ Note trips/activities for interview
- ☐ Clarify logs
- ☐ Interview
- ☐ RWR, if no, skip to **<u>step 11</u>** Notify UFOV
- ☐ RWR scores (x2)
- ☐ RWR feedback Q
- ☐ RWR interpretation sheets
- ☐ THSAO Winter Guide and Helpful Tips sheet.
- ☐ Future consent (Alert study)
- ☐ Uninstall devices
- ☐ Odometer reading

RWR: ___No ___Yes

Name:___________________________

Driving Habits Questionnaire

Please tell us about your <u>general</u> driving habits.

1. Approximately how **old were you** when you got your driver's license? _______

2. Apart from a standard driver's license, did you ever hold **any other class of license**? ___No ___Yes

3. Did you **commute to work as a driver** more than one hour each way?
   ___No ___Yes

4. How many **days a week** do you **usually** drive?

   Now: ______ Spring to fall: ______

5. **How long** are <u>most</u> of your driving trips (each way)?
   ___ Less than 15 minutes ___ About 15 to 30 minutes
   ___ About 30 to 60 minutes ___ Over 60 minutes

6. What **types of roads** do you typically drive on? (Check all that apply)
   ___ Residential streets ___ Main city streets
   ___ Rural roads ___ Freeways (e.g., 400 series)
   ___ Highways (e.g., Hwys 6,7, and 8)

7. What **times of the day** do you usually drive? (Check all that apply)
   ___ Morning ___ Afternoon
   ___ Early evening (<u>before</u> dark) ___ At night (<u>after</u> dark)

8. Overall, **compared to 10 years ago**, do you drive:
   ___Much less often ___A little less ___The same ___More often

9. How do you **prefer** to get around?
   ___ Drive yourself ___ Have someone drive you ___Special transit services
   ___ Taxis ___ Buses ___ Walk

10. Does anyone else **rely on you** to drive them? ___ No ___Yes
    (Note: this person may or may not live with you)

11. To what extent **do you worry about car related expenses**?
    (e.g., gas, maintenance or repair costs, license and insurance costs)
    ___ Often ___ Sometimes ___ Rarely ___ Never

12. Who takes your household vehicle in for **regular servicing**?
___ Me ___ Other (Specify relationship with person: ________________)

13. Do you **change your tires** for winter driving? ___No ___Yes

14. If you did not feel like driving, are you **close enough to walk** to:
a) Do your weekly shopping & errands? ___ No ___ Yes
b) Get to church, social or recreation clubs? ___ No ___ Yes

15. Has your physician ever **asked you whether you drive**? ___No ___Yes

16. Have you **talked about your driving** with any of the following?
An eye care professional ___ No ___ Yes
Family members ___ No ___ Yes
Friends ___ No ___ Yes

17. Has anyone **suggested** that you **limit or stop driving**? ___ No ___ Yes
If yes, who? (Check all that apply)
___Family ___Friends ___Your physician ___An eye care professional

18. Are you seriously thinking about **giving up driving** in the next few years?
___No ___Yes If so, why? ____

19. Have you seriously thought about **reducing the amount you drive**?
___No ___Yes

20. Have you taken **any driving courses**? ___No ___Yes

If yes, what type of course?________________________________

21. In the past five years, have you been asked by the Ministry of Transportation **to take:**
A vision test? ___ No ___ Yes
A rules test? ___ No ___ Yes
A road test? ___ No ___ Yes
A vision or medical examination? ___ No ___ Yes
A comprehensive or rehabilitation driving assessment? ___ No ___ Yes

22. In the past year, have you had any of these **problems when driving**?

Accidents involving another vehicle?	___ No ___Yes
Near misses (almost an accident)?	___ No ___Yes
Backing into things besides other cars?	___ No ___Yes
Driving over curbs or medians?	___ No ___Yes
Getting lost?	___ No ___Yes
Traffic violations with demerit points?	___ No ___Yes

23. What are the **main reasons** you drive? (Check all that apply)

___ Shopping, banking and other errands
___ Getting to appointments (such as the doctor or dentist)
___ Visiting family or friends
___ Getting to religious services
___ Getting to recreational activities or social events
___ Other (volunteer, employment), specify: _____________________

24. How **important** is it for you, personally, to **continue** to drive? (Circle one)

1	2	3	4	5
Extremely Important	Very	Moderately Important	Somewhat	Not that Important

25. Using the scale above, please rate **how important** (from 1 to 5) it is for you to **keep driving** for each of the following reasons:

_____To maintain your present lifestyle (places you want to go)

_____To meet commitments such as volunteer work or helping others

_____To get to shops and services from where you live

_____Due to poor public transportation

_____Other people counting on you to drive them

_____Family or friends not available to drive you

_____Not wanting to bother others for rides

_____Physical difficulty walking or using public transport

Thank you for completing the questionnaire.
Please let me know if any questions are unclear or confusing.

Driving Comfort Scales©

Please rate your level of comfort by choosing one option from the scale (0, 25, 50, 75 or 100 %) and writing it beside each situation.

If you do not normally drive in the situation, imagine how comfortable you would be if you absolutely had to go somewhere and found yourself in the situation.

In your ratings, consider confidence in your own abilities and driving skills, as well as the situation itself (including other drivers).

Assume **normal traffic flow** unless otherwise specified.

0%	**25%**	**50%**	**75%**	**100%**
Not at all comfortable		Moderately comfortable		Completely comfortable

‘How **comfortable** are you driving in the **daytime**…?’

1. In light rain? _____ %

2. In heavy rain? _____ %

3. In winter conditions (snow, ice)? _____ %

4. If caught in an unexpected or sudden storm? _____ %

5. Making a left hand turn with no lights or stop signs? _____ %

~ Please continue ~

0%	**25%**	**50%**	**75%**	**100%**
Not at all comfortable		Moderately comfortable		Completely comfortable

‘How **comfortable** are you driving in the **daytime**…?’

6. Pulling in or backing up from tight spots in parking lots with large vehicles on either side? _____ %
7. Seeing street or exit signs with little warning? _____ %
8. On two-lane highways? _____ %
9. Keeping up with the flow of highway traffic when the flow is <u>over</u> the posted speed limit of 100 km/h (60 miles/h)? _____ %
10. With multiple transport trucks around you? _____ %
11. When other drivers tailgate or drive too close behind you? ___ %
12. When other drivers pass on a non-passing lane? _____ %
13. When other drivers do not signal or seem distracted? _____ %

~ Please continue ~

Now we would like you to rate your level of comfort when driving in the following situations **at night**.

Even if you **do not normally drive at night**, imagine that you were out in the afternoon, got delayed and it was dark on your way back.

In your ratings, consider confidence in your own abilities and driving skills, as well as the situation itself (including other drivers).

Assume **normal traffic flow** unless otherwise specified.

0%	**25%**	**50%**	**75%**	**100%**
Not at all comfortable		Moderately comfortable		Completely comfortable

‘How **comfortable** are you driving **at night** …?’

1. In good weather and traffic conditions? _____ %
2. In light rain? _____ %
3. In heavy rain? _____ %
4. In winter conditions (snow, ice)? _____ %
5. When there is glare or reflection from lights? _____ %

~ Please continue ~

0%	25%	50%	75%	100%
Not at all comfortable		Moderately comfortable		Completely comfortable

‘How **comfortable** are you driving **at night** …?’

6. In unfamiliar routes (different areas), detours or sign changes?__%
7. Making a left hand turn with no lights or stop signs? _____ %
8. Pulling in or backing up from tight spots in parking lots with large vehicles on either side? _____ %
9. Seeing street or exit signs with little warning? _____ %
10. On two-lane highways? _____ %
11. Keeping up with the flow of highway traffic when the flow is <u>over</u> the posted speed limit of 100 km/h (60 miles/h)? _____ %
12. With multiple transport trucks around you? _____ %
13. Merging with traffic and changing lanes on the highway? ____ %
14. When other drivers tailgate or drive too close behind you? ___ %
15. When other drivers pass on a non-passing lane? _____ %
16. When other drivers do not signal or seem distracted? _____%

How would you rate your **current ability** to…..?

Assume daytime driving unless specified otherwise (night).

	Poor	**Fair**	**Good**	**Very Good**
1. See road signs at a distance	☐	☐	☐	☐
2. See road signs at a distance (night)	☐	☐	☐	☐
3. See your speedometer and controls	☐	☐	☐	☐
4. See pavement lines (at night)	☐	☐	☐	☐
5. Avoid hitting curbs or medians	☐	☐	☐	☐
6. See vehicles coming up beside you	☐	☐	☐	☐
7. See objects on the road (at night) with glare from lights or wet roads	☐	☐	☐	☐
8. Quickly spot pedestrians stepping out from between parked cars	☐	☐	☐	☐
9. Move your foot quickly from the gas to the brake pedal	☐	☐	☐	☐
10. Make an over the shoulder check	☐	☐	☐	☐
11. Quickly find a street or exit in an unfamiliar area and heavy traffic	☐	☐	☐	☐
12. Get in and out of your car	☐	☐	☐	☐
13. Reverse or back up	☐	☐	☐	☐
14. Make quick driving decisions	☐	☐	☐	☐
15. Drive safely (avoid accidents)	☐	☐	☐	☐

Compared to 10 years ago,
how would you rate your own ability to…?

	Better	Same	A Little Worse	A Lot Worse
1. See road signs at a distance	☐	☐	☐	☐
2. See road signs at a distance (night)	☐	☐	☐	☐
3. See your speedometer and controls	☐	☐	☐	☐
4. See pavement lines (at night)	☐	☐	☐	☐
5. Avoid hitting curbs or medians	☐	☐	☐	☐
6. See vehicles coming up beside you	☐	☐	☐	☐
7. See objects on the road (at night) with glare from lights or wet roads	☐	☐	☐	☐
8. Quickly spot pedestrians stepping out from between parked cars	☐	☐	☐	☐
9. Move your foot quickly from the gas to the brake pedal	☐	☐	☐	☐
10. Make an over the shoulder check	☐	☐	☐	☐
11. Quickly find a street or exit in an unfamiliar area and heavy traffic	☐	☐	☐	☐
12. Get in and out of your car	☐	☐	☐	☐
13. Reverse or back up	☐	☐	☐	☐
14. Make quick driving decisions	☐	☐	☐	☐
15. Drive safely (avoid accidents)	☐	☐	☐	☐

Based on your present lifestyle, on average **how often** do you drive….?
Check one box for each situation.

Note:14 pt font was used for this actual form

	Never	**Rarely** Less than once a month	**Occasionally** More than once a month, but not weekly	**Often** 1 - 3 days a week	**Very Often** 4 - 7 days a week
1. In the winter?	☐	☐	☐	☐	☐
2. At night?	☐	☐	☐	☐	☐
3. On two-lane highways?	☐	☐	☐	☐	☐
4. In rural areas?	☐	☐	☐	☐	☐
5. On highways with 3 or more lanes?	☐	☐	☐	☐	☐
6. Over the posted highway speed limit?	☐	☐	☐	☐	☐
7. On one-way trips lasting over 2 hours?	☐	☐	☐	☐	☐
8. In heavy traffic or rush hour in town?	☐	☐	☐	☐	☐
9. In heavy traffic or rush hour on the highway?	☐	☐	☐	☐	☐
10. With passengers?	☐	☐	☐	☐	☐
11. Outside your village, town or city?	☐	☐	☐	☐	☐
12. In new or unfamiliar areas?	☐	☐	☐	☐	☐
13. Making left hand turns at intersections?	☐	☐	☐	☐	☐
14. Parking in tight spaces?	☐	☐	☐	☐	☐

If possible, do you **try to avoid** any of these driving situations?

(*Check all that apply.)*

1. Night	☐
2. Dawn or dusk	☐
3. Bad weather conditions (in general)	☐
4. Heavy rain	☐
5. Fog	☐
6. Nighttime driving in bad weather (e.g., heavy rain)	☐
7. Winter	☐
8. First snow storm of the season	☐
9. Trips lasting more than 2 hours (one way)	☐
10. Unfamiliar routes (different areas) or detours	☐
11. Heavy traffic or rush hour in town	☐
12. Heavy traffic or rush hour on the highway (or expressway)	☐
13. Making left hand turns with traffic lights	☐
14. Making left hand turns with no lights or stop signs	☐
15. Parking in tight spaces	☐
16. Highways with 3 or more lanes and speed limits of 100 km/h or more	☐
17. Changing lanes on a highway with 3 or more lanes	☐
18. Two-lane highways	☐
19. Rural areas at night	☐
20. Driving with passengers who may distract you	☐
21. No: I don’t try and avoid any of these situations	☐

Final Visit Interview Script

Name: ___________________________________ Date: ____________________

Part A: Driving Over the Past Two Weeks

1. Did having the **devices** in your car **affect your driving** behavior in any way?

   ___No ___Yes If so, how? ____

2. Can you **estimate the number of km** you drove over the last two weeks? __ No __ Yes

   If yes, ________ (# kms) If unsure, do you want to try and guess? _________ (# **km**)

   or ___Can't estimate

3. Over the past 2 weeks, did you have **any car or driving problems**? ___ No ___ Yes

   If so, **what were they**? ____

   ____

   ____

   (Probe: Accidents involving another vehicle, near misses, backing into things besides other cars, getting lost, traffic violations with loss of demerit points, car troubles)

4. Were the last two weeks **typical** **of your usual driving** with respect to **how much** you drove, **when, where, passengers**? ___Yes ___No If not, **what was different?**

   ____

   ____

   ____

5. Any **special circumstances** (e.g., illness, visitors) OR **events** (e.g., birthdays, appointments) that affected your usual driving patterns (e.g., longer trips than usual)?

   ____

   ____

   ____

6. Did you have any **regularly scheduled activities** (e.g., curling, bridge club) or appointments over the past two weeks? ___ Yes ___ No

   If yes, what were these?____

7. Over the past two weeks, were there **any trips you were going to take but decided not to**? ___No ___Yes *If yes, elaborate. Probe: **<u>why</u>** canceled or postponed, typicality*

   ____

   ____

   ____

<u>Part B: Activity Trip Logs</u>

I looked over your activity trip logs and want to clarify a few things with you.

List activities (apart from routine chores like shopping) from the logs *and probe for typical frequency of things like exercise classes, volunteering, babysitting, playing bridge.*

I see you went to….. Do you do this on a <u>regular basis</u>? How often? (e.g., weekly)

<u>Activities from Logs:</u> **<u>Regularity:</u>**

<u>Part C: General Questions</u>

1. Generally speaking, what are the kinds of things you **might cancel or postpone** if you did not feel like driving (e.g., tired) or the weather was bad?

   ____

   ____

2. Are there any activities you **feel compelled to do,** even if you did not feel like driving?

   ____

   ____

   ____

3. If you did **not feel like driving yourself**, could you get there **another way**?

____

____

4. **If you were no longer able to drive** for some reason, what would be affected the most?

____

____

Comments:____

____

____

Thank them for completing the interview.

RWR: ___No ___Yes

If not, reason:

____

____

If yes, administer RWR feedback questionnaire.

AAA's Roadwise Review Individual Screening Results

Name: ____ **Date: ____________________**

*Ability Screened**	*Measure Completed*	*Raw Score*	*Level of Impairment*
1. Leg strength & general mobility	___ Yes	__ seconds	___None ___Mild ___Serious
2. Head/neck flexibility	___ Yes	___Okay ___Limited	___None ___Serious
3. High contrast visual acuity	___ Yes	20/____ or	___None ___Mild ___Serious
4. Low contrast visual acuity	___ Yes	20/____ or	___None ___Mild ___Serious
5. Visualizing missing information	___ Yes	__ incorrect	___None ___Mild ___Serious
6. Visual info. processing speed	___ Yes	__ millisecs	___None ___Mild ___Serious
7. Visual search	___ Yes	__ seconds	___None ___Mild ___Serious
8. Working memory	___ Yes	__ incorrect	___None ___Mild ___Serious

***Tests**: 1. 10 ft Rapid Paced; 2. Turning to look at screen (10 ft); 3 & 4. Reversed E (high and low contrast); 5. MVPT; 6. UFOV (test 2); 7. Trail Making Test (B);
8. MMSE Delayed Recall

IMPORTANT: These computerized tests may not be completely accurate and do not substitute for complete evaluations by eye care professionals, physicians or driving specialists. If you have concerns in any of these areas, you should see one of these specialists for a more thorough assessment. You will be given a copy of these results to take home.

Interpretation Sheet for Leg Strength & General Mobility
Am I At Risk?

Based on your score for this measure, you appear to have a mild impairment in your leg strength and general mobility. Your score has been compared with the scores of thousands of drivers, age 55 and older, who completed this same test in a controlled, scientific study.

One reason leg strength is important for safe driving is so you can always maintain steady control over the pedals, without fatigue. Without enough strength and flexibility in your leg and ankle, you could have difficulty in quickly and accurately shifting back and forth from the gas to the brake pedal. You must be able to put your brakes on quickly in an emergency, and also must be able to smoothly control your speed in routine situations. If you drive erratically, by speeding up and slowing down for no apparent reason, other drivers may react by trying to avoid you or pass you when they shouldn't. This creates an unsafe situation for everyone.

Though you appear to have a mild loss in leg strength and general mobility, you may still be able to drive without exposing yourself or other to any significant increase in crash risk. Your *Roadwise Review* score suggests that your level of risk will depend more on when and where you choose to drive than on the mild impairment you have in this particular area.

What Should I Do?
Based on your screening results, you appear to have a modest loss in leg strength and general mobility. This does <u>not</u> mean that you should be thinking about giving up driving - in fact, now is the time to concentrate on what you can do to keep driving safely longer.

Here are some suggestions...
You may benefit substantially from some type of therapy or rehabilitation that can slow or even revere your loss, or there may be adaptive equipment that can make the driving task safer and easier for you. A follow-up visit with your physician, with a physical or occupational therapist, or with a certified driving rehabilitation specialist can help you decide upon the best course of action.

At the same time, knowing that a loss of leg strength can increase your risk in some situations more than others, it may be in your best interest to adjust when, where, or how often you drive. You may wish avoid heavy traffic, where you will need to brake often, as well as reduced visibility conditions, where the chances are higher that you will need to brake suddenly. Again, consulting you doctor, occupational therapist, or a driving evaluation specialist is strongly recommended, to get advice that is most appropriate for your level of ability, your travel needs and preferences, and your local driving conditions.

Driving Examples
Here are some examples of common situations where having good leg strength is critical to drive safely:

- Responding quickly to avoid hitting a pedestrian, who isn't paying attention and steps into your path
- Switching between the brake and gas smoothly, to maintain a steady speed under normal traffic conditions

Roadwise Review Feedback Questionnaire

1. Did this program make you more aware of changes that can affect someone's driving as they age?

   [ ] Yes
   [ ] No

2. Did you discover any changes in yourself that you had not been aware of?

   [ ] Yes
   [ ] No

3. Did you learn anything new from the program?

   [ ] Yes
   [ ] No Was it a useful reminder? [ ] Yes [ ] No

4. Now that you have done this self-assessment, are you planning to make any changes to your actual driving?

   [ ] Yes
   [ ] No

5. Do you plan to discuss your results with your doctor or optometrist?

   [ ] Yes
   [ ] No
   [ ] Don't know

6. Do you plan to discuss your results with family members or friends?

   [ ] Yes
   [ ] No
   [ ] Don't know

7. Would you recommend the Roadwise Review to friends or family?

   [ ] Yes
   [ ] No

8. Overall, how would you rate the usefulness of doing the Roadwise Review?

[ ] Very useful
[ ] Somewhat useful
[ ] A little useful
[ ] Not at all useful

9. Do you think it would be useful to do it again periodically as the program recommends (say once or twice a year)?

[ ] Yes
[ ] No

10. Would you be willing to pay for this program?

[ ] Yes If so, how much? $__________
[ ] No

11. Do you have access to a computer that you could have used to do the Roadwise Review assessment?

[ ] Yes
[ ] No

12. Would you be comfortable installing the software and going through the program with a partner of your choosing?

[ ] Yes
[ ] No

Please note any comments or suggestions for improving the program:

____

____

Thank you for giving us your feedback on the Roadwise Review program.

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Permission to Contact for Future Studies

In the future, we will likely be conducting further studies with older drivers at the University of Waterloo. We also would like to contact participants from our various driving studies at six to 12 month intervals to see if there have been any important changes. If you would like to receive information about future studies, or if we can contact you to conduct a brief follow-up interview by phone, we require your permission to contact you by mail, phone or e-mail.

I give my permission for Dr. Anita Myers from the University of Waterloo or her graduate students to contact me in the next five years to follow-up or let me know about further studies with older drivers. I understand that I am under no obligation to participate should I be contacted. Contact information will be kept secure (in a locked cabinet) and not given to anyone or used for any other purpose. This information will be destroyed once contact has been made, if any, or within five years from this date.

☐ Please check if you would like to receive a summary of the study results.

Name (print):____

Address: ____

Phone number:____________________ E-mail:_________________________

Signature:____________________________ Date:____________________

Researcher's Signature:_____________________ Date: ________________

Appendix D: Driving Conditions

Weather Descriptors were based on Environment Canada's hourly archives. Weather data as recorded by the Region of Waterloo airport and snow depths as recorded by the University of Waterloo weather station.


Rain/Drizzle


Freezing Rain


Snow


Wet Snow


Fog


Clear

A Weather Alert (reported in the K-W Record's online archive)

A! Weather Alert – severe storms (as reported by the K-W Record)

Driving Condition Descriptors: Based on subjects' descriptions in their trip logs.

Weather Descriptors

S Snow
R Rain
F Fog
C Clear

Road Descriptors

SC Snow-covered
SL Slush-covered
W Wet/damp
I Icy
D Dry/clear

November 2008

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
2 **DLS Starts** 7*C Sunrise: 6:58am Sunset: 5:12pm	3 16*C Sunrise: 7:00am Sunset: 5:11pm	4 20*C Sunrise: 7:01am Sunset: 5:09pm	5 20*C Sunrise: 7:02am Sunset: 5:08pm	6 19*C Sunrise: 7:03am Sunset: 5:07pm	7 18*C Sunrise: 7:05am Sunset: 5:06pm	8 9*C Sunrise: 7:06am Sunset: 5:04pm
9 5*C Sunrise: 7:07am Sunset: 5:03pm	10 3*C Sunrise: 7:09am Sunset: 5:02pm	11 4*C Sunrise: 7:10am Sunset: 5:01pm	12 8*C Sunrise: 7:11am Sunset: 5:00pm	13 10*C Sunrise: 7:13am Sunset: 4:59pm	14 12*C Sunrise: 7:14am Sunset: 4:58pm	15 9*C Sunrise: 7:15am Sunset: 4:57pm
16 1*C Sunrise: 7:16am Sunset: 4:56pm	17 -1*C Sunrise: 7:18am Sunset: 4:55pm	18 -2*C Sunrise: 7:19am Sunset: 4:54pm	19 -2*C Sunrise: 7:20am Sunset: 4:54pm	20 -2*C Sunrise: 7:22am Sunset: 4:53pm	21 -6*C Sunrise: 7:23am Sunset: 4:52pm	22 -4*C Sunrise: 7:24am Sunset: 4:51pm
23 -1*C Sunrise: 7:25am Sunset: 4:51pm	24 **R W** 3*C Sunrise: 7:26am Sunset: 4:50pm 5-9pm	25 **R W** 1*C Sunrise: 7:28am Sunset: 4:49pm 4-11am ***Snow: 2.5cm***	26 **S I** 1*C Sunrise: 7:29am Sunset: 4:49pm Overnight 11-1pm **A**(freezing rain) ***Snow:1cm***	27 **S SC** 1*C Sunrise: 7:30am Sunset: 4:48pm Overnight ***Snow:2.5cm***	28 **S SC** 2*C Sunrise: 7:31am Sunset: 4:48pm 11am-12am **A** (snow)	29 **S SC** 2*C Sunrise: 7:32am Sunset: 4:47pm Overnight **A** (snow) ***Snow:2cm***
30 **S I** 1*C Sunrise: 7:33am Sunset: 4:47pm 3-10pm						

Weather			Road		
Snow	**S**	5	Snow-covered	**SC**	3
Rain	**R**	2	Slush-covered	**SL**	0
Fog & Rain	**F**	0	Wet/damp	**W**	2
Clear	**C**	0	Icy	**I**	2
			Dry/clear	**D**	0

Total days monitored = 7 in Nov.

December 2008

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1 **S SC** 2*C Sunrise: 7:35am Sunset: 4:46pm Overnight 1pm, 8-12am **A** (snow) ***Snow:8cm***	2 **S SL** -1*C Sunrise: 7:36am Sunset: 4:46pm Overnight-11am, 4-7pm ***Snow:2cm***	3 **C W** 3*C Sunrise: 7:37am Sunset: 4:46pm 8pm-Overnight	4 **S W** 3*C Sunrise: 7:38am Sunset: 4:46pm 7am-12pm ***Snow: trace***	5 **S SC** -6*C Sunrise: 7:39am Sunset: 4:45pm Overnight, 9am-4pm	6 **S SC** -3*C Sunrise: 7:40am Sunset: 4:45pm Overnight, 1pm-12am
7 **S SC** -4*C ***Min: -17*C*** Sunrise: 7:41am Sunset: 4:45pm ***Snow:10.5cm***	8 **S W** -4*C Sunrise: 7:42am Sunset: 4:45pm 9am-1pm ***Snow: trace***	9 **R W** 3*C Sunrise: 7:43am Sunset: 4:45pm Overnight Thru out day ***Snow:6.5cm***	10 **C W** 1*C Sunrise: 7:43am Sunset: 4:45pm Overnight	11 **C D** -3*C Sunrise: 7:44am Sunset: 4:45pm Clear	12 **S I** -3*C Sunrise: 7:45am Sunset: 4:45pm 9am-6pm	13 **S SL** -1*C Sunrise: 7:46am Sunset: 4:45pm 6pm-Overnight
14 **R SL** 5*C Sunrise: 7:47am Sunset: 4:45pm Overnight Thru out day	15 **S W** 8*C Sunrise: 7:48am Sunset: 4:46pm Overnight-12pm 5pm-Overnight	16 **S SC** -5*C Sunrise: 7:48am Sunset: 4:46pm Overnight-9am **A** (snow)	17 **S SC** -2*C Sunrise: 7:49am Sunset: 4:46pm Overnight **A** (snow) ***Snow:5cm***	18 **C D** -4*C Sunrise: 7:50am Sunset: 4:47pm Clear	19 -5*C Sunrise: 7:50am Sunset: 4:47pm Thru out day **A!** (snow)	20 -11*C Min: -17*C Sunrise: 7:51am Sunset: 4:47pm **A!** (snow) ***Snow: 17.5cm***

Weather			**Road**		
Snow	**S**	12	Snow-covered	**SC**	6
Rain	**R**	2	Slush-covered	**SL**	3
Fog & Rain	**F**	0	Wet/damp	**W**	1
Clear	**C**	4	Icy	**I**	6
			Dry/clear	**D**	2

Total days monitored = 18 in Dec.

January 2009

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
4 0*C Sunrise: 7:55am Sunset: 4:58pm	5 **C D** 0*C Sunrise: 7:55am Sunset: 4:59pm Clear	6 **C D** -2*C ***Min: -15*C*** Sunrise: 7:54am Sunset: 5:00pm Clear	7 **S SC** 0*C Sunrise: 7:54am Sunset: 5:01pm Overnight, Thru out day 7am-10am, 4pm-Overnight **A** (snow) ***Snow:10.5cm***	8 **S SC** -3*C Sunrise: 7:54am Sunset: 5:02pm Overnight-7am, 2pm ***Snow:5cm***	9 **S SC** -5*C ***Min: -18*C*** Sunrise: 7:54am Sunset: 5:03pm Thru out day **A** (snow)	10 **S SL** -7*C ***Min: -16*C*** Sunrise: 7:54am Sunset: 5:04pm 1pm, 7pm-Overnight ***Snow:1cm***
11 **S SC** -6*C ***Min: -19*C*** Sunrise: 7:53am Sunset: 5:05pm 6pm-11pm ***Snow:8cm***	12 **S SC** -5*C ***Min: -18*C*** Sunrise: 7:53am Sunset: 5:06pm 8-10am **A** (snow) ***Snow:trace***	13 **S SL** 0*C ***Min: -18*C*** Sunrise: 7:53am Sunset: 5:08pm Thru out day **A** (extreme cold) ***Snow:4cm***	14 **S SC** -14*C ***Min: -24*C*** Sunrise: 7:52am Sunset: 5:09pm 1pm-7pm ***Snow:1.5cm***	15 **S SC** -12*C ***Min: -28*C*** Sunrise: 7:52am Sunset: 5:10pm 1pm **A** (snow) ***Snow:1cm***	16 **C SC** -15*C ***Min: -20*C*** Sunrise: 7:51am Sunset: 5:11pm Clear	17 **S SC** -8*C ***Min: -21*C*** Sunrise: 7:51am Sunset: 5:12pm 2pm-Overnight
18 **S SC** -5*C Sunrise: 7:50am Sunset: 5:14pm Overnight – Thru out day **A** (snow) ***Snow:11cm***	19 **S SC** -8*C Sunrise: 7:49am Sunset: 5:15pm Overnight – Thru out day **A** (snow) ***Snow:4.5cm***	20 **C W** -10*C ***Min: -17*C*** Sunrise: 7:49am Sunset: 5:16pm Overnight, 8pm	21 **C W** -7*C ***Min: -15*C*** Sunrise: 7:48am Sunset: 5:17pm Clear	22 **S W** -3*C Sunrise: 7:47am Sunset: 5:19pm 9am 2pm	23 **S W** 2*C Sunrise: 7:47am Sunset: 5:20pm 6pm- Overnight ***Snow: trace***	24 **C D** -9*C Sunrise: 7:46am Sunset: 5:21pm Clear
25 **C D** -11*C Sunrise: 7:45am Sunset: 5:23pm Clear	26 **C D** -10*C ***Min: -16*C*** Sunrise: 7:44am Sunset: 5:24pm Clear	27 -6*C Sunrise: 7:43am Sunset: 5:25pm Mainly Sunny/Clear	28 **S SC** -6*C Sunrise: 7:42am Sunset: 5:27pm Overnight – Thru out day **A!** (Snow) ***Snow:4cm***	29 **S SC** -4*C Sunrise: 7:41am Sunset: 5:28pm Overnight – Thru out day **A!** (strong wind) ***Snow: 7cm***	30 **S SC** -5*C Sunrise: 7:40am Sunset: 5:29pm Overnight – Thru out day ***Snow:3cm***	31 **S SL** -4*C Sunrise: 7:39am Sunset: 5:31pm 11am-7pm

Weather

Snow	**S**	18
Rain	**R**	0
Fog & Rain	**F**	0
Clear	**C**	8

Road

Snow-covered	**SC**	14	Icy	**I**	4
Slush-covered	**SL**	3	Dry/clear	**D**	5
Wet/damp	**W**	0			

Total days monitored = 26

February 2009

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 **C SC** 3*C Sunrise: 7:38am Sunset: 5:32pm Clear ***Snow:2.5cm***	2 **C D** 0*C Sunrise: 7:37am Sunset: 5:33pm Clear	3 **S W** -4*C Sunrise: 7:36am Sunset: 5:35pm Overnight – Thru out day	4 **S W** -10*C ***Min: -26*C*** Sunrise: 7:35am Sunset: 5:36pm Clear Overnight – 9am ***Snow:9cm***	5 **C D** -9*C ***Min: -30*C*** Sunrise: 7:33am Sunset: 5:38pm Clear	6 **C W** -3*C ***Min: -15*C*** Sunrise: 7:32am Sunset: 5:39pm 9-12pm	7 **R W** 6*C Sunrise: 7:31am Sunset: 5:40pm 10am, 1pm
8 **C D** 4*C Sunrise: 7:30am Sunset: 5:42pm Clear	9 **C D** 3*C Sunrise: 7:28am Sunset: 5:43pm Clear	10 **C W** 8*C Sunrise: 7:27am Sunset: 5:44pm Overnight	11 **F R W** 9*C Sunrise: 7:26am Sunset: 5:46pm Mainly foggy 9am – Overnight **A** (rain)	12 **R W** 7*C Sunrise: 7:24am Sunset: 5:47pm Overnight-1pm **A** (rain)	13 **C W** 0*C Sunrise: 7:23am Sunset: 5:48pm Overnight	14 **C W** -3*C Sunrise: 7:22am Sunset: 5:50pm 3pm
15 **C D** 0*C Sunrise: 7:20am Sunset: 5:51pm Clear	16 **C D** -1*C Sunrise: 7:19am Sunset: 5:52pm Clear	17 **C D** 0*C Sunrise: 7:17am Sunset: 5:54pm Clear	18 **S W** 1*C Sunrise: 7:16am Sunset: 5:55pm Overnight-12pm ***Snow:1cm***	19 **S W** 0*C Sunrise: 7:14am Sunset: 5:56pm Thru out day ***Snow:3cm***	20 -4*C Sunrise: 7:13am Sunset: 5:58pm	21 -2*C Sunrise: 7:11am Sunset: 5:59pm

Weather			Road		
Snow	**S**	4	Snow-covered	**SC**	1
Rain	**R**	2	Slush-covered	**SL**	0
Fog & Rain	**F**	1	Wet/damp	**W**	0
Clear	**C**	12	Icy	**I**	11
			Dry/clear	**D**	7

Total days monitored = 19 in Feb.

March 2009

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 -4*C Sunrise: 6:58am Sunset: 6:09pm	2 **C D** -9*C ***Min: -16*** Sunrise: 6:57am Sunset: 6:11pm Clear	3 **C D** -13*C ***Min:-17*** Sunrise: 6:55am Sunset: 6:12pm Clear	4 **C D** -11*C ***Min: -15*** Sunrise: 6:53am Sunset: 6:13pm Clear	5 **C D** -8*C Sunrise: 6:52am Sunset: 6:15pm Clear	6 **C D** 0*C Sunrise: 6:50am Sunset: 6:16pm Clear	7 **R W** 8*C Sunrise: 6:48am Sunset: 6:17pm 12pm-Midnight
8 **DLS Ends** **F R W** 2*C Sunrise: 7:46am Sunset: 7:18pm Fog 4pm-Overnight	9 **S W** 0*C Sunrise: 7:45am Sunset: 7:20pm 12pm ***Snow: Trace***	10 **R W** 2*C Sunrise: 7:43am Sunset: 7:21pm 11am-1pm 8pm-Overnight	11 **S W** 2*C Sunrise: 7:41am Sunset: 7:22pm Overnight-7am 10am-Overnight	12 **C D** -7*C Sunrise: 7:39am Sunset: 7:23pm Clear ***Snow: 0.5cm***	13 **C D** -6*C Sunrise: 7:38am Sunset: 7:24pm Clear	14 **C D** 1*C Sunrise: 7:36am Sunset: 7:26pm Clear
15 **C D** 3*C Sunrise: 7:34am Sunset: 7:27pm Clear	16 **C D** 7*C Sunrise: 7:32am Sunset: 7:28pm Clear	17 **C D** 5*C Sunrise: 7:31am Sunset: 7:29pm Clear	18 **C D** 7*C Sunrise: 7:29am Sunset: 7:31pm Clear	19 **R I** -2*C Sunrise: 7:27am Sunset: 7:32pm 4pm-8pm	20 **Spring Begins** **C D** -2*C Sunrise: 7:25am Sunset: 7:33pm Clear	21 **C D** 0*C Sunrise: 7:23am Sunset: 7:34pm Clear
22 **C D** -1*C Sunrise: 7:22am Sunset: 7:35pm Clear	23 **C D** -2*C Sunrise: 7:20am Sunset: 7:37pm Clear	24 **C D** -1*C Sunrise: 7:18am Sunset: 7:38pm Clear	25 **R W** 5*C Sunrise: 7:16am Sunset: 7:39pm 11am-9pm	26 5*C Sunrise: 7:14am Sunset: 7:40pm	27 5*C Sunrise: 7:13am Sunset: 7:41pm	28 6*C Sunrise: 7:11am Sunset: 7:43pm

Weather			Road		
Snow	**S**	2	Snow-covered	**SC**	0
Rain	**R**	4	Slush-covered	**SL**	0
Fog & Rain	**F**	1	Wet/damp	**W**	1
Clear	**C**	17	Icy	**I**	6
			Dry/clear	**D**	17

Total days monitored = 24 in Mar.

Appendix E: Participants with Missing Otto (Trip) Data

ID#	Gender, age	Week 1	Week 2	Overall	Problems
New Participants					
12	Female, 81	**1/9:** D6(1)	**0/10**	1/19	
17	Male, 80	**0/8**	**4/14:** D8(1), D12(1), D14(2)	4/22	
27 *	Male, 85	**0/7**	**5/10:** D8(1), D9(2), D11(2)	5/17 (29.4%)	Removed Otto to prevent theft (day 7)
45	Male, 78	**0/9**	**3/8:** D9(2)	3/17	
Sub-total	4	1	12	13	
Repeat Participants					
18	Female, 78	**0/10**	**1/11:** D11(1)	1/21	
19	Female, 80	**0/8**	**2/4:** D10(1), D14(1)	2/12	
22 *	Male, 79	**4.5/4.5:**D1(2), D3(1), D5(1), D6(.5)	**0.5/2.5:** D9(.5)	5/7(71.4%)	Splitter on socket: bad connection
39 *	Female, 80	**3/7:** D4(2), D6(1)	**3/10:** D9(1), D11(1), D13(1)	6/17 (35.3%)	Connection
40 *	Male, 85	**3/6:** D1(1), D5(1), D7(1)	**5/8 :** D8(2), D11(1), D12(2)	8/14 (57.1%)	Connection
Sub-total	5	10.5	11.5	22	
Total	**9**	**11.5/319.5 (3.6%)**	**23.5/321.5 (7.3%)**	**35/641 (5.5%)**	

Values shown are # missing trips / total trips for specific days of the 2-week monitoring period.
***** When these 4 individuals were removed (plus 11 unrecovered Otto trips from the remaining 5 subjects), the number of usable Otto trips was reduced to 575.

Appendix F: Additional Results from the Background Questionnaire

Appendix F1. Sample Characteristics

Characteristics	Total Sample (N=47)	Gender		Age Group	
		Male (n = 24)	Female (n = 23)	Under 80 (n = 28)	80 & Over (n = 19)
Place of residence [a]					
Private Home	30 (63.8)	19 (79.2)	11 (47.8)	20 (71.4)	10 (52.6)
Apartment/Condo	14 (29.8)	5 (20.8)	9 (39.1)	8 (28.6)	6 (31.6)
Retirement Complex	3 (6.4)	0	3 (13.0)	0	3 (15.8)
Employed					
Full-time	1 (2.1)	1 (4.2)	0	1 (3.6)	0
Not employed	46 (97.9)	23 (95.8)	23 (100)	27 (96.4)	19 (100)
Income					
For most things	34 (72.3)	16 (66.7)	18 (78.3)	23 (82.1)	11 (57.9)
For many things	12 (25.5)	7 (29.2)	5 (21.7)	5 (17.9)	7 (36.8)
Little for extras	1 (2.1)	1 (4.2)	0	0	1 (5.3)

Note: Values presented as *frequencies (valid percent)*, or *Mean±S.D., range*.
[a] Gender difference; [b] Age group difference

Appendix F2. Household and Common Technology Experience

Variables	Total Sample (N = 47)	Gender		Age Group	
		Male (n = 24)	Female (n = 23)	Under 80 (n = 28)	80 & Over (n = 19)
Comfort using household technology [a]					
Yes	29 (63.0)	21 (87.5)	8 (36.4)	17 (60.7)	12 (66.7)
No	17 (37.0)	3 (12.5)	14 (63.6)	11 (39.3)	6 (33.3)
Missing	1	0	1	0	1
Have used					
Computer [b]	40 (85.1)	22 (91.7)	18 (78.3)	27 (96.4)	13 (68.4)
Only	3 (6.4)	1 (4.2)	2 (8.7)	0	3 (15.8)
With e-mail	5 (10.6)	2 (8.3)	3 (13.0)	2 (7.1)	3 (15.8)
With e-mail & searches	32 (68.1)	19 (79.2)	13 (56.5)	25 (89.3)	7 (36.8)
Cell phone	35 (74.5)	19 (79.2)	16 (69.6)	22 (78.6)	13 (68.4)
Digital camera [b]	29 (61.7)	18 (75.0)	11 (47.8)	21 (75.0)	8 (42.1)
VCR/DVD [b]	43 (91.5)	23 (95.8)	20 (87.0)	28 (100)	15 (78.9)
ATM/Bank machine	37 (78.7)	21 (87.5)	16 (69.6)	24 (85.7)	13 (68.4)
In-car navigational device					
Yes	10 (21.7)	7 (29.2)	3 (13.6)	8 (28.6)	2 (11.1)
No	36 (78.3)	17 (70.8)	19 (86.4)	20 (71.4)	16 (88.9)
Missing	1	0	1	0	1
If yes					
Rated comfort using	3.63±1.30 2 to 5	4.00±1.41 2 to 5	3.00±1.00 2 to 4	3.86±1.21 2 to 5	2.00±0.0 2 to 2
Missing	2	2	0	1	1
Currently in car	3 (30.0)	3 (42.9)	0	3 (37.5)	0
Used for out-of-town	4 (40.0)	4 (57.1)	0	4 (50.0)	0
Used for new locations	3 (30.0)	1 (14.3)	2 (66.7)	3 (37.5)	0

Note: Values are *frequencies (valid percent)*, or *Mean±S.D., range*. Comparisons are Chi-square, $\chi^2(p)$, or independent *t*-test, *t(p)*. [a] Gender difference; [b] Age difference.

Appendix F3. Health Profile

Health Characteristics	Total Sample (N = 47)	Gender		Age Group	
		Male (n = 24)	Female (n = 23)	Under 80 (n = 28)	80 & Over (n = 19)
Days/wk of mod. activity	3.51±1.83 0 to 7	3.46±1.83 1 to 7	3.57±1.89 0 to 7	3.43±1.71 1 to 7	3.65±2.06 0 to 7
Missing	3	1	2	1	2
Exercise classes/activity [a]					
Yes	22 (50.0)	9 (39.1)	13 (61.9)	17 (63.0)	5 (29.4)
No	22 (50.0)	14 (60.9)	8 (38.1)	10 (37.0)	12 (70.6)
Missing	3	1	2	1	2
Fallen past year					
Yes	7 (15.6)	2 (8.7)	5 (22.7)	2 (7.4)	5 (27.8)
No	38 (84.4)	21 (91.3)	17 (77.3)	25 (92.6)	13 (72.2)
Missing	2	1	1	1	1
Diagnosed conditions [a]	2.34±1.27 0 to 6 44 (93.6)	2.21±1.32 0 to 6 22 (91.7)	2.48±1.24 0 to 5 22 (95.7)	1.93±0.98 0 to 3 26 (92.9)	2.95±1.43 0 to 6 18 (94.7)
If yes, types of conditions					
Arthritis, rheumatism or osteoporosis [a]	12 (25.5)	2 (8.3)	10 (43.5)	8 (28.6)	4 (21.1)
Parkinson's disease	0	0	0	0	0
Multiple sclerosis	0	0	0	0	0
Stroke	1 (2.1)	0	1 (4.3)	1 (3.6)	0
High blood pressure, cholesterol, heart problems	29 (61.7)	17 (70.8)	12 (52.2)	18 (64.3)	11 (57.9)
Diabetes	4 (8.5)	2 (8.3)	2 (8.7)	2 (7.1)	2 (10.5)
Asthma, other breathing problems	1 (2.1)	0	1 (4.3)	1 (3.6)	0
Back problems	14 (29.8)	8 (33.3)	6 (26.1)	6 (21.4)	8 (42.1)
Foot problems	1 (2.1)	1 (4.2)	0	0	1 (5.3)
Hearing problems	13 (27.7)	8 (33.3)	5 (21.7)	5 (17.9)	8 (42.1)
Vision	21 (44.7)	9 (37.5)	12 (52.2)	7 (25.0)	14 (73.7)
Cataracts [a]	18 (38.3)	8 (33.3)	10 (43.5)	4 (14.3)	14 (73.7)
Glaucoma	3 (6.4)	1 (4.2)	2 (8.7)	3 (10.7)	0
Macular degeneration	1 (2.1)	0	1 (4.3)	0	1 (5.3)
Diabetic retinopathy	0	0	0	0	0
Sleeping disorders	5 (10.6)	3 (12.5)	2 (8.7)	1 (3.6)	4 (21.1)
Other	8 (17.0)	3 (12.5)	5 (21.7)	5 (17.9)	3 (15.8)

Appendix F3 Continued

Health Characteristics	Total Sample (N = 47)	Gender		Age Group	
		Male (n = 24)	Female (n = 23)	Under 80 (n = 28)	80 & Over (n = 19)
Difficulties	0.95±1.28 0 to 5	0.83±1.30 0 to 4	1.10±1.26 0 to 5	0.67±1.04 0 to 4	1.41±1.50 0 to 5
Yes	22 (50.0)	9 (39.1)	13 (61.9)	11 (40.7)	11 (64.7)
Types of difficulties					
Staying awake/alert	5 (11.1)	3 (13.0)	2 (9.1)	3 (10.7)	2 (11.8)
Maintaining balance [a]	9 (20.5)	4 (17.4)	5 (23.8)	3 (11.1)	6 (35.3)
Initiating movement	3 (6.7)	2 (8.7)	1 (4.5)	1 (3.6)	2 (11.8)
Persistent pain	4 (8.9)	1 (4.3)	3 (13.6)	1 (3.6)	3 (17.6)
Limited strength/ movement	7 (15.9)	4 (17.4)	3 (14.3)	4 (14.8)	3 (17.6)
Lack of feeling/ sensation	1 (2.3)	1 (4.3)	0	0	1 (5.9)
Stiffness [b]	11 (25.0)	3 (13.0)	8 (34.8)	5 (18.5)	6 (35.3)
Involuntary movement	1 (2.3)	1 (4.3)	0	1 (3.7)	0
Cataract surgery					
No	28 (60.9)	15 (65.2)	13 (56.5)	24 (85.7)	4 (22.2)
Yes, **one eye**	4 (22.2)	2 (8.7)	2 (8.7)	1 (3.6)	3 (16.7)
Within a year	1	1	0	0	1
Over a year ago	3	1	2	1	2
Yes, **both eyes**	14 (77.8)	6 (26.1)	8 (34.8)	3 (10.7)	11 (61.1)
First eye					
Within a year	1	0	1	1	0
Over a year ago	13	6	7	2	11
Second eye					
Within a year	1	0	1	1	0
Over a year ago	13	6	7	2	11
Missing	1	1	0	0	1
Drive with glasses or contacts					
All the time	32 (69.6)	15 (65.2)	17 (73.9)	19 (67.9)	13 (72.2)
Sometimes	5 (10.9)	3 (13.0)	2 (8.7)	3 (10.7)	2 (11.1)
Never	9 (19.6)	5 (21.7)	4 (17.4)	6 (21.4)	3 (16.7)
Missing	1	1	0	0	1

Appendix F3 Continued

Health Characteristics	Total Sample (N = 47)	Gender		Age Group	
		Male (n = 24)	Female (n = 23)	Under 80 (n = 28)	80 & Over (n = 19)
Hearing aid [a]					
Most of the time	7 (15.2)	4 (17.4)	3 (13.0)	3 (10.7)	4 (22.2)
Sometimes	3 (6.5)	0	3 (13.0)	0	3 (16.7)
No	36 (78.3)	19 (82.6)	17 (73.9)	25 (89.3)	11 (61.1)
Missing	1	1	0	0	1
Visited a physician					
Within 6 mths	36 (78.3)	18 (78.3)	18 (78.3)	22 (78.6)	14 (77.8)
Past year	6 (13.0)	2 (8.7)	4 (17.4)	5 (17.9)	1 (5.6)
More than a year	4 (8.7)	3 (13.0)	1 (4.3)	1 (3.6)	3 (16.7)
Missing	1	1	0	0	1

Note: Values are *frequencies (valid percent)*, or *Mean±S.D., range*. Comparisons are Chi-square, $\chi^2(p)$, independent *t*-test, *t(p)*, or Mann-Whitney U test, *z(p)*.
[a] Age difference; [b] Gender difference

Appendix G: Additional Results from the Driving Habits Questionnaire

Questions	Total Sample (N = 46)	Gender		Age Group	
		Male (n = 23)	Female (n = 23)	Under 80 (n = 28)	80 & Over (n = 18)
Years driving [b]	57.85±8.55 34 to 75	59.65±7.24 49 to 75	56.04±9.50 34 to 73	54.89±6.23 39 to 65	62.44±9.75 34 to 75
Other license [a]					
No	38 (82.6)	16 (69.6)	22 (95.7)	23 (82.1)	15 (83.3)
Yes	8 (17.4)	7 (30.4)	1 (4.3)	5 (17.9)	3 (16.7)
Commuted					
Yes	5 (10.9)	3 (13.0)	2 (8.7)	4 (14.3)	1 (5.6)
No	41 (89.1)	20 (87.0)	21 (91.3)	24 (85.7)	17 (94.4)
Compared to 10 yrs					
Drove much less	13 (28.3)	4 (17.4)	9 (39.1)	8 (28.6)	5 (27.8)
Drove a little less	12 (26.1)	7 (30.4)	5 (21.7)	8 (28.6)	4 (22.2)
Drove the same	20 (43.5)	11 (47.8)	9 (39.1)	11 (39.3)	9 (50.0)
Drove more	1 (2.2)	1 (4.3)	0	1 (3.6)	0
Preferred mode					
Drive self	43 (93.5)	23 (100)	20 (87.0)	26 (92.9)	17 (94.4)
Others driving you	3 (6.5)	0	3 (13.0)	2 (7.1)	1 (5.6)
Rely on you as driver					
Yes	19 (41.3)	9 (39.1)	10 (43.5)	10 (35.7)	9 (50.0)
No	27 (58.7)	14 (60.9)	13 (56.5)	18 (64.3)	9 (50.0)
Car-related expenses					
Often	1 (2.2)	1 (4.3)	0	0	1 (5.6)
Sometimes	12 (26.1)	6 (26.1)	6 (26.1)	7 (25.0)	5 (27.8)
Rarely	24 (52.2)	12 (52.2)	12 (52.2)	17 (60.7)	7 (38.9)
Never	9 (19.6)	4 (17.4)	5 (21.7)	4 (14.3)	5 (27.8)
Regular servicing					
Me	39 (84.8)	22 (95.7)	17 (73.9)	22 (78.6)	17 (94.4)
Spouse	7 (15.2)	1 (4.3)	6 (26.1)	6 (21.4)	1 (5.6)
Winter tires [a]					
Yes	14 (30.4)	8 (34.8)	6 (26.1)	13 (46.4)	1 (5.6)
No	32 (69.6)	15 (65.2)	17 (73.9)	15 (53.6)	17 (94.4)
Close to walk					
Shopping and errands	18 (39.1)	7 (29.2)	2 (8.3)	11 (40.7)	7 (38.9)
Church and social	8 (17.4)	11 (47.8)	6 (26.1)	6 (22.2)	2 (11.1)

Appendix G Continued

Questions	Total Sample (N = 46)	Gender		Age Group	
		Male (n = 23)	Female (n = 23)	Under 80 (n = 28)	80 & Over (n = 18)
Dr asked if drive					
Yes	5 (10.9)	3 (13.0)	19 (90.5)	16 (72.7)	3 (88.9)
No	39 (84.8)	20 (87.0)	2 (9.5)	6 (27.3)	2 (11.8)
Discussed driving					
Eye care professional	21 (46.7)	10 (43.5)	11 (50.0)	11 (40.7)	10 (55.6)
Family member	14 (31.1)	6 (26.1)	8 (36.4)	6 (22.2)	8 (44.4)
Friends	11 (24.4)	5 (21.7)	6 (27.3)	4 (14.8)	7 (38.9)
Missing	1	0	1	0	1
Asked to limit/stop					
No	46 (100)	23 (100)	23 (100)	28 (100)	18 (100)
Yes	0	0	0	0	0
Give up driving					
Yes [a]	1 (2.2)	0	1 (4.3)	0	1 (5.6)
No	45 (97.8)	23 (100)	22 (95.7)	28 (100)	17 (94.4)
Reducing driving					
Yes	8 (17.8)	3 (13.0)	5 (22.7)	5 (17.9)	3 (17.6)
No	37 (82.2)	20 (87.0)	17 (77.3)	23 (82.1)	14 (82.4)
Missing	1	0	1	0	1
Took driving course					
No	23 (50.0)	14 (60.9)	9 (39.1)	11 (39.3)	12 (66.7)
Yes	23 (50.0)	9 (39.1)	14 (60.9)	17 (60.7)	6 (33.3)
If yes,					
Training	14 (60.9)	3 (33.3)	11 (47.8)	11 (64.7)	3 (50.0)
Defensive Driving	6 (26.1)	5 (55.6)	1 (4.3)	5 (29.4)	1 (16.7)
CAA	3 (13.0)	1 (11.1)	2 (8.7)	1 (5.9)	2 (33.3)
MTO testing					
Vision	12 (26.1)	4 (17.4)	8 (34.8)	0	12 (66.7)
Rules	10 (21.7)	6 (26.0)	4 (17.4)	0	10 (55.6)
Road	2 (4.3)	0	2 (8.7)	0	2 (11.1)
Vision or medical	5 (10.9)	2 (8.7)	3 (13.0)	1 (3.6)	4 (22.2)
Comprehensive	3 (6.5)	2 (8.7)	1 (4.3)	1 (3.6)	2 (11.1)
Driving problem score	0.58±0.69 0 to 3	0.59±0.80 0 to 3	0.57±0.59 0 to 2	0.63±0.79 0 to 3	0.50±0.51 0 to 1
Yes	22 (48.9)	12 (52.2)	10 (45.5)	13 (48.1)	9 (50.0)
No	23 (51.1)	11 (47.8)	12 (54.5)	14 (51.9)	9 (50.0)
Missing	1	0	1	1	0

Appendix G Continued

Questions	Total Sample (N=46)	Gender		Age Group	
		Male (n = 23)	Female (n = 23)	Under 80 (n = 28)	80 & Over (n = 18)
Types of problems					
Hitting curbs/medians	7 (15.9)	4 (18.2)	3 (13.6)	6 (22.2)	1 (5.9)
Getting lost	7 (15.9)	2 (9.1)	5 (22.7)	5 (18.5)	2 (11.8)
Near misses	6 (14.0)	3 (14.3)	3 (13.6)	2 (7.4)	4 (25.0)
Accidents with vehicle(s)	3 (6.7)	2 (8.7)	1 (4.5)	1 (3.7)	2 (11.1)
Backing into things	2 (4.5)	1 (4.5)	1 (4.5)	2 (7.4)	0
Traffic violation	1 (2.3)	1 (4.5)	0	1 (3.7)	0
Reasons for driving					
Shopping & errands	44 (97.8)	23 (100)	21 (95.5)	26 (96.3)	18 (100)
Visiting family/friends	44 (97.8)	23 (100)	21 (95.5)	26 (96.3)	18 (100)
To appointments	43 (95.6)	22 (95.7)	21 (95.5)	25 (92.6)	18 (100)
Rec/social events	43 (95.6)	22 (95.7)	21 (95.5)	27 (100)	16 (88.9)
To religious services	25 (55.6)	11 (47.8)	14 (63.6)	17 (63.0)	8 (44.4)
Other [b]	20 (44.4)	7 (30.4)	13 (59.1)	12 (100)	8 (44.4)
Volunteering	13 (65.0)	4 (57.1)	9 (69.2)	0	5 (62.5)
Unspecified	4 (20.0)	2 (28.6)	2 (15.4)	4 (33.3)	0
Driving others	3 (15.0)	1 (14.3)	2 (15.4)	8 (66.7)	3 (37.5)
Missing	1	0	1	1	0

Appendix G Continued

Driving Habit	Total Sample (N = 46)	Gender		Age Group	
		Male (n = 23)	Female (n = 23)	Under 80 (n = 28)	80 & Over (n = 18)
Continuing to drive	3.42±0.69 1 to 4	3.48±0.59 2 to 4	3.36±0.79 1 to 4	3.44±0.64 2 to 4	3.39±0.78 1 to 4
Extremely important	23 (51.1)	12 (52.2)	11 (50.0)	14 (51.9)	9 (50.0)
Very important	19 (42.2)	10 (43.5)	9 (40.9)	11 (40.7)	8 (44.4)
Moderately important	2 (4.4)	1 (4.3)	1 (4.5)	2 (7.4)	0
Somewhat important	1 (2.2)	0	1 (4.5)	0	1 (5.6)
Missing	1	0	1	1	0
Reasons to continue driving					
Maintain lifestyle	3.31±1.15 0 to 4	3.47±1.07 0 to 4	3.13±1.25 0 to 4	3.35±1.19 0 to 4	3.22±1.09 1 to 4
Missing	14	17	15	23	9
Get to shops/services	2.97±1.20 0 to 4	3.00±1.00 1 to 4	2.93±1.44 0 to 4	2.91±1.12 0 to 4	3.11±1.45 0 to 4
Missing	14	17	15	23	9
Meet commitments	2.52±1.52 0 to 4	2.44±1.46 0 to 4	2.60±1.64 0 to 4	2.64±1.43 0 to 4	2.22±1.79 0 to 4
Missing	15	16	15	22	9
Others need you to drive	1.83±1.51 0 to 4	1.80±1.61 0 to 4	1.87±1.46 0 to 4	1.81±1.50 0 to 4	1.89±1.62 0 to 4
Missing	16	15	15	21	9
Not bothering others	1.63±1.56 0 to 4	1.31±1.54 0 to 4	1.73±1.49 0 to 4	1.67±1.62 0 to 4	1.56±1.51 0 to 4
Missing	16	15	15	21	9
No one to drive you	1.45±1.57 0 to 4	1.31±1.54 0 to 4	1.60±1.64 0 to 4	1.45±1.60 0 to 4	1.59±1.44 0 to 4
Missing	15	16	15	22	9
Poor public transport.	1.38±1.26 0 to 4	1.41±1.42 0 to 4	1.33±1.11 0 to 3	1.61±1.27 0 to 4	0.78±1.09 0 to 3
Missing	14	17	15	23	9
Physical difficulty	0.97±1.43 0 to 4	0.50±0.85 0 to 2	1.40±1.72 0 to 4	0.90±1.41 0 to 4	1.11±1.54 0 to 4
Missing	17	14	15	20	9

Note: Values are *frequencies (valid percent)*, or *Mean±S.D.*, *range*. Comparisons are chi-square test, $\chi^2(p)$, independent *t*-test, *t(p)*, or Mann-Whitney U test, *z(p)*.
[a] Age difference; [b] Gender difference; [c] Due to vision.

Appendix H: Additional Results from the Interview

Follow-up Questions	Total Sample (N = 46)	Gender		Age Group	
		Male (n = 23)	Female (n = 23)	Under 80 (n = 28)	80 & Over (n = 18)
Cancel/Postpone trips for					
Weather	39 (84.8)	20 (87.0)	19 (82.6)	24 (85.7)	15 (83.3)
Illness	17 (37.0)	8 (34.8)	9 (39.1)	11 (39.3)	6 (33.3)
Schedule conflict	6 (13.0)	2 (8.7)	4 (17.4)	4 (14.2)	2 (11.1)
Emergency	2 (4.3)	0	2 (8.7)	2 (7.1)	0
Car problems	1 (2.2)	1 (4.3)	0	0	1 (5.6)
Nothing	2 (4.3)	1 (4.3)	1 (4.3)	1 (3.6)	1 (5.6)
Compelled to do					
No	42 (91.3)	21 (91.3)	21 (91.3)	25 (89.3)	17 (94.4)
Yes	4 (8.7)	2 (8.7)	2 (8.7)	3 (10.7)	1 (5.6)
If yes					
Helping others	2 (50.0)	1 (4.3)	1 (4.3)	1 (3.6)	1 (5.6)
Family events	1 (25.0)	0	1 (4.3)	1 (3.6)	0
Groceries	1 (25.0)	1 (4.3)	0	1 (3.6)	0
Other means for traveling					
Ride from family/friends	28 (60.9)	16 (69.6)	12 (52.2)	18 (64.3)	10 (55.6)
Taxi	16 (34.8)	4 (17.4)	12 (52.2)	7 (25.0)	5 (27.8)
Public transportation	13 (28.7)	9 (39.1)	4 (17.4)	9 (32.1)	4 (22.2)
Walk	6 (13.0)	3 (13.0)	3 (13.0)	5 (17.9)	1 (5.6)
None	5 (10.9)	3 (13.0)	2 (8.7)	3 (10.7)	2 (11.1)
Bike	2 (4.3)	1 (4.3)	1 (4.3)	2 (7.1)	0
Most affected if cease driving					
Everything (including all below)	15 (32.6)	8 (34.8)	7 (30.4)	11 (39.3)	4 (22.2)
Social	15 (32.6)	8 (34.8)	7 (30.4)	11 (39.3)	4 (22.2)
Independence	9 (19.6)	3 (13.0)	6 (26.1)	7 (25.0)	2 (11.1)
Able to adapt	8 (17.4)	4 (17.4)	4 (17.4)	5 (17.9)	3 (16.7)
Shopping & errands	6 (13.0)	3 (13.0)	3 (13.0)	4 (14.2)	2 (11.1)
Work	1 (2.2)	0	1 (4.3)	1 (3.6)	0
Caregiving	1 (2.2)	1 (4.3)	0	0	1 (5.6)
Finance	1 (2.2)	0	1 (4.3)	0	1 (5.6)

Note: Values are presented as *frequencies (valid percent)*, or *Mean±S.D., range*.
Data based on N=46 (missing data for 87 y.o. man).

Appendix I: Additional Driving Indicators

Appendix I1. Distance by Day of the Week (N = 46)

When	Total Sample (N = 46)	Gender		Age Group	
		Male (n = 24)	Female (n = 22)	Under 80 (n = 28)	80 & Over (n = 18)
Weekday [a,b]	21.81±27.83 0 to 248.7	30.55±32.81 0 to 248.7	12.27±16.54 0 to 113.1	25.77±30.64 0 to 248.70	14.37±19.64 0 to 136.3
Monday	15.96±18.01 0 to 78.1	23.03±19.70 0 to 78.1	8.26±12.09 0 to 46.7	17.77±18.30 0 to 67.9	12.58±17.23 0 to 78.1
Tuesday	28.09±32.82 0 to 133.2	40.08±35.02 0 to 133.2	15.02±24.58 0 to 113.1	34.70±35.88 0 to 133.2	15.70±21.67 0 to 101.9
Wednesday	20.06±21.76 0 to 130.1	27.18±25.41 0 to 130.1	12.29±13.33 0 to 51.1	24.34±23.46 0 to 130.0	12.03±15.48 0 to 52.8
Thursday	22.21±27.35 0 to 136.3	31.95±32.46 0 to 136.3	11.59±14.48 0 to 59.1	24.23±27.59 0 to 131.5	18.44±26.90 0 to 136.3
Friday	22.70±34.73 0 to 248.70	30.49±44.69 0 to 248.7	14.21±15.09 0 to 65.7	27.81±40.86 0 to 248.7	13.13±14.77 0 to 59.2
Weekend [a]	23.80±44.43 0 to 385.4	32.57±51.73 0 to 385.4	14.24±32.47 0 to 218.3	24.47±47.85 0 to 385.4	22.55±37.53 0 to 173.1
Saturday	27.41±53.22 0 to 385.4	39.76±63.85 0 to 385.4	13.94±34.39 0 to 218.3	28.76±60.70 0 to 385.4	24.88±35.96 0 to 151.8
Sunday	20.20±33.35 0 to 173.1	25.38±35.02 0 to 125.8	14.55±30.83 0 to 173.1	20.18±29.94 0 to 124.2	20.22±39.47 0 to 173.1

Note: Values are *Mean±S.D., range*. Comparisons are Mann-Whitney U test, *z(p)*. Driving data missing for 81 y.o. woman. [a] Gender difference; [b] Age difference.

Appendix I2a. Driving Exposure Results for the Total Sample (N = 46)

Indicators	Study Period			
	Week 1	Week 2	Cumulative	Average
#Days Driven	4.89±1.40 2 to 7	4.87±1.89 0 to 7	9.76±2.95 3 to 14	4.88±1.48 1.5 to 7
Distance (km)	146.30±107.11 25.5 to 477.5	168.84±146.75 0 to 554.6	315.14±227.53 45.3 to 932.1	156.64±108.84 22.65 to 466.05
Duration (hr:min:sec)	4:21:59±2:22:44 0:53:59 to 10:14:23	4:38:44±3:07:10 0 to 12:46:12	9:00:43±4:58:22 1:44:38 to 20:30:48	4:30:21±2:29:11 0:52:19 to 10:15:24
#Trips	7.27±3.18 2 to 15	7.34±4.02 0 to 15	14.61±6.84 3 to 28	7.30±3.42 1.5 to 14
#Segments	23.72±11.07 5 to 57	24.52±13.87 0 to 51	48.24±23.32 8 to 108	24.12±11.66 4 to 54
#Stops	16.09±8.15 3 to 41	16.96±9.75 0 to 39	33.04±16.51 5 to 80	16.52±8.25 2.5 to 40
#Nights Driven	1.89±1.59 0 to 6	1.80±1.77 0 to 6	3.71±2.96 0 to 12	1.85±1.49 0 to 6
Night Distance	30.70±45.67 0 to 249.99	31.59±46.58 0 to 225.2	62.29±79.13 0 to 431.69	31.15±39.68 0 to 215.85
Night Duration	0:51:19±1:01:59 0 to 5:17:35	0:51:15±0:59:48 0 to 3:48:25	1:42:35±1:49:04 0 to 9:06:00	0:51:17±0:54:32 0 to 4:33:00
#Night Trips	2.02±1.77 0 to 7	1.85±1.84 0 to 6	3.87±3.22 0 to 13	1.93±1.61 0 to 6.5

Note: Values presented as *frequencies (valid percent)*, or M*ean±S.D., range.* Data missing for an 81 y.o. woman.

Appendix I2b. Driving Exposure Results for the Male Participants (N = 24)

Indicators	Study Period			
	Week 1	Week 2	Combined	Average
#Days Driven [a]	5.38±1.10 4 to 7	5.38±1.74 2 to 7	10.75±2.45 6 to 14	5.38±1.23 3 to 7
#Trips [b]	8.60±3.12 4 to 15	8.94±4.13 2 to 15	17.54±6.83 6 to 28	8.77±3.41 3 to 14
#Segments [b]	28.63±10.89 14 to 57	30.17±14.26 6 to 51	58.79±22.97 22 to 108	29.40±11.49 11 to 54
#Stops [b]	19.50±8.29 8 to 41	20.79±10.44 4 to 39	40.29±16.80 13 to 80	20.15±8.40 6.5 to 40
Distance (km) [b]	195.58±109.36 63.3 to 477.5	242.43±158.73 25.1 to 578.0	441.06±239.50 88.4 to 989.5	217.86±112.68 44.20 to 466.05
Duration (hr:min:sec)	5:33:29±2:12:06 1:53:01 to 10:14:23	6:14:17±3:14:24 1:01:46 to 12:46:12	11:47:46±4:48:13 2:54:47 to 20:30:48	5:53:53±2:24:06 1:27:24 to 10:15:24
#Nights Driven	2.21±1.64 0 to 6	2.21±1.79 0 to 6	4.42±2.90 0 to 12	2.19±1.47 0 to 6
#Night Trips	2.29±1.78 0 to 7	2.21±1.89 0 to 6	4.50±3.15 0 to 13	2.25±1.57 0 to 6.5
Night Distance [a]	40.04±53.73 0 to 249.99	40.65±44.46 0 to 181.7	80.69±91.09 0 to 431.69	40.34±45.54 0 to 215.85
Night Duration	1:00:53±1:08:11 0 to 5:17:35	1:05:41±1:04:58 0 to 3:48:25	2:06:35±2:01:58 0 to 9:06:00	1:03:17±1:00:59 0 to 4:33:00

Note: Values presented as *frequencies (valid percent)*, or M*ean±S.D.*, *range.*
Significant gender difference with average indicators: [a] $p < .05$, [b] $p < .001$

Appendix I2c. Driving Exposure Results for the Female Participants (N = 22)

Indicators	**Period**			
	Week 1	**Week 2**	**Combined**	**Average**
#Days Driven [a]	4.36±1.53 2 to 7	4.32±1.94 0 to 7	8.68±3.12 3 to 14	4.34±1.56 1.5 to 7
#Trips [b]	5.82±2.61 2 to 12	5.59±3.13 0 to 11	11.41±5.34 3 to 23	5.70±2.67 1.5 to 11.5
#Segments [b]	18.36±8.67 5 to 30	18.36±10.64 0 to 38	36.73±17.91 8 to 66	18.36±8.96 4 to 33
#Stops [b]	12.36±6.26 3 to 22	12.77±7.00 0 to 28	25.14±12.23 5 to 48	12.57±6.11 2.5 to 24
Distance (km) [b]	89.27±70.42 25.5 to 332.6	88.50±74.77 0 to 258.0	177.77±101.13 45.3 to 376.4	89.85±50.19 22.65 to 188.20
Duration (hr:min:sec)	3:03:59±1:51:01 0:53:59 to 7:17:55	2:54:30±1:48:56 0 to 6:20:20	5:58:30±3:01:59 1:44:38 to 11:38:12	2:59:15±1:30:59 0:52:19 to 5:49:06
#Nights Driven	1.55±1.50 0 to 5	1.41±1.65 0 to 5	2.95±2.90 0 to 10	1.47±1.45 0 to 4.5
#Night Trips	1.73±1.75 0 to 5	1.45±1.74 0 to 5	3.18±3.22 0 to 10	1.59±1.61 0 to 5
Night Distance [a]	20.52±33.15 0 to 138.27	21.70±47.83 0 to 225.2	42.22±60.03 0 to 225.2	21.11±30.01 0 to 112.6
Night Duration	0:40:58±0:54:03 0 to 3:24:37	0:35:31±0:50:25 0 to 3:06:11	1:16:24±1:28:28 0 to 4:41:30	0:38:12±0:44:14 0 to 2:20:45

Note: Values presented as *frequencies (valid percent)*, or M*ean±S.D., range.* Data missing for an 81 y.o. woman.
Significant gender difference with average indicators: [a] $p < .05$, [b] $p < .001$

Appendix I2d. Driving Exposure Results for the Participants Under 80 (N = 28)

Indicators	Period			
	Week 1	Week 2	Combined	Average
#Days Driven	4.79±1.45 2 to 7	4.96±1.90 0 to 7	9.75±2.93 3 to 14	4.88±1.46 1.5 to 7
#Trips	7.52±3.38 2 to 15	7.59±3.84 0 to 15	15.11±6.85 3 to 28	7:55±3.42 1.5 to 14
#Segments	24.50±12.00 5 to 57	25.57±13.43 0 to 51	50.07±23.70 8 to 108	25.04±11.85 4 to 54
#Stops	16.57±8.76 3 to 41	17.79±9.35 0 to 39	34.36±16.66 5 to 80	17.18±8.33 2.5 to 40
Distance (km)	143.41±98.15 25.5 to 377.5	188.51±151.02 0 to 578.0	331.92±221.99 56.1 to 932.1	164.79±106.74 28.05 to 466.05
Duration (hr:min:sec)	4:24:45±2:20:57 0:53:59 to 10:14:23	5:00:40±3:07:44 0 to 12:46:12	9:25:26±4:50:07 1:44:38 to 20:30:48	4:42:43±2:25:03 0:52:19 to 10:15:24
#Nights Driven	2.04±1.64 0 to 5	1.93±1.77 0 to 5	4.00±2.83 0 to 9	1.98±1.42 0 to 4.5
#Night Trips	2.18±1.81 0 to 5	2.00±1.91 0 to 5	4.18±3.13 0 to 10	2.09±1.56 0 to 5
Night Distance	27.98±31.77 0 to 138.27	35.86±47.91 0 to 225.2	63.84±58.80 0 to 225.2	31.92±29.40 0 to 112.6
Night Duration	0:49:49±0:51:19 0 to 3:24:37	0:59:02±0:58:25 0 to 3:06:11	1:48:51±1:29:04 0 to 4:45:21	0:54:25±0:44:32 0 to 2:22:41

Note: Values presented as *frequencies (valid percent)*, or M*ean±S.D., range.*

Appendix I2e. Driving Exposure Results for the Participants 80 and Over (N = 18)

Indicators	**Period**			
	Week 1	**Week 2**	**Combined**	**Average**
#Days Driven	5.06±1.35 2 to 7	4.72±1.93 1 to 7	9.78±3.08 3 to 14	4.89±1.54 1.5 to 7
#Trips	6.89±2.91 2 to 12	6.94±4.37 1 to 14	13.83±6.94 3 to 26	6.92±3.47 1.5 to 13
#Segments	22.5±9.65 6 to 44	22.89±14.76 2 to 49	45.39±23.09 8 to 86	22.69±11.55 4 to 43
#Stops	15.33±7.28 3 to 31	15.67±10.47 1 to 36	31.00±16.52 5 to 59	15.50±8.26 2.5 to 29.5
Distance (km)	150.79±122.62 29.4 to 477.5	138.25±138.40 10.3 to 512.0	289.03±239.9 45.3 to 989.5	143.96±113.93 22.65 to 463.45
Duration (hr:min:sec)	4:17:39±2:29:28 1:30:49 to 9:46:24	4:04:37±3:06:23 0:31:26 to 9:46:50	8:22:17±5:15:18 2:05:16 to 19:14:49	4:11:08±2:37:39 1:02:38 to 9:37:24
#Nights Driven	1.67±1.53 0 to 6	1.61±1.75 0 to 6	3.28±3.20 0 to 12	1.64±1.60 0 to 6
#Night Trips	1.78±1.73 0 to 7	1.61±1.75 0 to 6	3.39±3.38 0 to 13	1.69±1.69 0 to 6.5
Night Distance	34.94±62.34 0 to 249.99	24.94±44.95 0 to 181.7	59.88±105.71 0 to 431.69	29.94±52.86 0 to 215.85
Night Duration	0:53:40±1:17:19 0 to 5:17:35	0:39:10±1:01:33 0 to 3:48:25	1:32:50±2:16:51 0 to 9:06:00	0:46:25±1:08:25 0 to 4:33:00

Note: Values presented as *frequencies (valid percent)*, or M*ean±S.D., range*. Data missing for one female.

Appendix I3. Driving Radii by Gender and Age Group (N=40)

Radius	Total Sample	Gender		Age Group	
		Male (n=19)	Female (n=21)	Under 80 (n=24)	80 & Over (n=16)
Min					
Week 1	2.25±3.14 0.15 to 18.77	3.27±4.25 0.47 to 18.77	1.33±1.06 0.15 to 4.70	1.76±1.49 0.31 to 7.23	2.99±4.61 0.15 to 18.77
z(p)		-2.05 (.04)		-0.03 (.98)	
Week 2	2.48±3.18 0 to 18.75	3.50±4.29 0.45 to 18.75	1.56±1.16 0 to 4.70	2.20±1.96 0 to 7.10	2.90±4.49 0.38 to 18.75
z(p)		-1.73 (.08)		-0.25 (.80)	
Average [a]	2.37±3.04 0.43 to 18.76	3.38±4.12 0.43 to 18.76	1.45±0.93 2.42 to 49.48	1.98±1.42 0.43 to 6.71	2.94±4.51 0.57 to 18.76
z(p)		-2.10 (.02)		-0.04 (.47)	
Max					
Week 1	15.65±18.55 2.43 to 95.56	17.75±17.21 5.48 to 70.63	13.75±19.91 2.43 to 95.56	14.29±18.88 3.18 to 95.56	17.7±18.45 2.43 to 70.63
z(p)		-2.15 (.03)		-0.88 (.38)	
Week 2	20.43±30.87 0 to 128.26	32.07±37.84 2.42 to 128.26	9.90±18.03 0 to 86.40	28.04±37.65 0 to 128.26	9.02±8.53 2.01 to 34.47
z(p)		-3.41 (.001)		-1.66 (.10)	
Average [a]	18.04±18.33 2.42 to 80.78	24.91±21.45 6.45 to 80.78	11.83±12.46 2.42 to 49.48	21.16±21.14 3.76 to 80.78	13.36±12.21 2.42 to 42.52
z(p)		-2.53 (.007)		-0.91 (.29)	
Average					
Week 1	6.16±5.38 1.52 to 24.38	7.40±6.41 2.41 to 24.38	5.04±4.09 1.52 to 21.07	5.37±4.27 2.41 to 21.07	7.36±6.70 1.52 to 24.38
z(p)		-1.38 (.17)		-0.84 (.40)	
Week 2	7.27±8.40 0 to 44.19	9.52±7.24 1.44 to 25.99	5.24±9.02 0 to 44.19	8.71±9.95 0 to 44.19	5.11±4.85 1.44 to 20.60
z(p)		-2.70 (.007)		-1.52 (.13)	
Average [a]	6.95±5.74 1.89 to 26.46	8.56±5.92 2.97 to 20.49	5.50±5.29 1.89 to 26.46	7.28±5.80 2.90 to 26.46	6.47±5.80 1.89 to 20.49
z(p)		-2.14 (.03)		-1.17 (.24)	

Note: Values presented as *Mean±S.D.*, *range*. Comparisons are Mann-Whitney U test, *z(p)*.
[a] Over the two-week monitoring period.

Appendix I4: Frequency of Night Driving (N = 46)

Night Driving	Full Sample	Gender		Age Group	
		Male (n = 24)	**Female (n = 22)**	**Under 80 (n = 28)**	**80 & Over (n = 18)**
Week 1					
0 days	10 (21.7)	3 (12.5)	7 (31.8)	7 (25.0)	3 (16.7)
1 days	12 (26.1)	7 (29.2)	5 (22.7)	4 (14.3)	8 (44.4)
2 days	9 (19.6)	4 (16.7)	5 (22.7)	6 (21.4)	3 (16.7)
3 days	8 (17.4)	6 (25.0)	2 (9.1)	6 (21.4)	2 (11.1)
4 days	3 (6.5)	1 (4.2)	2 (9.1)	2 (7.1)	1 (5.6)
5 days	3 (6.5)	2 (8.3)	1 (4.5)	3 (10.7)	0
6 days	1 (2.2)	1 (4.2)	0	0	1 (5.6)
Week 2					
0 days	15 (32.6)	6 (25.0)	9 (40.9)	9 (32.1)	6 (33.3)
1 days	10 (21.7)	4 (16.7)	6 (27.3)	5 (17.9)	5 (27.8)
2 days	3 (6.5)	2 (8.3)	1 (4.5)	1 (3.6)	2 (11.1)
3 days	8 (17.4)	6 (25.0)	2 (9.1)	6 (21.4)	2 (11.1)
4 days	7 (15.2)	4 (16.7)	3 (13.6)	5 (17.9)	2 (11.1)
5 days	2 (4.3)	1 (4.2)	1 (4.5)	2 (7.1)	0
6 days	1 (2.2)	1 (4.2)	0	0	1 (5.6)
Total					
0 days	5 (10.9)	1 (4.2)	4 (18.2)	3 (10.7)	2 (11.1)
1 days	7 (15.2)	2 (8.3)	5 (22.7)	2 (7.1)	5 (27.8)
2 days	8 (17.4)	5 (20.8)	3 (13.6)	5 (17.9)	3 (16.7)
3 days	7 (15.2)	3 (12.5)	4 (18.2)	5 (17.9)	2 (11.1)
4 days	4 (8.7)	3 (12.5)	1 (4.5)	3 (10.7)	1 (5.6)
5 days	2 (4.3)	1 (4.2)	1 (4.5)	1 (3.6)	1 (5.6)
6 days	2 (4.3)	2 (8.3)	0	2 (7.1)	0
7 days	5 (10.9)	4 (16.7)	1 (4.5)	2 (7.1)	3 (16.7)
8 days	3 (6.5)	2 (8.3)	1 (4.5)	3 (10.7)	0
9 days	2 (4.3)	0	2 (9.1)	2 (7.1)	0
10 days	0	0	0	0	0
11 days	0	0	0	0	0
12 days	1 (2.1)	1 (4.2)	0	0	1 (5.6)

Note: Values are presented as *Frequencies (valid percent)*. Missing CarChip data for an 81 y.o., female.

Appendix J: Additional Perception Scores

Appendix J1. Driving Exposure & Patterns by Day Driving Comfort (N=45)

Indicators	DCS - Daytime Scores		Comparison(*p*)
	≤ 50% (n = 9)	**> 50% (n = 36)**	
# Days driven	1.56±1.10 2.5 to 6.50	4.90±1.54 1.5 to 7	t = -0.64 (.53)
# Trips	6.17±3.20 3 to 14	7.43±3.38 1.5 to 14	t = -1.01 (.32)
# Stops	13.17±4.85 9.5 to 25	17.11±8.75 17.11 to 8.76	t = -1.81 (.08)
Distance (km)	112.46±79.12 29.5 to 242.6	167.20±114.78 22.7 to 466.1	z = -1.19 (.23)
Duration (hr:min)	3:18±1:31 1:30 to 5:58	4:45±2:37 0:52 to 10:15	t = -1.39 (.16)
Radius (min)	2.12±2.02 0.5 to 6.2	2.48±3.35 0.4 to 18.8	z = -0.53 (.59)
Radius (max)	14.77±16.85 2.4 to 46.2	19.28±19.14 4.2 to 80.8	z = -1.47 (.14)
Radius (avg)	6.86±6.52 1.9 to 19.2	7.11±5.66 2.4 to 26.5	z = -0.88 (.38)
# Nights	1.11±0.82 0 to 2.5	2.06±1.58 0 to 6	z = -1.53 (.13)
Night trips	1.11±0.82 0 to 2.5	2.17±1.71 0 to 6.5	z = -1.60 (.11)
Night (km)	14.00±15.86 0 to 48.8	36.25±42.89 0 to 215.9	z = -1.73 (.08)
Night (duration)	0:24±0:18 0 to 0:50	0:59±0:58 0 to 4:33	z = -1.42 (.16)

Note: Values presented as *Mean±S.D.*, *range*. Comparisons are independent *t*-test, *t(p)*, or Mann-Whitney U test, *z(p)*. Missing scores/ratings for an 87 y.o. man and driving data for an 81 y.o. woman, thus, indicators based on N=45, except radius (N=39).

Appendix J2. Driving Exposure & Patterns by Night Driving Comfort (N=45)

Indicators	**DCS – Nighttime Scores**		**Comparison(*p*)**
	≤ 50% (n = 16)	**> 50% (n = 29)**	
# Days driven	4.53±1.45 1.5 to 6.5	5.00±1.46 1.5 to 7	t = -1.03 (.31)
# Trips	6.19±3.42 1.5 to 14	7.72±3.23 1.5 to 14	t = -1.50 (.14)
# Stops	14.16±9.05 2.5 to 40	17.52±7.65 2.5 to 31	t = -1.32 (.19)
Distance (km)	116.90±96.86 22.7 to 382.7	177.97±112.37 28.1 to 466.1	z = -1.99 (.05)
Duration (hr:min)	3:35±2:18 1:02 to 10:15	4:57±2:30 0:52 to 9:37	t = -1.76 (.08)
Radius (min)	2.03±1.70 0.5 to 6.2	2.65±3.76 0.4 to 18.8	z = -0.46 (.65)
Radius (max)	11.29±11.45 2.4 to 41.3	23.07±21.07 4.2 to 80.78	z = -2.48 (.01)
Radius (avg)	5.19±4.05 1.9 to 19.2	8.34±6.50 3.0 to 26.5	z = -1.63 (.10)
# Nights	1.41±1.37 0 to 4.5	2.12±1.53 0 to 6	z = -1.55 (.12)
Night trips	1.44±1.39 0 to 4.5	2.24±1.69 0 to 6.5	z = -1.65 (.10)
Night (km)	17.23±22.62 0 to 76.6	39.84±45.13 0 to 215.9	z = -2.42 (.02)
Night (duration)	0:34±0:40 0 to 2:22	1:01±0:59 0 to 4:33	z = -1.69 (.09)

Note: Values presented as *Mean±S.D.*, *range*. Comparisons are independent *t*-test, *t(p)*, or Mann-Whitney U test, *z(p)*. Missing scores/ratings for an 87 y.o. man and driving data for an 81 y.o. woman, thus, indicators based on N=45, except radius (N=39).

Appendix K: Additional Results for Seasonal Comparisons

Appendix K1a. Case Descriptions for the Fall Group

Participant	Follow-up Interview		Interpretation
	Fall (7 day period)	Winter (14 day period)	
ID# 22, Male Age:78 Sole driver Living alone	Reported atypical (less). Didn't visit son (2hrs away). Visited daughter for Thanksgiving (round trip: 160km).	Reported (more). Visited son for 4 days (round trip: 180km) during inclement weather.	Large decrease in km during winter may be explained by trip to visit his son for 4 days. Subject did not drive during this period (son drove).
Days Driven, Distance DCS-D, DCS-N	5 days (1 inclement), 310 km 94, 92	3.5 (1 inclement), 192 km 92, 89	
ID# 28, Female Age:79 Sole driver Living alone	Reported atypical (less). Shared vehicle with relative.	Reported atypical (no reason given).	Appeared to be a low mileage driver. Has low comfort.
Days Driven, Distance DCS-D, DCS-N	4 days (1 inclement), 75 km 44, 27	4.5 days (1 inclement), 46 km 39, 22	
ID# 34, Female Age:88 Sole driver Living alone	Reported typical. Felt unwell and didn't drive for 2 days. Took long trip to country side (round trip: 63 km, where all other trips were under 17 km).	Reported typical. Took friend to the hospital (in town).	Has low comfort. Fall trip to countryside may explain greater km driven in fall.
Days Driven, Distance DCS-D, DCS-N	4 days (2 inclement), 141 km 44, 22	4.5 days (3 inclement), 30 km 42, 20	

Appendix K1a Continued

Participant	Follow-up Interview		Interpretation
	Fall (7 day period)	Winter (14 day period)	
ID# 38, Male Age:86 Sole driver Lives with spouse	Reported typical. Out-of-town trip to London, Brantford, and New Hamsburg during clear and inclement weather.	Refused visit 2, hence interview data missing.	Primary driver and his wife (legally blind) depends on him. Three out-of-town trips in fall may explain greater driven km in fall.
Days Driven, Distance DCS-D, DCS-N	7 days (2 inclement), 592 km 60, 45	7 days (2 inclement), 174 km *Missing*, *Missing*	
ID# 39, Female Age:79 Couple driver Lives with spouse (ID# 40)	Reported atypical (more) because partner was ill. Missed bridge games and Thanksgiving dinner.	Reported typical. Out-of-town trip to Mississauga (round trip: 167km) to sister's.	Shared vehicle with spouse. Primary driver based on km driven (see ID# 40). Greater km in winter likely due to out-of-town trip to Mississauga.
Days Driven, Distance DCS-D, DCS-N	6 days (1 inclement), 104 km 73, 70	5.5 days (1 inclement), 154 km 89, 67	
ID# 40, Male Age:84 Couple driver Lives with spouse (ID# 39)	Reported atypical (less) because ill. Missed bridge games and Thanksgiving dinner.	Reported typical.	Shared vehicle with spouse. Based on km driven, not the primary driver (see ID# 39). High DCS scores in fall and winter, and overall low level of km driven may be a result of sharing a vehicle.
Days Driven, Distance DCS-D, DCS-N	1 day (0 inclement), 9 km 98, 69	4 days (3 inclement), 78 km 96, 92	

Appendix K1a Continued

Participant	Follow-up Interview		Interpretation
	Fall (7 day period)	Winter (14 day period)	
ID# 47, Male Age:86 Sole driver Living alone Rural resident	Reported typical. Overnight trip to daughter's for Thanksgiving (round trip: 104 km). He's a PhD candidate (UW) and conducted interviews for school (total: 257 km).	Reported atypical (less) due to house renovations. Missed 2 (grand-daughters') hockey games. Visited son (Caledon, Brampton), round trip: 152 km.	Rural residence (St. Agatha) likely explains higher level of km driven. Fall data collection and winter home renovations may explain large decrease in km driven in winter.
Days Driven, Distance DCS-D, DCS-N	6 days (3 inclement), 633 km 73, 81	3.5 days (1 inclement), 172 km 46, 36	
ID# 48, Female Age:79 Sole driver Living alone	Reported atypical (less) because many social events in complex.	Reported typical. Attended funeral. One shopping trip of 46 km while all other trips were under 12 km.	Appears to be a low mileage driver. Has low comfort. Similar fall and winter km.
Days Driven, Distance DCS-D, DCS-N	3 days (0 inclement), 36 km 73, 55	2.5 days (1 inclement), 37 km 64, 23	

Appendix K1b. Case Descriptions for the Spring Group

Participant	Follow-up Interview		Interpretation
	Spring (7 day period)	Winter (14 day period)	
ID# 13, Female Age:77 Sole driver Lives alone Days Driven, Distance DCS-D, DCS-N	Reported atypical (less). Didn't drive to Toronto or Stratford to visit son & daughter, (usually once/month). 5 days (1 inclement), 49 km 77, 63	Reported typical**.** One out-of-town trips (i.e., Toronto) during inclement weather. Attended several social events. Drove others. 4.5 days (4 inclement), 188 km 71, 66	Reported events in winter explains the greater winter km.
ID# 16, Female Age:72 Sole driver Lives alone Days Driven, Distance DCS-D, DCS-N	Reported typical driving. Visited friend in Cambridge. Missed fitness class. 4 days (1 inclement), 86 km 35, 23	Reported typical. 2.5 days (3 inclement), 39 km 40, 22	Appears to be a low mileage driver. Had low comfort. Out-of-town trip to Cambridge and decreased days driven in winter may explain the greater spring km.
ID# 18, Female Age:77 Sole driver Lives with spouse Days Driven, Distance DCS-D, DCS-N	Reported atypical (less) because felt unwell. Attended dinner party. Missed bridge (event canceled). 6 days (2 inclement), 110 km 94, 77	Reported atypical (no reason given). 7 days (4 inclement), 95 km 85, 84	Primary driver. Dependent spouse (in wheelchair).

Appendix K1b Continued

Participant	Follow-up Interview		Interpretation
	Spring (7 day period)	Winter (14 day period)	
ID# 19 Female Age:79 Sole driver Lives alone Days Driven, Distance DCS-D, DCS-N	Reported atypical (less). Didn't visit daughters in Mississauga (usually once/2 months) or Burford (usually monthly). 6 days (1 inclement), 61 km 75, 61	Reported typical. Daughter visited during which she drove the subject. 5 days (4 inclement), 81 km 77, 48	Appears to be a low mileage driver. Had moderately low comfort. Slight increase in km during the winter may be explained by (1) missed (long distance) visit to daughter in spring, (2) daughter visiting in winter.
ID# 21 Male Age:69 Couple driver Lives with spouse Days Driven, Distance DCS-D, DCS-N	Reported typical. Trip to St. Jacob. Took partner to hospital. Missed visit to son & daughter in Georgetown, (usually once/2 weeks). 7 days (1 inclement), 270 km 85, 75	Reported typical. Took 2-day trip to Toronto with additional stops (round trip: 240 km) during inclement weather. 6.5 days (6 inclement), 383 km 75, 39	High level of km driven can be explained by primary driver status and subject working full-time. Winter out-of-town trip likely increased km driven in winter.
ID# 23, Female Age:85 Sole driver Lives alone Days Driven, Distance DCS-D, DCS-N	Reported atypical (less). Dental appointment. Missed visit to son in Toronto (usually once/3 months). Attended a play. 4 days (1 inclement), 43 km 65, 25	Reported typical. Experienced car problems: car battery died. Problem did not seem to interfere with routine/plans much as car was immediately serviced. 5.5 days (3 inclement), 76 km 52, 23	Appears to be a low mileage driver. Had low comfort. Additional 1.5 days of driving likely explains increase in winter km.

Appendix K1b Continued

Participant	Follow-up Interview		Interpretation
	Spring (7 day period)	Winter (14 day period)	
ID# 36, Male Age:63 Couple driver Lives with spouse (ID# 37)	Reported typical. Attended funeral. Missed monthly visits to daughters (Erin or Toronto).	Reported typical.	Primary driver based on km driven (in comparison to ID# 37). Unlike other participants, he has a high level of driven km but low DCS scores.
Days Driven, Distance DCS-D, DCS-N	6 days (0 inclement), 251 km 67, 52	6.5 days (4 inclement), 243 km 44, 44	
ID# 37, Female Age:64 Couple driver Lives with spouse (ID# 36)	Reported typical (less) because of company. Attended funeral. Visited ill friend (in-town) instead of driving to church and hiking trail.	Reported typical.	Appears to be a low mileage driver. Had moderately low comfort. Low mileage possibly due to sharing vehicle with husband (ID# 36), the primary driver.
Days Driven, Distance DCS-D, DCS-N	2 days (0 inclement), 69 km 52, 42	2 days (1 inclement), 49 km 69, 55	
ID# 44, Male Age:69 Couple driver Lives with spouse	Reported typical (less) because partner took vehicle to cottage (1 day).	Reported typical. Loaned car to daughter. Serviced car. Two-day, out-of-town trip to Port Franks & Elginmills (round trip: 300 km).	With high DCS scores, low spring km may be reflecting choice to travel by other modes (i.e., bus, walking during warmer season). Out-of-town trip to Port Franks and Elginmills may explain greater km driven in winter.
Days Driven, Distance DCS-D, DCS-N	6 days (1 inclement), 61 km 85, 88	7 days (5 inclement), 297 km 85, 80	

Appendix K2a. Driving Indicators and Related Variables for the Fall Group (N=8)

ID#	Gender	Entry Age	Sole Driver	Shared Vehicle	Distance (km)		Days Driven		# Nights		Driven Winter Advisories
					F	W	F	W	F	W	
22	Male	78	Y	N	310	192	5	3.5	1	0.5	1 of 5 instances
28	Female	79	Y	N	75	46	4	4.5	1	1.5	0 of 2 instances
34	Female	88	Y	N	141	30	4	4.5	0	0.5	1 of 2 instances
38	Male	86	Y	N	592	174	7	7	0	1	NA
39	Female	79	N	Y	104	154	6	5.5	1	0.5	NA
40	Male	84	N	Y	9	78	1	4	0	1.5	NA
47	Male	86	Y	N	633	172	6	3.5	1	0	NA
48	Female	79	Y	N	36	37	3	2.5	0	0	NA

Note: Winter indicators are averages over two weeks. ID# 39 and 40 are spouses.
F = fall, **W** = winter, **Entry age** = age during fall assessment (Oct/07).

Appendix K2b. Driving Indicators and Related Variables for the Spring Group (N=9)

ID#	Gender	Entry Age	Sole Driver	Shared Vehicle	Distance (km)		Days Driven		# Nights		Driven Winter Advisories
					S	W	S	W	S	W	
13	Female	77	Y	N	49	188	5	4.5	2	4	NA
16	Female	72	Y	N	86	39	4	2.5	1	1	1 of 6 instances
18	Female	77	Y	N	110	95	6	7	1	3.5	6 of 6 instances
19	Female	79	Y	N	61	81	6	5	2	2	4 of 5 instances
21	Male	69	N	Y	270	383	7	6.5	4	4	5 of 5 instances
23	Female	85	Y	N	43	76	4	5.5	0	1	3 of 3 instances
36	Male	63	N	Y	251	243	6	6.5	2	2	NA
37	Female	64	N	Y	69	49	2	2	1	0	NA
44	Male	69	N	Y	61	297	6	7	0	3	NA

Note: Winter indicators are averages over two weeks. ID# 36 and 37 are spouses.
S = spring, **W** = winter, **Entry Age** = age during spring assessment (Apr-May/08).

Appendix K3a. Weather Conditions on Days Driven in Fall versus Winter (N=8)

ID#	Gender	Fall (7 day period)				Winter (14 day period)				
		Weather		Inclement Weather		Weather		Inclement Weather		
		Clear	Inclement	Rain	Fog	Clear	Inclement	Snow	Rain	Fog
22	Male	**4 of 6** 66.7%	**1 of 1** 100%	1 of 1	0	**6 of 8** 75%	**1 of 6** 16.7%	1 of 6	0	0
28	Female	**3 of 5** 60%	**1 of 2** 50%	1 of 2	0	**8 of 10** 80%	**1 of 4** 25%	0 of 1	0 of 1	1 of 2
34	Female	**2 of 5** 40%	**2 of 2** 100%	2 of 2	0	**6 of 9** 66.7%	**3 of 5** 60%	3 of 3	0 of 1	0 of 1
38	Male	**5 of 5** 100%	**2 of 2** 100%	1 of 1	1 of 1	**12 of 12** 100%	**2 of 2** 100%	0	1 of 1	1 of 1
39	Female	**5 of 6** 83.3%	**1 of 1** 100%	1 of 1	0	**10 of 11** 90.9%	**1 of 3** 33.3%	0 of 1	1 of 2	0
40	Male	**1 of 6** 16.7%	**0 of 1** 0%	0 of 1	0	**5 of 9** 55.6%	**3 of 5** 60%	1 of 2	2 of 3	0
47	Male	**3 of 4** 75%	**3 of 3** 100%	3 of 3	0	**6 of 11** 54.5%	**1 of 3** 33.3%	0 of 1	1 of 2	0
48	Female	**3 of 5** 60%	**0 of 2** 0%	0 of 2	0	**3 of 11** 27.3%	**1 of 3** 33.3%	0 of 1	1 of 2	0

Note: Values indicate days driven/total days by weather condition for each person's monitoring period. E.g., In fall, ID# 22 drove 5 days in total; 4 clear days (but not for 2 clear days), and drove on the only day with inclement weather. In winter, he drove 7 days in total; 6 clear days (but not for 2 clear days), and drove 1 day with inclement weather (but not for the second).

Appendix K3b. Weather Conditions on Days Driven in Spring versus Winter (N=9)

ID#	Gender	Spring (7 day period)				Winter (14 day period)				
		Weather		Inclement Weather		Weather		Inclement Weather		
		Clear	Inclement	Rain	Fog	Clear	Inclement	Snow	Rain	Fog
13	Female	**4 of 5** 80%	**1 of 2** 50%	1 of 2	0	**5 of 8** 62.5%	**4 of 6** 66.7%	3 of 4	1 of 2	0
16	Female	**3 of 5** 60%	**1 of 1** 100%	1 of 1	0	**2 of 5** 40%	**3 of 9** 33.3%	3 of 9	0	0
18	Female	**4 of 5** 80%	**2 of 2** 100%	2 of 2	0	**10 of 10** 100%	**4 of 4** 100%	4 of 4	0	0
19	Female	**5 of 6** 83.3%	**1 of 1** 100%	1 of 1	0	**6 of 6** 100%	**4 of 8** 50%	4 of 8	0	0
21	Male	**6 of 6** 100%	**1 of 1** 100%	1 of 1	0	**7 of 8** 87.5%	**6 of 6** 100%	6 of 6	0	0
23	Female	**3 of 3** 100%	**1 of 4** 25%	1 of 4	0	**8 of 10** 80%	**3 of 4** 75%	3 of 4	0	0
36	Male	**6 of 7** 85.7%	**0**	0	0	**9 of 9** 100%	**4 of 5** 80%	1 of 1	3 of 4	0
37	Female	**2 of 7** 28.6%	**0**	0	0	**3 of 10** 30%	**1 of 4** 25%	1 of 1	0 of 3	0
44	Male	**5 of 6** 83.3%	**1 of 1** 100%	1 of 1	0	**9 of 9** 100%	**5 of 5** 100%	2 of 5	3 of 5	0

Note: Values indicate days driven/total days by weather condition for each person's monitoring period. E.g., In spring, ID# 13 drove 5 days in total; 4 clear days (but not for one clear days), and drove one day with inclement weather (but not for the second). In winter, she drove 9 days in total; 5 clear days (but not for 3 clear days), and drove 4 days with inclement weather (but not for the remaining 2).