Examination of Older Driver Perceptions and Actual Behaviour in Sole Household Drivers and Driving Couples

by

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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: Driver perceptions may be a more important determinant of behaviour than one's actual driving abilities. While there is evidence to support these associations, prior studies have relied on self-reports of driving behaviour.

Purpose: The primary purposes of this study were to extend previous research by examining driver perceptions in relation to measures of actual driving behaviour and to compare the perceptions and behaviour of sole versus couple drivers.

Methods: A convenience sample of 61 older drivers (aged 67 to 92, 59% women) were recruited as either sole drivers (only driver in the household, n=39) or couples (both currently driving and sharing a vehicle, n=22). Two in-vehicle devices (one with a GPS unit) were installed in participant vehicles for one week. Participants completed trip logs, out-of-home activity diaries, questions on usual driving habits and ratings of situational driving frequency and avoidance. Perceptions were assessed using the Driving Comfort Scales (DCS Day and Night) and Perceived Driving Abilities (PDA) Scales. Couples were also asked to rate their comfort level in their partner's driving using modified DCSs. Tools were administered at one of two home visits (during which vehicle devices were installed and removed) and an interview conducted at the end to ascertain whether the week's driving was typical.

Results: Driving comfort scores were significantly related to multiple indicators of actual driving behaviour, including: radius from home (DCS-D, $p<.05$; DCS-N, $p<.01$), total distance overall (DCS-N, $p<.001$) and at night (DCS-D, $p<.05$; DCS-N, $p<.01$). Perceived abilities, meanwhile, were related to distance driven ($p<.01$). Although sole drivers were significantly older, they drove more often, longer distances and for greater duration than couple drivers. Overall, men had higher DCS scores and, in couples, were more likely to rate themselves higher than their spouses. Partners' comfort levels in their spouses' driving were related to their spouses' self-reported situational avoidance and amount of night driving over the study week. When couples drove together, traditional roles were evident (i.e., the husband often preferred to drive and the wife let him). Multivariate analyses showed that the square-root of distance (km) was most influenced by household status, location of residence, perceived abilities, and gender (R^2 = .57), while the log of the average radius was influenced by location of residence and perceived comfort in night driving (R^2 = .33).

Conclusions: This was the first study to examine older drivers' perceptions in relation to actual driving behaviour and to compare the perceptions and behaviour of sole versus couple drivers. Study results supported prior associations (with self-reported driving) and extended our knowledge base by demonstrating that perceptions (both personal and those of others) are important to actual driving behaviour. The current findings also provide new insight into the importance of examining location of residence and household status.

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Chapter 1 – Introduction and Overview

The disproportionate number of older drivers involved in fatal crashes (per mile driven) together with the growing numbers of older drivers (Burkhardt & McGavock, 1999; Hopkins, Kilik, Day, Rows & Tseng, 2004; Lyman, Ferguson, Braver & Williams, 2002) has prompted attention regarding the safety of older drivers (Dellinger, Sehgal, Sleet & Barrett-Connor, 2001). Attempts to regulate older drivers, however, must be balanced against costs and impact on quality of life (Lyman et al., 2002). Driving cessation has been linked to feelings of regret, social isolation, and loss of self-worth (Rudman, Friedland, Chipman & Sciortino, 2006; Johnson, 1995), as well as depression and reduced out-of-home activities (Marottoli et al., 1997). For many older adults, driving is synonymous with mobility, autonomy and self-esteem (Dickerson et al., 2007; Kostyniuk & Shope, 2003). Until appropriate public transportation and other alternatives are established, older drivers will likely be reluctant to relinquish their driving privilege (Dickerson et al., 2007).

A recent review by a group of leading researchers in the field (Dickerson et al., 2007) described a shift in the direction of research from a focus on medical conditions that may affect the ability to drive safely to an emphasis on assessing functional ability, regardless of age. The authors emphasized the need for a better understanding of the decision making process concerning driver self-restriction and eventual cessation. Research has shown that driver perceptions (abilities and confidence levels) are important to self-regulation (MacDonald, Myers & Blanchard, 2008; Marottoli & Richardson, 1998; Myers, Paradis & Blanchard, 2008b; Parker, MacDonald, Sutcliffe & Rabbitt, 2001; Rudman et al., 2006). However, none of these studies have looked at driver perceptions in relation to self-reported (versus actual) driving behaviour. To establish the context for the current study, concerns about older drivers are briefly summarized. Self-regulation is then explained to provide a framework and basis for the study.

1.1 Statement of the Problem

1.1.1 Growing Number of Older Drivers

Older adults represent the fastest growing segment of licensed drivers (Ball et al., 2006; Bédard, Isherwood, Moore, Gibbons & Lindstrom, 2004; Hopkins et al., 2004) and will continue to grow as the baby boomers age (Lyman et al., 2002). The number of older drivers (65+ years) in Ontario has been projected to increase from approximately one half million in 1986 to nearly 2.5 million by 2028 (Hopkins et al., 2004). According to the Ministry of Transportation of Ontario (MTO) (2003), the number of licensed drivers aged 80 years and older has already doubled from about 77,000 to over 165,000 in 1996 to 2001. The number of female drivers is also increasing and will therefore comprise a greater proportion of older drivers in the future (Burkhardt & McGavock, 1999).

1.1.2 Collisions and Fatalities

Older drivers are over-represented in motor vehicle crashes per kilometer driven and are more likely to be considered at-fault and sustain fatal or serious injuries (Ball et al., 2006; Bédard, Stones, Guyatt & Hirdes, 2001; Zhang, Lindsay, Clarke, Robbins & Mao, 2000). Advanced age appears to lead to increased risk. That is, drivers in their 80's appear to be at higher risk than drivers in their 70's, who in turn, are at higher risk than drivers in their 60's (Bédard et al., 2001; Li, Braver & Chen, 2003; Perneger & Smith, 1991; Zhang et al., 2000). Researchers have speculated that a high proportion (40%) of all fatal crashes may be associated with age-related frailty (Staplin, Lococo, Gish & Decina, 2003). In Ontario, drivers aged 80+ have the second highest rate of fatalities (MTO, 2003). To compound the issue, future cohorts of older adults are likely to lead more dynamic lives and take more trips than today's older adults (Paéz, Scott, Potoglou, Kanaroglou & Newbold, 2007; Rosenbloom, 2001). Together, the crash risk, increased mileage and growing number of older drivers represent a significant public health concern.

1.1.3 Self-Regulation

Several researchers have described self-regulation as a gradual process, or continuum of self-restrictions that ultimately lead to driving cessation or "retirement" (Dellinger et al., 2001; Dickerson et al., 2007; Hakamies-Blomqvist & Wahlström, 1998; Rudman et al., 2006). For example, Hakamies-Blomqvist and Wahlström (1998) found that nearly half their sample of older drivers (N=3073) surveyed said that they drove less than they did 10 years ago and were more likely to avoid driving in peak hours, on highways, in bad weather and at night.

As they age, many older adults adjust their driving behaviour by reducing their overall amount of driving (Baldock, Mathias, McLean & Berndt, 2006; De Raedt & Ponjaert-Kristofferson, 2000; Ragland, Satariano & MacLoed, 2004) and avoiding challenging driving situations (e.g., bad weather, left-hand turns, night driving). However, their elevated crash risk suggests that not all seniors appropriately or effectively restrict their driving, whether due to lack of awareness (Freund, Colgrove, Burke & McLeod, 2005; Marottoli & Richardson, 1998; Stalvey & Owsley, 2000) or inconvenience (Baldock et al., 2006; Owsley, Stalvey, Wells, & Sloane, 2004). One study found that almost 70% of older drivers cited maintaining their current lifestyle as a major barrier to restricting their driving (Baldock et al., 2006). Drivers who deny or lack awareness of their deficits may be unsafe by continuing to drive in situations that exceed their ability to respond appropriately (Marottoli & Richardson, 1998).

Based on in-depth feedback from pre-senior, senior and former drivers, Rudman and colleagues (2006) developed a model of self-regulation. This model, presented in Figure 1.1, depicts the complex interplay of factors that can influence driver decision making. In particular, the model emphasizes the importance of personal comfort level (including confidence), as well as various interpersonal, intrapersonal and environmental factors that may affect comfort level.

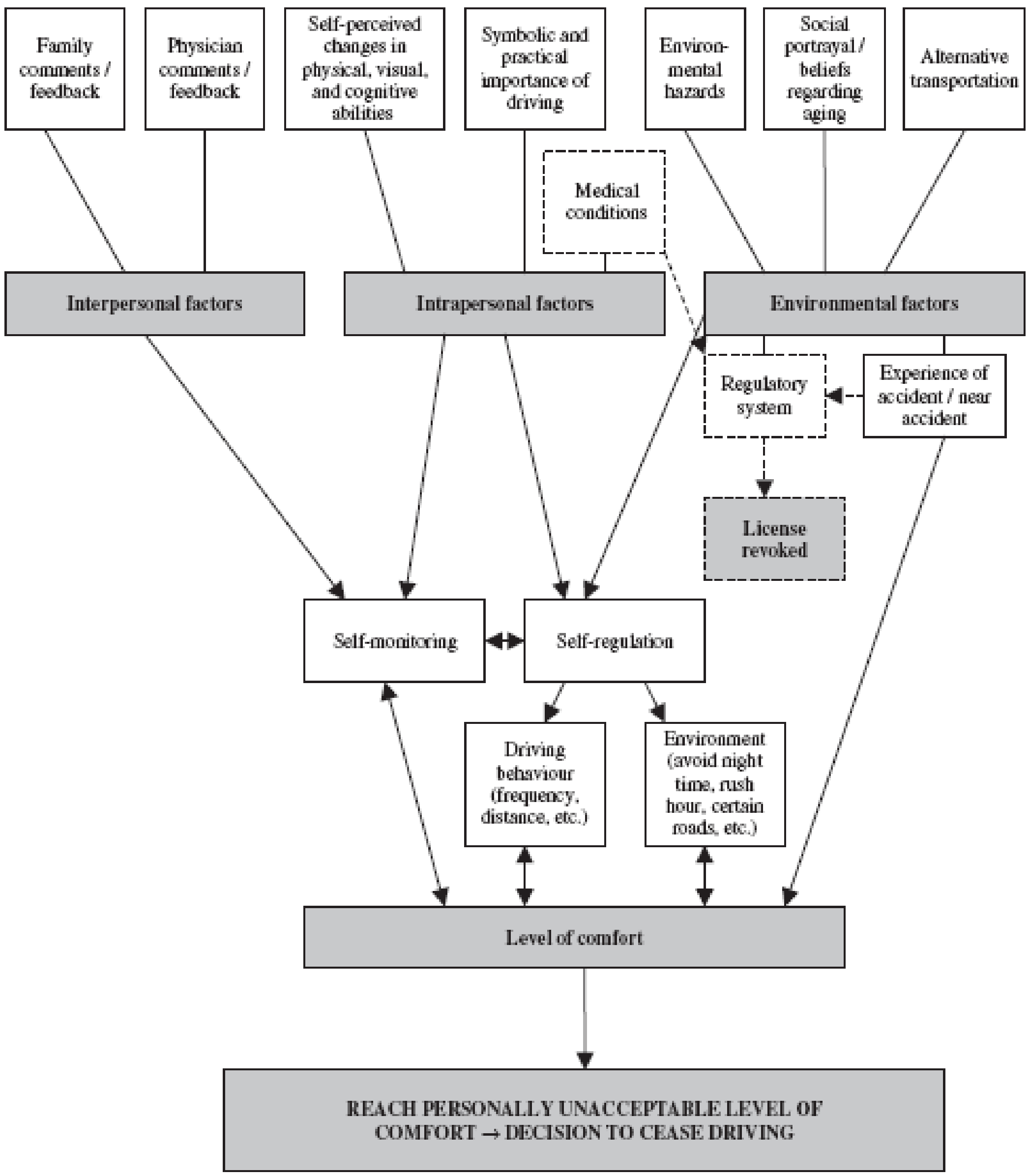

Figure 1.1 Model of the process of driving self-regulation with aging. Rudman et al., (2006). *Canadian Journal on Aging, 25*(1), 65-76. Reprinted with permission.

The importance of driver perceptions (central to Rudman et al.'s model) has been recognized by many other researchers (e.g., Dellinger et al., 2001; Dickerson et al., 2007; Eby et al., 2003; Hakamies-Blomqvist & Wahlström, 1998; Marottoli & Richardson, 1998). Our own work (Myers et al., 2008b; MacDonald et al., 2008) has empirically demonstrated the association between driver perceptions and self-reported driving frequency and avoidance of challenging situations. An important next step is to examine whether driver's perceptions are related to actual driving behaviour. Additionally, it is important to empirically examine how various inter, intrapersonal and environmental factors (depicted in Rudman et al.'s model) influence both driver perceptions and driving behaviour.

1.2 Overview

The current study was based on the premise that driver perceptions, as well as other personal as well as environmental factors, have a significant influence on driving behaviour. This study involved two main parts: (1) an examination of older driver perceptions in relation to actual driving behaviour (over one week); and (2) a comparison of sole (only driver in the household) versus couple (both of whom are drivers sharing one vehicle) older drivers with respect to perceptions and behaviour. This study also explored perceptions and behaviours within couples (e.g., correspondence between self- and partner-rated comfort levels) and compared actual and self-reported driving behaviour.

The next chapter presents a review of the relevant literature, while Chapter Three describes the study rationale and objectives and details the study methods. Chapter 4 presents the results, while Chapter 5 discusses the present findings relative to prior research and inherent limitations, as well as overall conclusions and directions for further research.

Chapter 2 – Literature Review

2.1 Introduction

Due to the increasing number of older drivers, their high crash rate per mile driven (Ryan, Legge & Rosman, 1998) and likelihood of associated injury and death (Massie, Green & Campbell, 1997), there has been an increased focus on driver safety (Hakamies-Blomqvist & Peters, 2000) and understanding the driving behaviour of this population (Dickerson et al., 2007). Historically, research regarding older driver safety has focused on identifying at-risk drivers and determining the appropriate time to give up driving through assessment and screening (Dickerson et al., 2007). There has also been a shift in focus from medical conditions to functional declines (associated with age, medical conditions and medications) that can affect driving (Dickerson et al., 2007).

Some researchers have attempted to identify problematic driving situations (e.g., Cobb, 1998; Stutts, 1998), others have looked at age-related changes in driving patterns such as situational avoidance (e.g., Benekohal, Michaels, Shim & Resende, 1994; Dellinger et al, 2001; Straight, 1997), while still others have investigated functional abilities that may be required for safe driving (e.g., Ball et al., 2006; Staplin, Gish & Wagner, 2003). Researchers also realize that it is important to investigate factors that influence the decision by older drivers to reduce or stop driving (Dickerson et al., 2007; Eby et al., 2003; Ragland et al., 2004; Rudman et al., 2006; Satariano, MacLeod, Cohn, & Ragland, 2004). Driver perceptions, particularly confidence, may be an important mediator between declining abilities, associated difficulties (such as night driving) and ensuing regulation (Myers et al., 2008b; Satariano et al., 2004; Rudman et al., 2006).

Building on our prior work (Myers et al., 2008b; MacDonald et al., 2008), as well as that of others (e.g., Marottoli & Richardson, 1998; Rudman et al., 2006), the primary purpose of the present study was to examine older drivers' perceptions in relation to actual driving behaviour. Additionally, we wanted to look at the effects of other factors (particularly inter- and intrapersonal factors, such as age, gender and household driving status), singly and in combination, on the perceptions and driving behaviour of older adults. In doing so, we hoped to further contribute to the knowledge base concerning the process of self-regulation as depicted in Rudman et al.'s model (presented in Chapter 1).

An extensive literature review was conducted to examine available evidence concerning driving behaviour and perceptions of older drivers. The search was conducted using the following electronic databases: Ageline (1978 – present), Applied Sciences Abstracts (1983-present), Medline (1960-present), Psych-info (1984-present), Health Sciences (1982 – present), Social Services Abstracts (1980-present), Sociological Abstracts (1963-present), Transportation Research Information Services (1996-present) and Urban Studies and Planning (1982 – present). Several key words were used singly and in combination for this search, including: "seniors", "older adults", "elderly", "driving", "drivers", "confidence", "mobility", "spouse", "passenger", "perceived", "ability", "functional", "avoidance", "behaviour", "patterns", "self-regulation", "life-space", "global positioning system", "travel diary", and "Geographical Information Systems". Government reports and reference lists from primary articles were also examined, while other articles were identified by colleagues.

The following review comprises three main sections: (1) driving behaviour; (2) driver perceptions; and (3) personal and environmental factors. The first section describes the trends in the travel patterns of older adults, components of driving behaviour and methods used to quantify these components. The second part looks at existing evidence pertaining to driver perceptions, including relationships with driving behaviour. Various measures that have been used to examine driver perceptions are compared and critiqued. The third part summarizes existing evidence concerning personal and environmental factors thought to be important in the process of self-regulation. The chapter concludes with a brief summary and implications.

2.2 Driving Behaviour

There is a declining trend in transit use and an increased reliance on the automobile among older adults in many countries, compared to past cohorts (Newbold, Scott, Spinney, Kanaroglou & Paéz, 2005; Rosenbloom, 2001; Straight, 1997). In the US, the majority (87%) of adults aged 60 to 64 years, 48% of those aged 80 to 84, and 22% of those 90 years and older use their cars as their main means of travel (Burkhardt, 1999). Just over one third of Canadians aged 80 years and older were driving a vehicle at least once a year in 1990 (Chipman, Payne & McDonough, 1998), whereas in 2005, 71% of Canadians aged 65 and older had access to and were able to drive a household vehicle (Turcotte, 2006). The driving behaviour of older adults involves multiple components, which are described below.

2.2.1 Components of Driving Behaviour

Driving behaviour may comprise: (1) exposure (i.e., amount of driving); (2) patterns, or "when" and "where"; and (3) habits (e.g., speed, common errors). Exposure is commonly reported as distance (km) driven per week (e.g., Huebner, Porter & Marshall, 2006; Johnson, 2003; Marshall et al., 2007) or year (e.g., Carr, Flood, Steger-May, Schechtman & Binder, 2006; Gallo, Rebok & Lesikar, 1999; Ozkan, Lajunen & Summala, 2006), frequency of trips per day (e.g., Collia, Sharp & Giesbrecht, 2003; O'Fallon & Sulllivan, 2003) or week (e.g., Gallo et al., 1999; Johnson, 2003) and length of trips, such as km per trip (e.g., Marshall et al., 2007). Furthermore, exposure is widely cited when discussing crash risk and driver safety (e.g., Bédard et al., 2001; Evans, 1991; Hakamies-Blomqvist & Wahlström, 1998; Margolis et al., 2002; Maycock, Lockwood & Lester, 1991) as well as self-regulation (e.g., Burns, 1999; Cox 1989; McGhee, 1983; Raitanen, Tormakangas, Mollenkopf & Marcellini, 2003). Some researchers (e.g., Hildebrand, Gordon & Hanson, 2004) define exposure in terms of encounters of risky situations (e.g., number of left hand turns); however, behaviour that considers situation (i.e., when, where) can also be classified in terms of "patterns".

Patterns of driving behaviour encompass trip destinations and route characteristics as well as the times of day and traffic situations in which older adults drive or do not drive. Driving patterns are most commonly discussed in the context of self-regulation, particularly the avoidance of challenging driving situations (e.g., Adler, Bauer, Rottunda & Kuskowski, 2005; Baldock et al., 2006; Marottoli et al., 2000).

Habits, meanwhile, are concerned with how people drive and are most often operationalized as "accident-causing behaviours", or errors (e.g., speeding, failure to yield the right of way, poor turning movements at intersections). Driving habits are often examined in studies investigating driving performance (e.g., Freund et al., 2005; Parker, MacDonald, Rabbitt, & Sutcliffe, 2000; Porter & Whitton, 2002; Ryan et al., 1998). The following section examines what is currently known about the various components of driving behaviour (i.e., exposure, patterns and habits) of older adults.

2.2.1.1 Exposure

Despite the importance of driving, older adults as a group drive less with increasing age (Burns, 1999; Davey & Nimmo, 2003). Older adults drive closer to home (Rosenbloom, 1999), travel shorter distances and fewer annual kilometers than their younger counterparts, with older women traveling shorter distances than older men (Benekohal et al., 1994; Collia et al., 2003; Rosenbloom, 1999). Trip distances are also considerably longer for rural elders, generally requiring more time per day for local travel and multiple activities within each trip (Glascow & Blakely, 2000).

As previously mentioned, measures of exposure have been widely used in crash risk analysis, particularly to show older drivers are overly involved in crashes on a per mile basis (e.g., Chipman et al., 1993; Massie et al., 1997; Ryan et al., 1998). This viewpoint, however, has been challenged by Janke (1991), arguing that, independent of age, drivers reporting fewer annual km have higher crash rates than those who drive more km per year. This "low mileage bias" (LMB) has been empirically examined by several researchers (e.g., Alvarez & Fierro, 2008; Hakamies-Blomqvist, Raitanen, & O'Neill, 2002; Langford, Methorst, Hakamies-Blomqvist, 2006), who have found that only those driving less than 3000 km annually had higher crash rates. Langford and colleagues (2006) speculated that this effect may be due to the fact that individuals with the most impairment are already restricting the amount they drive and consequently make up the low mileage group. Alternatively, they suggest that the crash rates may be due to differences in the location of driving across the mileage groups (i.e., high mileage drivers may be more likely to use freeways, while low mileage drivers may drive more on city roads with more potential conflict points). Additionally, reduced driving may increase risk due to lack of practice, which may contribute to a deterioration of skills (Chipman, 1982).

Staplin, Gish & Joyce (2008), however, question the research on the LMB, given the reliance on self-reported mileage and crash rates used in such analyses. Staplin and colleagues (2008) showed that the reliability of self-reported behaviour measures is questionable (e.g., low mileage drivers tended to underestimate km and high mileage drivers tend to overestimate km driven), which is discussed further in Section 2.2.2.3.

Distance can also be looked at in terms of radius, or the distance driven from home. As part of conditional licensing, jurisdictions in Canada and other countries (Marshall et al., 2002; Stutts, Stewart & van Heusen-Causey, 2000) often limit the radius a person is able to drive. The effectiveness of such restrictions has not been established (Marshall et al., 2002), and some senior advocacy groups are challenging the seemingly arbitrary limits, as well as highlighting potential consequences (e.g., isolation) (National Seniors, 2008).

Trip frequency also appears to decrease with age. In the US, it has been reported that up to 90% of individuals 75 years and older make only one trip away from the home on a given day compared to 80% of those aged 65 to 74 years and 75% of 50 to 64 year olds (Davey & Nimmo, 2003). Reduced trip frequency may be due to an absence or reduction in work-related mileage, an increasing proportion of older women drivers (who drive less) and/or awareness of declines in driving abilities (Bauer, Adler, Kuskowski & Rottunda, 2003; Mollenkopf et al., 2004; Rosenbloom, 1988).

Although still lower for older than younger drivers, the number of trips is increasing for all age groups in Canada (Scott et al., 2005). Compared with their counterparts in other countries (Rosenbloom, 2001), trip frequency by older Canadians is increasing fairly slowly (i.e., about 1% over six years). The increasing trip frequency of middle aged (45-54 years) and pre-seniors (55-64 years) (Scott et al., 2005) as well as women (Bauer, Rottunda & Adler, 2003), suggests that trip frequency will increase amongst future cohorts of older drivers.

It is unclear whether the number and type of activities per trip decreases or changes with age. Lerner-Frankiel, Vargas, Brown, Krusell and Schoneberger (1990) found that when shopping required stops at two or three stores, older adults were more likely to make two or three trips rather than one long excursion. In contrast, others (Burkhardt, 1999; Benekohal et al., 1994; Mollenkopft et al., 1997; Rosenbloom, 1999) report that older drivers reduce trip frequency by "trip-chaining" (or combining several activities into single trips). Some researchers have found that urban elders take fewer trips than their rural counterparts (Mollenkopf et al., 2004; Pucher & Renne, 2005), whereas others have found the converse (Hildebrand et al., 2004).

2.2.1.2 Patterns

In contrast to their younger counterparts, older adults tend to do most of their driving in daytime and the least amount at night (Burns, 1999; Collia et al., 2003; Hakamies-Blomqvist & Wahlström, 1998; Keall & Frith, 2006). Reduced night driving may be related to less demand for nighttime travel as well as deliberate avoidance (Hakamies-Blomqvist & Wahlström, 1998). Using national survey data, researchers have reported that over 60% of trips occur between 9 a.m. and 4 p.m., peaking in late morning (Collia et al., 2003) with few starting after 8:00 p.m. (Mollenkopf et al., 2004). Driving at these times allows older adults to avoid dense traffic and congestion (Burns, 1999; Keall & Frith, 2004; Rimmo & Hakamies-Blomqvist, 2002). Most trips take place on weekdays compared to weekends (Keall & Frith, 2004). Not surprisingly, seasonal and geographic differences have also been reported, with older drivers in northern regions driving less in the winter (Keall & Frith, 2004; Sabback & Mann, 2005).

Older drivers tend to do most of their driving on well-lit city roads in familiar areas (Keall & Frith, 2006). In addition to driving at night, in poor weather and rush hour, older adults also tend to avoid city centers, highways, turning across traffic (i.e., left turns) and unfamiliar routes or areas (Benekohal et al., 1994; Burns, 1999).

Reasons reported by older adults for driving (or trip purposes) vary in nature and importance (Hoenig et al., 2006). The most important reasons older adults drive (in descending order) tend to be social/recreational, shopping-related, followed by personal business or medical and to accompany someone else (Davey & Nimmo, 2003; Mollenkopf et al., 1997). Leisure activities tend to decrease with age to accommodate more essential activities of daily living (Siren, Hakamies-Blomqvist, & Lindeman, 2004).

2.2.1.3 Habits

Understanding the driving habits of older adults is key to understanding crash risk (McKenna, Stanier & Lewis, 1986; Ranney, 1994). Unlike their younger counterparts, older drivers tend to be disproportionately involved in motor vehicle crashes that occur at intersections (Hakamies-Blomqvist, 1993; Keskinen, Ota & Katila, 1998; Preusser, Williams, Ferguson, Ulmer & Weinstein, 1998), at lower speeds and involving two or more vehicles (Preusser et al., 1998). Violations involving older drivers are typically due to failure to obey signs, failure to yield right of way, improper turns (particularly left), illegal passing, drifting across the center line and lane changing (Goggin & Keller, 1996).

2.2.2 Quantifying Driving Behaviour

Driving behaviour has been quantified previously using self-reports or objective measures. Self-reports, by far the most common method, are described first, followed by actual driving behaviour as measured through more objective methods and available findings comparing self- versus actual measures.

2.2.2.1 Self-Reported Measures

The driving behaviour of older adults has been typically examined using self-reported data. Such data can be collected through single- (e.g., how many km did you drive over a certain period) or multi-item questionnaires (e.g., how often do you drive at night), as well as more in depth activity diaries or trip logs. The following sections reviews these methods.

2.2.2.1.1 Questionnaires

Self-report questionnaires are the most common method for measuring driver behaviour and have appeared in several formats including: paper and pencil (Kiernan, Cox, Kovatchev, Kiernan & Giuliano, 1999), telephone (Owsley et al., 1999; De Carlo, Scilley, Wells, Owlsey, 2003) and computer-based surveys (e.g., Wolf, Guensler, Washington & Frank, 2001). Researchers often develop their own questionnaires, whether single- (e.g., Retchin, Cox, Fox & Irwin, 1988) or multi-item (e.g., Ball et al., 1998; Kostyniuk & Shope, 2003; Jette & Branch, 1992; Dellinger et al., 2001; Marottoli et al., 1998; Marottoli et al., 2000; Parker et al., 2001; Ragland et al., 2004), to collect information on driving records and current driving practices. To be comprehensive, Johnson (2003) has suggested that questions should include driving frequency, number and length of trips, type of traffic patterns encountered, situations of perceived difficulty and history (i.e., past accidents and violations).

Only a few driving questionnaires or rating forms designed for older adults have reported evidence of reliability and/or validity. Some of these tools include: the Driver Behaviour Questionnaire, or DBQ (Parker et al., 2000); the Driving Habits Questionnaire, or DHQ (Owlsey et al., 1999); one used in a study (unnamed) by Anstey and Smith (2003); and the Situational Driving Frequency (SDF) and Avoidance (SDA) scales (Myers et al., 2008b).

The DBQ (Parker et al., 2000) consists of 24 items based on slips and lapses (errors of action), mistakes (errors of intention) and violations (deliberate infringements). Reliability testing with large samples (e.g., n = 1600, Parker et al., 2001) demonstrating high internal consistency and test-retest reliability over seven months. Scores on the DBQ have also been associated with crash rates.

The 34-item DHQ (Owlsey et al., 1999) gathers information on driving experiences in the previous three months (i.e., current driving status, driving exposure and avoidance, crashes and citations, dependence on others and driving space) and has established construct validity and test-retest reliability. The DHQ has since been used in several studies (e.g., Fisk, Owsley & Mennemeir, 2002; Huebner et al., 2006; Owlsey, Stalvey & Philips, 2003; Stalvey & Owsley, 2000). Baldock et al (2006) developed a questionnaire by combining questions from the DHQ and the barriers to driving self-restriction item from a questionnaire developed by Stalvey & Owlsey (2000) (with no psychometric support for the tool).

To compare self-reported driving behaviour to sensory function and driving confidence, Anstey and Smith (2003) developed a 5-item questionnaire addressing exposure, familiarity of places typically driven, night driving and confidence on a 5-point scale. The developers reported good internal consistency but no further evidence for reliability or validity. Two measures of self-reported driving restrictions, the SDF and SDA scales were recently developed to examine associations with perceptions and objective abilities (Myers et al., 2008b; MacDonald et al., 2008). These tools were used in the current study and therefore are discussed further in Chapter 3.

Like most questionnaires, these tools may be limited by problems of recall (e.g., forget trips), estimation (e.g., distance traveled) and interpretation of questions (e.g., crashes versus near-crashes). Of particular importance, single-item estimates of exposure (e.g., km driven) may be unreliable and difficult for older adults (Huebner et al., 2006; Paradis, 2006).

2.2.2.1.2 Activity Diaries

Activity or travel diaries typically collect trip data on a day-to-day basis over a designated period of time (e.g., weekly). For example, the 47-item "Driving Diary" (Hutcherson, 1989), developed as a self-monitoring tool for older drivers, captures information on time of day, places driven and difficulties experienced while driving over four, one-week periods. Other diaries collect information for 2-3 days per person but are completed by large numbers of people in order to profile travel behaviour over a week (e.g., Arentze, Borgers, Ponje, Starns & Timmermans, 2001; Mollenkopf, Marcellini & Ruoppila., 1998). Travel diaries can be self-completed using paper-and-pencil (e.g., Hutcherson, 1989), electronic personal digital assistants (Wolf et al., 2001), or via interview (Shumway-Cook et al., 2002).

Although less limited by recall problems, travel diaries can be burdensome and lead to significant subject dropout (Wolf et al., 2001). Subjects may become less compliant with increasing length of the study (Marshall et al., 2007). At the same time, longer periods of observation may be required as activity patterns are becoming increasingly varied (Lee-Gosselin, 2005).

2.2.2.2 Actual Behaviour Measures

Actual behaviour can be examined, alone or in combination, using video cameras (e.g., Keskinen et al., 1998), Global Positioning Systems (GPS) technology with (e.g., Hildebrand, 2003) or without (Huebner et al., 2006; Marshall et al., 2007; Porter & Whitton, 2002; Porter & Ash, 2008) Global Information Systems (GIS) information and data loggers that exploit vehicle On-board Diagnostic Systems (OBDII) (e.g., Huebner et al., 2006; Marshall et al., 2007; Porter & Ash, 2008; Porter et al., in press). For example, Keskinen and colleagues (1998) set up three video cameras at T-shaped junctions to identify driving habits (i.e., head movements, or attention) of older adults at intersections. The authors claim this protocol has been previously used with reliable results. While such (unobtrusive) observations may have been more likely to capture normal driving behaviour, it was difficult to determine sample characteristics. The authors divided subjects into three age groups (under 30, 30-60 and over 60) based on apparent age. Also, attention behaviour was estimated roughly (could not examine eye movements).

In another study, Fitten, Perryman and Wilkinson (1995) fitted a car with a computer to register input from video and audio equipment and installed other sensors to monitor braking, steering, speed, distance, elapsed time and crossing the center line of the road. Similar equipment has also been used to assess performance in a car-following task (driver follows a lead car) by continually measuring the speed of both vehicles and the distance that the subjects maintain between the two vehicles (Kortelling, 1990). No psychometric properties of the measures were reported in either study.

More advanced driver monitor systems include global positioning systems (GPS) receivers and/or video cameras (Porter & Whitton, 2002). GPS receivers measure position through the use of satellite signals (four satellite signals are required to obtain a 3D position) (Porter & Whitton, 2002) and in some cases velocity. In conjunction with time data, acceleration and deceleration can then be calculated. GPS units can often be quickly and easily set-up in any vehicle, do not require calibration or any additional data acquisition systems (i.e., Geographic Information Systems) and have a power supply supported by batteries or the vehicle lighter (Porter & Whitton, 2002). The addition of video cameras provides opportunities for assessing driving performance by simultaneously providing context to the driving situation (i.e., vehicle position relative to other objects and specific infractions). GPS data can also be coupled with mapping software, to determine driving location, distance and roadways traveled.

Although they do not have GPS capabilities, some data loggers (e.g., CarChip), exploit the On-Board Diagnostic (OBDII) systems of newer vehicles in order to measure driving exposure (Huebner et al., 2006). Information collected can include: date; time of day; duration; distance; and average, maximum, and velocity every 5 seconds for each trip. Such devices are easy to plug into vehicles, although the vehicle must be 1996 or newer to have the appropriate OBDII plug. Similar to GPS receivers, data loggers like the CarChip® constitute little subject burden (i.e., not intrusive and do not require odometer readings or diary entries).

2.2.2.3 Comparison of Self-reported and Actual Behaviour Measures

As discussed, self-reports of driving behaviour rely on the ability of people to accurately recall and report information. Unfortunately, people have been notoriously poor at providing accurate reports of travel patterns (i.e., number of trips, origin and destination addresses, duration, distance and time of day) (Stopher, 2004). Although transport planners have been aware of these inaccuracies for some time (Stopher, Fitzgerald & Xu, 2007), the recent availability of practicable GPS and on-board diagnostic devices has enabled investigations of actual levels of error associated with self-reported driving behaviour.

Although not limited to older drivers, Ogle (2005) examined the accuracy of household trips (trip number, duration and mileage) for a two-day period (as reported in a travel diary) by comparing simultaneous trip data measured by GPS. The researcher found that the total number of trips was underreported by 29%, travel duration by 10% and mileage by 22% relative to GPS data. When comparing only trips with corresponding GPS data, respondents overestimated travel duration and mileage by 15% and 2% respectively (Ogle, 2005). Staplin and colleagues (2008), analyzed data from the 2001 National Household Travel Survey

(NHTS), which contained self-reported mileage and corresponding odometer readings. When classified according to the Langford et al. (2006) mileage categories, they found that annual mileage, based on odometer readings, was underestimated for the lowest mileage group (< 3000 km), but slightly overestimated for the highest mileage group (>14000 km).

Other researchers have examined the correspondence between actual and reported driving behaviour specifically with older adults (Huebner et al., 2006; Marshall et al., 2007). Compared to data collected with CarChips, Huebner and colleagues (2006) found that older drivers both under and overestimated distances traveled over a one-week observation period, concluding that most subjects could not accurately indicate how far they had driven in the past week. In another study, a fellow graduate student (Paradis, 2006), also found that older adults had difficulty estimating annual km driven (i.e., 53/100 drivers did not attempt to estimate the number of km driven in the past year).

In contrast, Marshall and colleagues (2007) found that exposure (km/week) collected by a self-completed driving diary was highly correlated with CarChip data and moderately correlated with exposure determined by a GPS device (FleetPlus™). Not surprisingly, Marshall et al. (2007) found that subjects preferred the devices over completing the diaries.

2.3 Driver Perceptions

It is becoming increasingly apparent that perceptions may have an important influence on driving behaviour (Baldock et al., 2006; Freund et al., 2005; Hakamies-Blomqvist and Wahlström, 1998; Holland & Rabbitt, 1992; Marottoli & Richardson, 1998; Myers et al., 2008b; Parker et al., 2001; Ragland et al., 2004; Rudman et al., 2006; Stalvey & Owlsey, 2000). Critical to driver safety, it is important to identify discrepancies between perceived and actual abilities (Eby et al., 2003; Marottoli & Richardson, 1998). Drivers who lack awareness of, or deny functional declines may engage in situations which are overly challenging (i.e., exceed their capabilities), thereby putting themselves and others at risk (Marottoli & Richardson, 1998; Myers et al., 2008b). Confidence, in particular, may be a key mediator among declining abilities, related driving problems, and ensuing self-regulation (Myers et al., 2008b; Parker et al., 2001; Rudman et al., 2006; Satariano et al., 2004).

Conceptually, confidence, or self-efficacy is based on Bandura's Social Cognitive Theory (Bandura, 1977; Bandura, 1986). Self-efficacy, or the belief in one's capabilities to execute a specific action or set of actions in a given situation, is a stronger determinant of one's behaviour than one's skills or abilities (Bandura, 1977). People who lack confidence in a particular area (such as driving) will try and avoid challenging situations and are less likely to persist in the face of obstacles (Myers et al., 2008b). Self-efficacy is influenced (either positively or negatively) by four primary sources (Bandura, 1977). Using examples pertaining to driving, these are (1) mastery or performance accomplishments (e.g. presence or absence of accidents, near accidents or traffic violations); (2) vicarious experiences (e.g. peers who have had car accidents); (3) verbal persuasion (e.g., by peers, family, health professionals); and (4) physiological cues such as sweaty palms or gripping the steering wheel (Myers et al., 2008b).

Given the demonstrated importance of self-efficacy in other domains of functioning, such as the influence of balance confidence on self-imposed activity restriction (Jorstad, Hauer, Becker & Lamb, 2005), it is not surprising that older drivers' self-perceptions, including their driving confidence, appear to influence their driving behaviour. For example, Myers et al. (2008b) found that driving confidence (operationalized as comfort level) was related to self-reported driving frequency and avoidance, which was further supported by MacDonald et al. (2008) through both prospective and cross-sectional examinations. Marottoli and Richardson

(1998) and Parker et al. (2001) found that driving confidence was related to self-reported mileage. Others have also found associations with reported avoidance (e.g., Baldock et al., 2006; George, Clark & Crotty, 2007).

MacDonald and colleagues (2008) also found that perceptions had more influence on self-reported behaviour compared to actual abilities. Drivers with inflated perceptions of their abilities, together with high confidence, may be less likely to regulate their driving (MacDonald et al., 2008; Marottoli & Richardson, 1998). Some researchers are now including measures of driver perceptions when examining the effectiveness of targeted interventions (e.g., Nasvadi & Vavrik, 2007; Peduzzi et al., 2007). The relationship between driver perceptions and actual driving behaviour, however, requires further examination.

2.3.1 Measures

Driver perceptions have been measured in a variety of ways. Some researchers have attempted to quantify driving stress, nervousness and/or confidence (Baldock et al., 2006; George et al., 2007; Hakamies-Blomqvist & Wahlström, 1998; Marottoli & Richardson, 1998; Parker, MacDonald, Sutcliffe & Rabbitt, 2001), while others have assessed perceived driving abilities (Freund et al., 2005; MacDonald et al., 2008; Marottoli & Richardson, 1998; Parker et al., 2000; Ragland et al., 2004; Ruechel and Mann, 2005; Satariano et al., 2004) or driving difficulties (DeRaedt & Ponjaret-Kristofferson, 2000).

Only four studies have quantified driving confidence using multi-item measures (Baldock et al., 2006; George et al., 2007; Marottoli & Richardson, 1998; Myers et al., 2008b). As described in Myers et al. (2008b), three of the multi-item measures of confidence (the Driving Confidence Rating Scale by Marottoli and Richardson, 1998; the Driver Mobility Questionnaire by Baldock et al., 2006; and the Adelaide Driving Self-Efficacy Scale by

George et al., 2007) were developed ‘deductively’. That is, items were generated from the literature and the researchers themselves without the input of older drivers. Moreover, these tools have little or no psychometric evidence (Myers et al., 2008b).

In contrast, the Day and Night Driving Comfort Scales (DCSs) were systematically developed ‘inductively’ with older drivers themselves (Myers et al., 2008b). Older drivers felt that “comfort level” best captured this phenomenon (both confidence in their own abilities, as well as the ability to deal with situations created by other drivers on the road). This conceptualization was independently supported by Rudman et al.’s (2006) study. Current and former drivers considered personal comfort level as a key factor in regulating their driving, as depicted in the ensuing model shown in Chapter One. In the Myers et al (2008b) study, older drivers were adamant that most driving situations were more challenging at night than in the day. As a result, two comfort scales were created, one for daytime and one for driving at night. Prior tools have included only one item on night driving.

The DCSs have undergone rigorous psychometric testing and have demonstrated good structural properties (via Rasch analysis), test-retest reliability and discriminative properties (Myers et al., 2008b). Mean DCS scores were found to be related to self-reported driving frequency and lower situational avoidance (MacDonald et al., 2008; Myers et al., 2008b) and predictive of self-imposed restrictions and cessation over 5 to 17 months (MacDonald et al., 2008). Comfort scores were also more strongly related to perceived driving abilities than actual abilities based on functional measures predictive of crash risk (MacDonald et al., 2008).

Perceived abilities have also been measured in a variety of ways, including single item- (e.g., “How do you think your driving ability compares to other drivers your age?”, Peduzzi et al., 2007) and multi-item measures concerning different aspects of ability (e.g., Holland &

Rabbitt, 1992; Parker et al., 2001; Ruechel & Mann, 2005). Some tools ask respondents to rate themselves from very poor to very good (e.g., Parker et al., 2001), while others ask them to compare themselves to drivers their own age (Freund et al., 2005; Marottoli & Richardson, 1998). Unfortunately, few researchers have reported any psychometric properties for their measures.

The Perceived Driving Abilities (PDA) scales, on the other hand, were developed by MacDonald et al (2008) to examine associations with perceived comfort (DCS) scores, objective driving-related abilities (functional performance tasks) and self-reported driving patterns. The PDA scales, which were developed with feedback from older drivers, have demonstrated evidence of internal consistency, good structural properties via Rasch analysis (MacDonald et al., 2008) and moderate test-retest reliability (separate, unpublished study).

In addition to driving frequency and avoidance, driver perception ratings have been related to km driven (e.g., Marottoli and Richardson, 1998; Parker et al., 2001), as well as exposure to certain driving situations (e.g., Anstey & Smith, 2003). Findings are mixed, however, concerning the association with driving performance as indicated by driving history (Marottoli & Richardson, 1998; Parker et al., 2001), functional driving-related abilities (MacDonald et al., 2008), on-road assessments (Baldock et al., 2006; Freund et al., 2005; Marottoli & Richardson, 1998) or scores on a driving simulator (e.g., Rogé et al., 2008).

2.4 Personal and Environmental Factors

As discussed in Chapter 1, Rudman and colleagues (2006) developed a model of self-regulation (refer back to Figure 1.1), highlighting the importance of personal (both inter and intra) and environmental factors, as well as level of comfort on decisions to keep driving. While many researchers have examined gender, age, location of residence and marital status in relation to driving frequency, avoidance and license retention, these variables are usually examined in isolation. Findings are summarized below.

Older men and those who are married are more likely to be licensed to drive (Burkhardt & McGavock, 1999; Turcotte et al., 2006), drive more km (Benekohal et al., 2004) and be the driver when traveling with their spouse (Burkhardt & McGavock, 1999; Golob & Hensher, 2007). Female drivers are more likely to be passengers (Kostyniuk & Shope, 2003), tend to avoid more challenging situations and stop driving earlier compared to men (Benekohal et al., 2008; Burkhardt & McGavock, 1999; Okonkwo, Wadley, Roenker, Crowe & Ball, 2007). Burkhardt and McGavock (1999), however, note that gender differences may be due to a cohort effect.

Studies examining gender differences in driving perceptions (e.g., confidence and perceived abilities) have yielded mixed results (George et al., 2007; MacDonald et al., 2008; Marottoli & Richardson, 1998; Myers et al., 2008b; Windsor, Anstey & Walker, 2007). Some studies have found that men report higher levels of driving confidence and/or perceived abilities (e.g., George et al., 2007; Myers et al., 2008b; Windsor et al., 2007), while others have not found any significant gender differences (e.g., MacDonald et al., 2008; Marottoli & Richardson, 1998).

As noted previously, older drivers tend to drive less and self-restricted more (e.g., avoid night driving) as they age (Persson, 1993). Furthermore, drivers living in rural areas tend to drive more km than those living in urban areas (Burkhardt et al., 1999; Glascow & Blakely, 2000). Few studies have looked at differences in driver perceptions by age (e.g., MacDonald et al., 2008; Myers et al., 2008b), while none have looked at differences in urban versus rural living drivers. Also, although marital status is often considered important, no one has looked at differences in perceptions between sole and couple drivers.

Rudman et al (2006) highlighted the importance of social factors, such as feedback from others, in driving behaviour. This is consistent with Bandura's Theory (1977), which postulates that the influence of others, particularly through verbal persuasion, can affect behaviour. Most of the research examining the influence of others has focused on passengers and co-pilots. For example, in their study investigating co-pilots and navigation technology, Vrkljan and Polgar (2007) assessed nervousness of passengers when they were traveling with their spouse (n=22 couples). However, they did not assess the influence of the passengers comfort level in relation to the driver's comfort level.

Older drivers may behave differently in the presence or absence of spectators (Baxter et al., 1990; Hing, Stamatiadis & Aultman-Hall, 2003; Vrkljan & Polgar, 2007), but generally appear to benefit from the presence of "co-pilots" (Bédard, Molloy & Luel, 1998; Bédard & Meyers, 2004; Chen, Baker, Braver & Li, 2000; Vollrath, Meilinger & Kruger, 2002). However, the protective effect of co-pilots may be situation specific (Bédard & Meyers, 2004). While the presence of passengers was associated with a reduced risk in some aberrant behaviour (e.g., speeding, driving the wrong way) in drivers aged 65 to 79, Bédard and Meyers (2004) found a higher risk of other unsafe actions, including turning, lane changing and failure to obey signs, warnings and the right of way.

2.5 Summary and Implications

Although older adults tend to reduce the amount they drive and avoid more challenging situations (e.g., driving at night, in bad weather, in heavy traffic, or on highways), crash statistics indicate that not all older drivers appropriately or effectively regulate their driving behaviour. There is evidence that driving comfort and perceived abilities play an important role in the driving behaviour in older drivers. Perceptions have been related to self-reported behaviour (e.g., km, avoidance, frequency) (Myers et al., 2008b; MacDonald et al., 2008) and performance (functional abilities and on-road) (e.g., Marottoli & Richardson, 1998), but have not yet been examined in relation to actual behaviour. Inclusion of objective measures is necessary to further our understanding of self-regulation by older drivers and how factors such as driver perceptions may affect their driving behaviour.

Chapter 3 Methods

This chapter begins by outlining the study objectives and a priori expectations. Ethics approval and consent, selection criteria and sample recruitment are presented next. Procedures, including pilot-testing, are then outlined, followed by instruments. The final section of this chapter provides details on data handling and analyses.

3.1 Study Objectives and Expectations

As argued in the previous chapter, driver perceptions, particularly confidence, may be a more important determinant of behaviour than one's actual driving abilities. While there is evidence to support these associations, prior studies have relied on self-reports of driving behaviour. Thus, the overarching goal of the present study was to extend this research by examining driver perceptions in relation to measures of actual driving behaviour. Additionally, we wanted to compare the influence of driver perceptions relative to other factors such as gender, age, household driving status (i.e., whether one is the sole driver versus part of a driving couple) and location of residence (urban versus rural). The primary and secondary objectives of this study are outlined below, followed by a priori expectations associated with each objective.

Primary Objectives

1) To examine driver perceptions in relation to actual driving behaviour
2) To compare sole versus couple older drivers with respect to perceptions and behaviour

Secondary Objectives

3) To examine correspondence between self- and partner-rated comfort levels (couples)
4) To compare actual and self-reported driving behaviour

A Priori Expectations

1) Driver Perceptions and Actual Driving Behaviour

Findings from previous studies, both cross-sectional and prospective, have shown that DCS scores (particularly DCS-N and DCS-N item#1) were significantly related to self-ratings of situational driving frequency and avoidance (MacDonald et al., 2008; Myers et al., 2008b), with lower comfort levels associated with lower frequency and higher avoidance scores. Cross-sectionally, similar results were seen between perceived abilities and situational ratings of frequency and avoidance. Based on these prior studies, it was expected that driving comfort scores (particularly DCS-N and DCS-N item#1) would be positively related to various indicators of driving exposure (i.e., number of trips, total distance driven over the week, radius or distance from home), as well as engagement in more challenging driving situations (e.g., night driving, highway driving and left turns). That is, higher levels of driving comfort would correspond to greater exposure and engagement in situations that are often avoided by older drivers. Similar relationships were expected with perceived driving abilities.

2) Sole versus Couple Older Driver Perceptions and Behaviour

As described in Chapter Two, older men tend to drive more often than women. While traditional sex roles are known to influence driving patterns in this cohort, gender differences may be more pronounced in married couples (for instance husbands tend to do the driving and wives tend to be the passengers). Based on the literature, we expected that in general men would drive more often (and perhaps greater distances and in more challenging situations) than women and that sole drivers would drive more than couple drivers (i.e., may have no one else to drive them). However, we wanted to explore whether factors such as location of residence (urban versus rural), age and household status (i.e., whether one is the sole driver versus part of a driving couple) may be more important determinants of driving behaviour than gender per se.

With respect to perceptions (of comfort levels and perceived abilities), available findings on gender differences are mixed (i.e., men have been found to have higher comfort or confidence scores in some studies, but not all). Perceptions in sole versus couple older drivers by gender have yet to be explored.

3) Self- versus Partner-rated Comfort Levels and Driving Behaviour

Bandura's Social Cognitive Theory (1977) postulates that performance accomplishments (or failures) have the greatest impact on self-efficacy (confidence) and ensuing behaviour; however, the influence of others (through verbal persuasion and actions) is also important.

Interpersonal factors are included in many theoretical frameworks concerning driver decision-making or self-regulation (e.g., Rudman et al., 2006), however, there is little empirical evidence in this regard. The study by Vrkljan and Polgar (2007) reviewed in Chapter Two supports the notion that couples do influence one another as driver and passenger. While partners generally felt positive toward their driving partner, level of anxiety (as a passenger) increased when traveling with their driving partner on highways, at night and through unfamiliar areas. Although Vrkljan and Polgar (2007) assessed driver confidence in various situations, they did not assess the partner's confidence in the driver. Unfortunately, gender differences were not reported.

The current study presented the opportunity to examine self- versus partner ratings of driving confidence (operationalized as comfort level using the DCSs). Given traditional roles in the present cohort of older drivers, we may expect older men to feel more comfortable when they are driving than when their female partner is driving. However, circumstances (particularly partner illness) may have an important influence on couples' perceptions and behaviour (i.e., who does the driving when couples take trips together).

4) Actual versus Self-reported Driving Behaviour

Based on findings presented by Huebner et al. (2006), it was expected that discrepancies (both over- and under-estimation) would emerge between self-reported and actual driving behaviour, particularly in regards to distance driven (km). The magnitude of the difference would likely be different for the various indicators of behaviour (e.g., self-reported number of days driven in the week would likely be more accurate than the number of km driven). Finally, the present study provided the opportunity to compare results from the various sources of driving data (vehicle devices, trip logs and activity diaries), thereby adding to this area of research.

3.2 Ethics and Consent

Prior to recruitment, ethics approval was obtained from the Office of Research Ethics at the University of Waterloo. Informed consent was obtained from all subjects prior to data collection. In the second visit, participants also provided consent for audio taping of the interview and, if interested, permission for further contact. The letter of study information and consent forms are shown in Appendix A. To ensure confidentiality, data was uniquely coded, stored in a secure location and accessed only by the researcher.

3.3 Selection Criteria

Two sets of inclusion criteria were used to determine study eligibility, based on driver characteristics and vehicle specifications, respectively. A flowchart which illustrates the steps in participant recruitment and screening is shown in Figure 3.1.

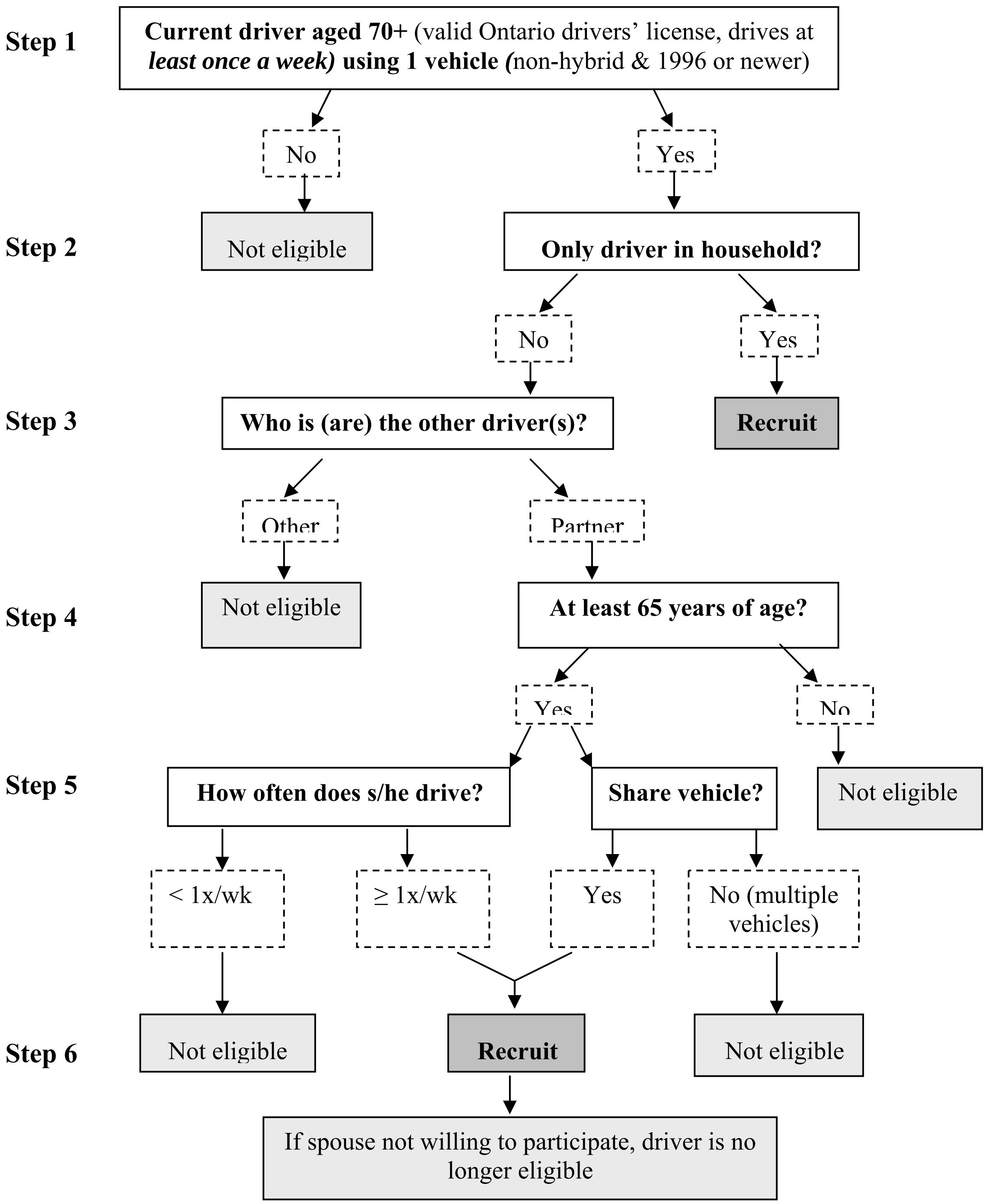

Figure 3.1 Recruitment and Screening Flowchart

Sample Inclusion Criteria:

1. Each study participant had to be a current driver (defined as holding a valid Ontario driver's license and driving at least once a week).
2. Participants were classified as either "sole" drivers (defined as the only driver in the household) or as driving "couples" (defined as partners/spouses living in the same household, sharing one vehicle). Sole drivers had to be at least 70 years of age. For couples, one partner had to be aged 70 or over, while the other had to be at least 65 years of age. It was anticipated that requiring both partners to be over the age of 70 would have significantly restricted the recruitment of older driving couples.

Vehicle Inclusion Criteria:

1. Each driver (sole or couple) was required to routinely operate only one vehicle, which had an interface unit (i.e., 1996 or newer) and was not a hybrid (as CarChips do not function with older and/or hybrid models).

3.4 Recruitment

The target sample size was 15 driving couples and 30 sole drivers, for a total of 60 individual participants. Subjects were recruited in person at senior's centres, condominiums, and Group Education Sessions (GESs) at the Ministry of Transportation's (MTO) Waterloo location. Specifically, Activity Directors (or equivalent) at recreation/seniors' centres were approached to obtain permission to recruit and advice about the best times to do so (i.e., largest and most appropriate audience). Resident Managers of condominiums were approached and approval obtained as needed to promote the study through coffee clubs or other gatherings.

Permission to recruit at scheduled GESs in Waterloo was obtained through MTO contacts. The sessions are part of the mandatory license renewal process for drivers aged 80+

years and comprise up to 15 drivers. At the end of each GES and before the written exam was started, the Driving Improvement Counselor (session facilitator) introduced the researcher, who then explained the study. Interested individuals then approached the researcher at the end of the session for more information and to sign up for the study.

Other recruitment strategies were also considered at the outset, such as the Waterloo Research in Aging Participant Pool. Fortunately, the target sample size was achieved without having to access this pool or approach participants from our previous studies.

3.5 Procedures

Before beginning the study, the materials and protocol were pilot-tested with a small sample of older drivers (who did not take part in the actual study). The pilot-testing and resulting study protocol are described below, followed by the instruments and data analyses.

3.5.1 Pilot-testing

A small convenience sample of six couples from our previous studies was approached to pilot the new tools and study protocol; three couples (six people) agreed to participate. Initially, the volunteers were met by the researcher either at their home or at a recreation centre to complete and provide feedback on a background/driving habits questionnaire and the partner DCSs. Volunteers then agreed to complete the draft trip logs and activity diaries for seven days. After seven days, the researcher contacted the volunteers by phone to obtain feedback. The electronic devices (CarChip and Otto) were not installed given that prior studies have shown that the devices were acceptable to use with older drivers (Huebner et al., 2006; Marshall et al., 2007; Porter & Ash, 2008).

In soliciting feedback, particular attention was paid to the ease of completing the trip logs, activity diaries and partner DCS ratings. Based on participant feedback, changes were made to improve the clarity, instructions and layout of the trip logs and activity diaries. Pilot-testing also influenced the study protocol (e.g., the decision to administer the perception scales and rating tools at the second visit so as to not influence driving behaviour over the week).

3.5.2 Protocol

Data collection took place from June, 2008 to October, 2008. Potential participants were given the opportunity to enroll in the study in-person, immediately after a recruitment session, or later by contacting the researcher by phone or e-mail. At the time of enrollment, the researcher confirmed that both the individual and their vehicle(s) met the study inclusion criteria, as outlined in Section 3.3 (see Appendix B for "recruitment" script).

After determining eligibility, the researcher arranged to meet with individuals at their home (or other location of their choosing). At the first visit (see Figure 3.2), the researcher went over the study, obtained consent and had participants complete the background questionnaire and a measure of mobility confidence[1]. Subsequently, the researcher explained and distributed the trip logs (which were left in each vehicle) and activity diaries and then equipped each vehicle with one set of electronic data loggers (a CarChip and Otto). Subjects were asked to drive as they usually would on a day-to-day basis over the subsequent week.

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[1] The ABC Scale was administered for future research use. As it is not germane to the current study objectives, neither the tool itself nor the results will be discussed further.

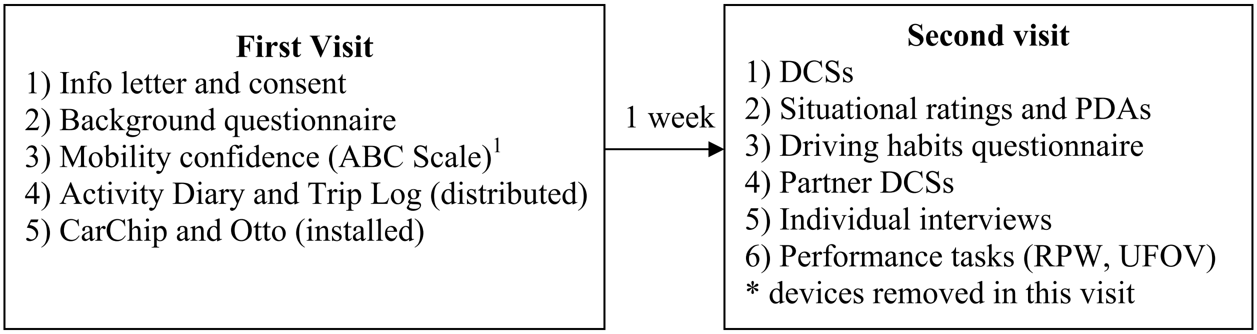

Figure 3.2 Order of Tool Administration

Similar to other studies (e.g., Marshall et al., 2007), data was collected for a one-week period to capture a sample of both weekday and weekend driving behaviour. After one week, the researcher returned to the participants' homes (or location of their choice) to pick up the devices, trip logs and activity diaries. In the same visit, subjects were asked to complete in order: the DCSs, the set of driving rating forms (situation driving frequency and avoidance and perceived abilities or PDA scales: current and compared to 10 years ago), a driving habits questionnaire as well as the partner DCSs (couples only). All of these forms were completed at the end of the study week to avoid influencing driving behaviour.

While individuals completed the questionnaires, the researcher reviewed their activity diaries and trip logs. A brief individual interview (script shown in Appendix C) was then conducted to discuss their driving and activities over the previous week (e.g., typical or not). Couples were also asked about car travel preferences (i.e., prefer to be the driver or passenger) and partner ratings. Lastly, participants had the opportunity to do two performance tasks; the Rapid-paced Walk (RPW) and the Useful Field of View (UFOV) Subtest 2. If agreeable, the RPW test was performed first. The in-vehicle devices were retrieved at either the beginning or end of the second visit.

3.6 Instruments

The tools used in the study, listed in Figure 3.2, are described below. Unless otherwise noted, participants completed these tools themselves.

3.6.1 Background and Driving Habits Questionnaires

The short background questionnaire (Appendix D) was modified from our prior studies. Part A requested basic demographic information (such as age, gender, education), while Part B asked about health and mobility. The driving habits questionnaire (also shown in Appendix D), was also adapted from prior studies (e.g., Baldock et al., 2006; Owsley et al., 1999) and consisted of 26 questions on driving history, typical behaviours, preferences, intentions (to restrict or stop driving) and challenges (or barriers) to restricting one's driving.

3.6.2 Perceived Comfort and Abilities Scales

The Day and Night Driving Comfort Scales (DCS-D and DCS-N), shown in Appendix E, were used to assess one's level of driving comfort. A description of how these measures were developed was provided earlier in Chapter Two.

The final 13-item Daytime (DCS-D) and 16-item Nighttime (DCS-N) scales, with a 5-point response scale, have high internal consistency (.92 and .97, respectively) and hierarchiality and unidimenitionality with good person (.89 and .96) and item (.98 and .97) reliabilities, respectively. Test-retest reliability over 7 to 16 days was good for both scales ($ICC_{2,1}$ = .86 and .91). Mean DCS-N scores were significantly lower than DCS-D scores (Myers et al., 2008b).

In the present study we also wanted to explore couples' ratings (i.e., the partner's comfort level in the other person's driving behaviour). For this purpose the DCS instructions were modified (Appendix E); however items and response options were unchanged. Although psychometric evidence (e.g., test-retest reliability) has not been established for this modified application, pilot-testing indicated that couples were willing to try the ratings.

Perceived driving abilities were assessed using two multi-item scales designed to assess perceptions currently (PDA) and compared to 10 years ago (PDA Change). These measures, shown in Appendix F were developed and used in our previous studies (MacDonald et al., 2008) to examine associations with perceived comfort (DCS scores), objective driving-related abilities (functional performance tasks) and self-reported driving patterns.

MacDonald et al. (2008) reported acceptable internal consistency for both current PDA (alpha .94) and PDA Change Scales (alpha .87). Rasch analysis (used to examine structural properties), showed that the 15-item PDA and PDA Change scales were unidimensional and hierarchic, with good person (.92, .82) and item reliabilities (.96, .90), respectively. In a separate sample of 39 older drivers (unpublished), when administered twice (over one to two weeks), the PDA scales had moderate test-retest reliability (ICC .65 and .66).

3.6.3 Ratings of Self-regulatory Behaviour

Two instruments were used to assess self-reported driving restrictions; situational driving frequency (SDF) and avoidance (SDA), respectively. These tools were developed to examine associations with perceptions and objective abilities (Myers et al., 2008b; MacDonald et al., 2008). The most recent versions (MacDonald et al., 2008), shown in Appendix G, were employed here. Both the SDF and SDA scales have shown high internal consistency (α =.92 and .87, respectively) and good 7-14 day test-retest reliability (ICC=.89 and .86, respectively).

3.6.4 Measures of Actual Driving

3.6.4.1 CarChip E/X®

CarChips E/X (Davis Instruments, Hayward, CA) were used to record trip information, including: date, time of day, duration, distance, points of origin and destination and speed (average, maximum and every 5 seconds) of each trip. A CarChip, shown in Figure 3.3, is a small device that easily plugs into the on-board diagnostic system (OBDII) of vehicles 1996 or newer to capture up to 300 hours of trip variables.

Figure 3.3 CarChip device and installation

Data are collected in trip segments, beginning when the vehicle is started and ending when turned off. Once 300 hours of variables have been logged, the device resets and begins recording over the information initially collected. After the monitoring period is completed, the CarChip is removed from the vehicle, information is downloaded to a computer and trip reports are generated. CarChips are easily installed (i.e., under the steering wheel) and constitute minimal subject burden (i.e., the device is not intrusive, nor do subjects have to record odometer readings). However, to be compatible with the CarChip, vehicles must be 1996 or newer (i.e., have an appropriate OBDII system). Also, the CarChip does not work in a hybrid vehicle when it switches between gas and electric power sources (Huebner et al., 2006).

With a sample of 19 older drivers aged 60 to 89, distances (in meters) measured by the CarChip on a road course showed minimal error (i.e., 300 meters over about 26 km) and were not significantly different from the distances recorded by a GPS on the same course (Huebner et al., 2006). Also, average and maximum velocities recorded by the CarChip were similar to the GPS recordings. The maximum velocities according to the CarChip, however, were significantly albeit slightly lower than the GPS measures. The difference was likely due to the higher sampling rate of the GPS (Huebner et al., 2006).

3.6.4.2 Otto Driving Companion

The Otto Driving Mate (Otto) is a portable device developed to reinforce good driving behaviour and reduce driving fines, primarily through alerts (i.e., voice prompts and indicator lights). The device (Figure 3.4) is relatively small (12.8cm x 7.0 cm x 3.2 cm), lightweight (320g without batteries) and is mounted on the vehicle's dash.

Figure 3.4 Otto device alone and mounted on dash

Otto uses GPS technology to calculate the speed, acceleration, deceleration and vehicle location, as well as the date, time of day, duration and distance of each trip. The GPS data, paired with digital maps (e.g., in Google Earth) also permits the exploration of roadways driven, turns made (e.g., left at intersections) and areas accessed (i.e., city versus rural).

Otto can generate alerts to hazardous driving situations (e.g., speeding, unsafe intersections, school zones, playgrounds, deer crossings and pedestrian corridors) by matching the GPS coordinates to electronic maps coded with speed limits and information about the built environment (depending on the coverage area). These alerts can be turned off (although the setting is lost once the device is unplugged). Devices come pre-loaded with available maps, but updates and new maps must be uploaded to the device from the Otto website. It is important to note that maps are not necessary for the device to record trip information; only for generating alerts (i.e., compares speeds of drivers to roadway speed limits). Prior to the study, maps of K-W were not available. The researcher worked with the developer to generate and audit such maps; however, these were not available until ten weeks into the study (end of August, 2007).

Because the devices used in the study did not have the maps of the coverage areas loaded, auditory alerts to hazardous situations were not available. Two ‘start-up’ alerts, “logging enabled” and “Outside coverage area”, were heard every time an Otto device was plugged into a vehicle (and when off for more than 10 hours). The default device configuration also provided one speed limit warning that triggers the "speed limit exceeded" alert when the default value (set at 110 km/hr) outside the coverage area was exceeded.

As no sounds were emitted when the researcher tested the devices in her own vehicle, she assumed that the auditory alerts were turned off when in fact they were not. The volume setting is not saved and the device must be muted each time it is plugged in. Participants were present during installation and therefore heard these start-up alerts. They were told that the device was just turning itself on and if they happened to hear these sounds at any other time during the week, they should not worry and need not do anything.

The Otto and CarChip can quantify similar trip information; however, since the CarChip does not have GPS capabilities, it cannot determine vehicle position (i.e., geographical coordinates). A pilot study (Porter & Ash, 2008) found that the distance recorded by the CarChips was always higher (personal communication, Dr. Porter, Fall, 2006). The GPS component of Otto takes time to lock into satellites and thus may miss or underestimate short trips as well as blend trips with short intervals.

3.6.4.3 Trip Logs

Trip logs were used to supplement the information collected by the CarChip and Otto. For each trip, the driver was asked to record who drove (each way), number and relation of passengers, number of stops and note general weather conditions. Shown in Appendix H, the logs were pre-formatted and left in the equipped vehicle with a pen, secured on a clipboard. Weather archives, accessed from Environment Canada (www.weatheroffice.ec.gc.ca), were consulted to fill in logs with missing weather conditions.

3.6.4.4 Activity Diaries

Activity diaries were used to examine trip purposes and modes of travel more generally (i.e., by car as driver or passenger, walking or public transport). Participants were given seven, 24-hour sheets (one for each day of the monitoring period), with instructions (Appendix I). They were asked to fill these out at the end of each day, or throughout the day if preferred.

Based on feedback from our pilot sample and committee advice (Dr. Andrey), every attempt was made to simplify the task by asking people to indicate only out-of-home activities. For each outing, they were asked to record the time they left and returned to their home, where they went (e.g., place and general location), mode(s) of travel and estimated travel time.

3.6.5 Objective Driving-related Abilities Tasks

At the end of the second visit, participants were asked if they were willing to do the two driving ability tasks (either at their home or location of their choosing). A measure of lower body mobility, the Rapid Paced Walk (RPW) test assesses the time required to walk 10 feet, turn around and return to the start point (Marottoli et al., 1994). The distance was marked off and participants were instructed to walk as fast but as safely and comfortably as possible. They were also allowed to use a walker or cane if normally used. The RPW requires minimal time for administration and has been found to be a significant predictor of at-fault crash involvement (Marottoli et al., 1994; Staplin et al., 2003). Similar to MacDonald et al. (2008), the present study used an established impairment cut-off (i.e., > 9 seconds).

The Useful Field of View (UFOV), Subtest 2, is a measure of cognitive processing speed, incorporating stimulus identification and divided attention (Ball et al., 2006). The duration of the display is varied (between 16.67 and 500ms) using a double-staircase method. Scores are expressed as the duration (ms) at which participants could correctly perform each subtest 75% of the time. While the UFOV has three subtests, Subtest 2 is the best predictor of crash involvement (Edwards et al., 2005; Owsley et al., 1998). Overall, the test has compelling support for use in predicting driving performance (Myers et al., 2000; Ball et al., 2006). A recent meta-analysis (Clay et al., 2005) reported that the UFOV is a valid, reliable index of driving performance. The established cut-off of 353 ms was used to denote impairment.

3.7 Data Handling and Analyses

The current project comprised multiple sources of data, including: (1) the background and driving habits questionnaires; (2) scales to assess perceptions of driving comfort (DCSs), and driving abilities (PDA); (3) ratings of situational driving frequency and avoidance; (4) one-week monitoring of driving behaviour (via CarChips, Otto), as well as trip logs and activity diaries; (5) two performance measures (RPW and UFOV); and (6) follow-up interviews. The administration of these tools (i.e., first or second visit) was outlined in Figure 3.2.

Data handling and analyses for each group of measures (other than the abilities tasks above) is presented below. All quantitative data was analyzed using the Statistical Package for the Social Sciences (SPSS), version 14.0. Qualitative data (from the semi-structured interviews, activity diaries and the background and driving habits questionnaires) were subjected to content analysis. Responses were categorized and then entered into the SPSS database for analysis.

In order to determine the appropriate analyses (i.e., parametric or non-parametric), all variables were assessed for normality (Pett, 1997), both visually (normal probability plots, stem and leaf plots) and statistically (Fisher skewness and kurtosis statistics, Kolmogrov-Smirnov and Shapiro-Wilks tests). Normally distributed variables should have Fisher skewness and kurtosis values within ± 1.96 the standard error of skewness and kurtosis, respectively (Pett, 1997).

3.7.1 Driver Perceptions and Ratings

The Driving Comfort Scales (DCSs), Perceived Driving Abilities (PDA) Scales and Situational Driving Frequency (SDF) and Avoidance (SDA) ratings were all scored according to the developers' instructions. The scoring for each of these measures (with potential ranges) is shown in Appendix J. Tool completion and handling of missing values is described below.

At least 75% of the items on the DCSs (i.e., 10/13 DCS-D and 12/16 DCS-N) must be answered to compute a total score for an individual (Myers et al., 2008b). All participants in the present sample completed the requisite number of items for each of the DCSs.

Missing values for the PDA, SDF and SDA scales were dealt with using either the item or person mean substitution methods, as described in MacDonald et al., (2008). Both methods are considered reliable, even when respondents are missing up to 70% of the items on a scale (King, Fogg & Downey, 1998). Item mean substitution replaces a missing value with the mean computed across subjects who responded to that item. Person mean substitution, meanwhile, replaces a missing item with the mean of the responses for the other items answered by that person. The latter approach assumes that if the tool assesses a single construct, the person's responses on the answered items are representative of potential responses for the missed item.

While everyone in the present sample completed both PDA Scales, two people missed one item each (items 6 and 7) when rating current abilities, while another person missed one item (item 6) on the perceived change ratings. Following MacDonald et al. (2008), item 6 on both forms was replaced using person mean substitution (items not directly related) and item 7 was estimated using the mean of items 2 and 4 (substitution with related items involving similar abilities). One person did not do any of the frequency ratings, while another did not do the avoidance ratings. Both were excluded from analyses involving these variables. None of the other subjects missed any of the avoidance rating items, while one person missed an item on the frequency ratings. The missing value was replaced using item mean substitution.

Several composite variables were derived from the background and driving habits questionnaires. These variables included "Driving Problem", "Nervousness" and "Barriers to Driving Reduction or Cessation" scores. Appendix J details the computation of these variables and the composite health variables (Diagnosis, upper-, lower- and full-body physical indices).

3.7.2 Driving Data

Data collected from the CarChips and Ottos were downloaded, cleaned (removed trips with 0.0 km or when a non-participant had driven) and then entered into the SPSS database. Paired t-tests (or Wilcoxon signed ranks tests) were performed to compare data from the two measures. Also, measurement error and coefficient of variation (CV; expressed as a percentage) were calculated to examine agreement between data collected by the CarChip and Otto. Measurement error determines how much the methods are likely to differ from each other (Bland and Altman, 1986) and the coefficient of variation assesses variability in relation to the mean and compares the relative dispersion in one type of data with another. Although the data collected from both devices were subjected to descriptive and comparative analyses (described below), given the Otto's limitations, the CarChip data were considered the gold standard when referring to "actual" driving behaviour.

Throughout the study, a trip was defined as leaving and returning to one's home (Hildebrand et al., 2004); other trip variables are defined in Appendix K. Accordingly, CarChip trip segments were linked by cross-referencing data from the activity diaries and/or Otto, to determine complete trips. The average, minimum and maximum radii each participant drove away from his or her home for each trip was also recorded from the GPS data using Google Earth (a ruled line was drawn from the home to the furthest distance on the trip path). Distance traveled over the study week was extrapolated to one year to examine possible "low mileage bias", using cut-offs (low: < 3000 km/year; middle: 3000 to 13, 999 km/yr; high: ≥ 14000 km/yr) by Langford et al. (2006).

For each day that someone drove in the study period, the time of sunrise and sunset was reviewed (www.sunrisesunset.com) to identify dawn, dusk and night time. In addition to completing trip log information, weather archives were consulted (Environment Canada website) to describe the weather conditions for days where no driving trips were made.

3.7.3 Descriptive and Comparative Analysis

Descriptive statistics included measures of central tendency (means, standard deviations, range) for continuous variables and frequency (frequencies, percentages, ranks) for categorical variables. Table 3.1 outlines the comparative analyses for each study objective.

Table 3.1 Summary of Comparative Analyses

Research Objective	Analyses
(1) To examine driver perceptions in relation to actual driving behaviour	Correlations of DCS and PDA scores with multiple indicators of driving exposure and patterns ANOVA: comparisons of DCS and PDA scores using low mileage cut-offs Multiple Regression, dependent variables: • actual distance (km) driven • average radius (km) driven
(2) To compare sole versus coupled drivers with respect to perceptions and driving behaviour	Independent t-tests: comparison of DCS scores, perceived abilities, driving exposure and patterns between sole and couple drivers
(3) To explore the correspondence between self- and partner-comfort and driving behaviour	Paired t-tests: Individuals' self- and partner ratings Correlations: Self-ratings and how they were rated by their partner Independent t-tests: gender differences in perceptions and actual driving within couples
(4) To compare actual and self-reported driving behaviour	Paired t-tests: • actual versus estimated km • driving behaviour versus SDF ratings Kappa statistics (agreement): • SDA items and corresponding actual behaviour • Typical roadways and time of day driven corresponding actual behaviour Correlations: Trip purposes and SDF, SDA ratings

Comparative statistics were used to examine associations between driver perceptions (scores on the DCSs and PDA Scales) with self-reported and actual driving exposure, patterns and habits (refer to Appendix L for the definitions and measurement of behaviour) and other relevant variables (e.g., gender). Specifically, Pearson correlation coefficients (parametric, continuous variables), Spearman Rank correlation coefficients (non-parametric, continuous variables), Chi-square (categorical variables), t-tests or ANOVA (parametric, continuous variables) and Mann-Whitney or Kruskal-Wallis (non-parametric, continuous variables) were used as appropriate.

Paired t-tests were performed to compare Daytime and Nighttime comfort scores as well as various aspects of actual driving behaviour (e.g., times of day driven, weekend versus weekday distances driven). Kappa (κ) statistics were conducted to examine the agreement between self-reported and actual behaviour in certain driving situations (e.g., situational avoidance items). The low mileage group (<3000 km/year) was compared to the other groups with respect to driver perceptions and other measures of driving behaviour (e.g., radius).

Correspondence between self-reported and actual driving behaviour was also examined. Using the GPS data, a composite situational frequency score of actual behaviour (Frequency Index) was calculated for comparison with a modified self-reported Situational Driving Frequency scale (11 rather than 14 items, as shown in Appendix J). The three situations excluded were: winter driving, speeding and parking items (#1, #6 and #14) as these could not be measured. Since driving data was collected for only one week, the first three response categories on the SDF (i.e., **Never**; **Rarely**, or less than once a month; **Occasionally,** more than once a month, but not weekly) were collapsed to "less than weekly". Driving behaviour in specific situations that could be assessed was compared (t-tests and κ statistics) for those who reportedly avoided the situations when possible (via SDA scale) and those who did not.

The perceptions and driving behaviour between sole and couple drivers as well as within couples themselves were examined in various ways. Specifically, descriptive statistics were used to determine the number of individual and shared trips of each partner. Subsequently, comparative statistics were used to examine differences in driver perceptions and behaviour between sole and couple drivers. Within couples, the amount that each partner drives and who does most of the driving on shared trips was examined in relation to gender and driving perceptions (including self- and partner-rated comfort).

Bivariate relationships between certain demographic, health and driving characteristics with two indicators of driving exposure (total km driven and average radius per trip, respectively) were examined (using correlations and t-tests). Variables that emerged as significant were then examined further in multivariate models using backwards linear regression to examine their relative influence (in the presence of other variables) or contribution. For each regression model (using distance and average radius as the dependent variable, respectively), all independent variables were entered simultaneously at the outset. Variables were then removed, one at a time in order of least importance, if they did not significantly contribute to the fit of the model ($p > .05$ and there was no significant change in the model R^2).

Following the selection of the final model, residuals were examined to check assumptions of independence, equal variance and normal distribution. Cook's distances were plotted to identify outliers and influential cases. Cases with a Cook's distance > 1.0 were examined further. Transformations were performed when there was evidence that the assumptions were not met. Multicollinearity was also assessed by examining variance inflation factors (VIF) and tolerance statistics. VIF values greater than 10 and tolerance values less than 0.25 indicate potential problems of multicollinearity (Katz, 2006).

3.7.4 Interview Data

Data from the follow-up interviews were used to help explain whether driving behaviour over the week was reflective of typical behaviour (and reasons for discrepancies) as well as interpret trip purposes, importance of driving and personal reliance on the vehicle. As previously described, couples were asked about their travel preferences and couple ratings. The interviews were transcribed into a word file by subject ID. Content analysis was then used to categorize responses (e.g., same amount of driving as usual, drove more, drove less). Each couple was also looked at individually (i.e., 'mini case studies') to examine the potential influence of personal circumstances (e.g., illness) on driving patterns.

Chapter 4 Results

This chapter presents the study findings, beginning with sample recruitment and general characteristics (demographics, health profile and driving experience). Scores on the two "objective" abilities tasks are presented next, followed by driver perceptions (comfort level, perceived abilities, importance, nervousness and barriers to restriction). Sample breakdowns for the various indicators of self-reported and actual driving behaviour are then presented. Correspondence of results for the CarChips, Ottos, diaries and trip logs are also addressed.

To enhance the flow of the Chapter, comparisons of actual and self-reported driving behaviour (exposure and patterns) are presented prior to associations with objective abilities and driver perceptions. Subsequent sections present comparison of sole versus couple drivers with respect to driving behaviour and perceptions, followed by an exploration of self- versus partner ratings and roles (driver versus passenger for shared trips) within couples. The final section presents the regression models examining the relative influence of various factors shown to be related to driving exposure (km and average radius) in the bivariate analyses.

Interview data is presented in various sections when useful to explain or elaborate on quantitative findings. Descriptive and comparative data are presented for the total sample, as well as by gender, age group (< 80 versus 80+) and household status (sole versus couple drivers). Urban versus rural differences are reported where appropriate.

4.1 Sample Recruitment and Characteristics

A convenience sample of 61 older drivers from Kitchener-Waterloo (KW), Cambridge, Guelph and surrounding areas was recruited from recreation centers, condominiums and the

MTO's Group Education Sessions (GESs). As shown in Table 4.1, 39 (64%) were 'sole drivers' (i.e., only driver in household), while 22 (36%) took part with their spouse (both drivers). For couples, both partners were considered to be recruited from the same location.

As shown in Table 4.1, four individuals (7% of the sample), all of whom lived in the same apartment complex, had taken part in our previous studies on the DCS (n=4) and the Roadwise Review (n=1). These people approached the researcher expressing interest. Since at least a year had elapsed since their last participation, they were allowed to take part.

Table 4.1 Recruitment Characteristics

	Total Sample N = 61	Gender		Age Group		Status	
		Male n=25	Female n=36	<80 n=26	80+ n=35	Sole n=39	Couple n=22
Prior study							
Yes	4 (6.6)	1 (4.0)	3 (8.3)	3 (11.5)	1 (2.9)	4 (6.6)	0
No	57(93.4)	24 (96.0)	33 (91.7)	23 (88.5)	34 (97.1)	35(89.7)	22 (100)
Recruitment site*†							
Apartment	11(18.0)	1 (4.0)	10 (27.8)	6 (23.1)	5 (14.3)	11(28.2)	0
Seniors' Centre	23(37.7)	10 (40.0)	13 (36.1)	18 (69.2)	5 (14.3)	9 (23.1)	14(63.6)
MTO	27(44.3)	14 (56.0)	13 (36.1)	2 (7.7)	25 (71.4)	19(48.7)	8 (36.4)
Month participated							
June	7 (11.5)	2 (8.0)	5 (13.9)	4 (15.4)	3 (8.6)	5 (12.8)	2 (9.1)
July	19(31.1)	6 (24.0)	13 (36.1)	9 (34.6)	10 (28.6)	11(28.2)	8 (36.4)
August	7 (11.5)	3 (12.0)	4 (11.1)	2 (7.7)	5 (14.3)	7 (17.9)	0
September	7 (11.5)	4 (16.0)	3 (8.3)	2 (7.7)	5 (14.3)	3 (7.7)	4 (18.2)
October	21(34.4)	10 (40.0)	11 (30.6)	9 (34.6)	12 (34.3)	13(33.3)	8 (36.4)
Residence							
Urban							
Waterloo	23(37.7)	7 (28.0)	16 (44.9)	10 (38.5)	13 (37.1)	17(43.6)	6 (27.3)
Kitchener	16(26.2)	8 (32.0)	8 (22.2)	4 (15.4)	12 (34.3)	10(25.6)	6 (27.3)
Cambridge	7 (11.5)	4 (16.0)	3 (8.3)	6 (23.1)	1 (2.9)	3 (7.7)	4 (18.2)
Guelph	6 (9.8)	3 (12.0)	3 (8.3)	4 (15.4)	2 (5.7)	2 (5.1)	4 (18.2)
Elmira	1 (1.6)	0	1 (2.8)	0	1 (2.9)	1 (2.6)	0
Rural							
St. Jacob's	2 (3.3)	0	2 (5.6)	0	2 (5.7)	2 (5.1)	0
Rural Cambridge	2 (3.3)	1 (4.0)	1 (2.8)	1 (3.8)	1 (2.9)	2 (5.1)	0
Freelton	1 (1.6)	0	1 (2.8)	1 (3.8)	0	1 (3.8)	0
Bamberg	2 (3.3)	1 (4.0)	1 (2.8)	0	2 (5.7)	0	2 (9.1)
St. Agatha	1 (1.6)	1 (4.0)	0	0	1 (2.9)	1 (2.6)	0

*gender difference; †age group difference

Most participants (53, 87%) lived in urban/sub-urban areas in KW, Cambridge, Guelph and the smaller town of Elmira. Eight were considered to live in rural areas, bordering either KW or Cambridge. Rural was defined as living outside places with 1,000 people or more, or when access to key amenities was beyond 5 km (Statistics Canada, 2008; Personal communication with committee).

There were significant differences in recruitment site by gender (χ^2 = 6.0, p=.05) and age group (χ^2 = 26.28, p<.001). Those recruited from apartment complexes were primarily female (91%) while those from senior's centres tended to be younger (78%). Not surprisingly, people recruited from the MTO-GES tended to be 80+ years of age (93%). The two people in this group who were less than 80 years of age were both spouses of GES attendees.

As shown in Table 4.2, the sample ranged in age from 67 to 92 (mean 80 years). The two people who were less than 70 years of age were each part of a driving couple. Slightly over half the sample was female (59%), had completed post secondary education (56%), lived alone (53%) or in private homes (53%). About three-quarters considered themselves financially able to meet their needs with enough left over to do most things, while 68% rarely or never worried about car expenses. A small percentage (8%) were currently employed, one part-time and one full-time (three people did not note part- or full-time status).

A higher percentage of men were in the older (80+) age group (72% versus 28%, χ^2= 7.4, p=.05). Living arrangement also differed by gender, with more women living alone (χ^2=11.44, p=.003). Differences in household status (sole versus couple drivers) emerged for age (t=2.62, p=.01), residence (χ^2 = 8.96, p = .01) and, not surprisingly, living arrangement (χ^2= 43.33, p<.001). Sole drivers were older, more likely to live alone and in an apartment or seniors' complex. The five sole drivers who lived with a spouse were men.

Table 4.2 Background Characteristics

Characteristic	Total Sample N = 61	Gender		Age Group		Status	
		Male n=25	Female n=36	<80 n=26	80+ n=35	Sole n=39	Couple n=22
Status†							
sole	39 (63.9)	14 (56.0)	25 (69.4)	12 (46.2)	27 (77.1)	-	-
couple	22 (36.1)	11 (49.0)	11 (30.6)	14 (53.8)	8 (22.9)	-	-
Gender†							
male	25 (41.0)	-	-	7 (26.9)	18 (51.4)	14 (35.9)	11 (50.0)
female	36 (59.0)	-	-	19 (73.1)	17 (48.6)	25 (64.1)	11 (50.0)
Age†‡	80.4±5.5 67 to 92	81.6±5.7 67-92	79.6±5.3 68-91	75.5±3.9 67 to 79	84.1±3.1 80 to 92	81.8±4.8 70 to 92	78.0±5.9 67 to 91
Education							
high school	47 (77)	17 (68.0)	30 (83.3)	23 (88.5)	24 (68.6)	28 (71.8)	19 (86.4)
post secondary	34 (55.7)	8 (32.0)	18 (50.0)	18 (69.2)	16 (45.7)	19 (48.7)	15 (68.2)
Residence‡							
private home	32 (52.5)	14 (56.0)	18 (56.0)	16 (61.5)	16 (45.7)	16 (41.0)	16 (72.7)
apartment	11 (29.5)	7 (28.0)	11 (30.6)	7 (26.9)	11 (31.4)	12 (30.8)	6 (27.3)
seniors' complex	11 (18.0)	4 (16.0)	7 (19.4)	3 (11.5)	8 (22.9)	11 (28.2)	0
Living Arrangement*‡							
alone	32 (52.5)	7 (28.0)	25 (69.4)	11 (42.3)	21 (60.0)	32 (82.1)	0
spouse	27 (44.3)	16 (64.0)	11 (30.6)	14 (53.8)	12 (34.3)	5 (12.8)	22 (100)
family members	2 (3.3)	2 (18.0)	0	1 (3.8)	2 (5.7)	2 (5.1)	0
Employed							
yes	5 (8.2)	3 (12.0)	2 (5.6)	3 (11.5)	2 (5.7)	3 (7.7)	2 (9.1)
no	56 (91.8)	22 (88.0)	34 (94.4)	23 (88.5)	33 (94.3)	36 (92.3)	20 (90.9)
missing	3 (60.0)	2 (66.6)	1 (50.0)	1 (33.3)	2 (100)	1 (33.3)	2 (100)
Income							
for most things	45 (73.8)	18 (72.0)	27 (75.0)	20 (76.9)	25 (71.4)	28 (71.8)	17 (77.3)
for many things	10 (16.4)	3 (12.0)	7 (19.4)	5 (19.2)	5 (14.3)	7 (17.9)	3 (13.6)
little for extras	6 (9.8)	4 (16.0)	2 (5.6)	1 (3.8)	5 (14.3)	4 (10.3)	2 (9.1)
Worry about car expenses							
often	3 (4.9)	3 (12.0)	0	1 (3.8)	2 (5.7)	3 (7.7)	0
sometimes	16 (26.2)	7 (28.0)	9 (25.0)	5 (19.2)	11 (31.4)	13 (33.3)	3 (13.6)
rarely	21 (34.4)	5 (20.0)	16 (44.4)	11 (42.3)	10 (28.6)	12 (30.8)	9 (40.9)
never	21 (34.4)	10 (40.0)	11 (30.6)	9 (34.3)	12 (34.3)	11 (28.2)	10 (45.5)

*gender difference; †age group difference; ‡status difference

Selected health characteristics of the sample are shown in Table 4.3 (additional characteristics shown in Appendix M). Generally, participants appeared to be in good health. Most rated their health as excellent or good (94%), were able to walk a quarter of a mile (89%), did not require the use of a cane or walker outdoors (85%) and had a low overall physical difficulty index (1.0 ± 1.3). The sample reported being physically active (at least 30 minutes) an average of four days a week. The most commonly reported health problems were arthritis, rheumatism and/or osteoporosis (61%), followed by high blood pressure, cholesterol or heart problems (54%) and vision disorders (44%). About half the sample (48%) had previously had cataract surgery. However, no one rated their eyesight as ‘worse than most’.

Table 4.3 Selected Health Characteristics

Health Characteristics	Total Sample	Gender		Age Group		Status	
		Male	Female	<80	80+	Solo	Couple
	N = 61	n=25	n=36	n=26	n=35	n=39	n=22
Health							
excellent	20 (32.8)	7 (28.0)	13 (36.1)	10 (38.5)	10 (28.6)	14 (35.9)	6 (27.3)
good	37 (60.7)	15 (60.0)	22 (61.1)	14 (53.8)	23 (65.7)	24 (61.5)	13(59.1)
fair	3 (4.9)	2 (8.0)	1 (2.8)	2 (7.7)	1 (2.9)	1 (2.6)	2 (9.1)
poor	1 (1.6)	1 (4.0)	0	0	1 (2.9)	0	1 (4.5)
Cane or walker							
yes	9 (14.8)	24 (96.0)	4 (11.1)	2 (7.7)	7 (20.0)	8 (20.5)	1 (4.5)
no	52 (85.2)	1 (4.0)	32 (88.9)	24 (92.3)	28 (80.0)	31 (79.5)	21(95.5)
Walk 1/4 mile							
yes	54 (88.5)	5 (20.0)	30 (83.3)	25 (96.2)	29 (82.9)	34 (87.2)	20(90.9)
no	7 (11.5)	20 (80.0)	6 (16.7)	1(3.8)	6 (17.1)	5 (12.8)	2 (9.1)
Diagnosis Score	2.43±1.4 0-5	2.68±1.4 0-5	2.25±1.3 0-5	2.54±1.4 0-4	2.34±1.4 0-5	2.41±1.3 0-5	2.45±1.4 0-5
Physical difficulty index	1.02±1.3 0 to 7	2.68±1.4 0 to 5	2.25±1.3 0 to 5	2.54±1.4 0 to 4	2.34±1.4 0 to 5	2.41±1.3 0 to 5	2.45±1.4 0 to 5
Lower body index	.57 ± .96 0 to 7	1.16±1.8 0 to 2	.91 ± .95 0 to 4	1.36± .68 0 to 7	.77 ± .97 0 to 4	.87 ± .95 0 to 4	1.29±1.9 0 to 7
Upper body index	.55 ± .81 0 to 4	.56 ± .82 0 to3	.54 ± .82 0 to 4	.80 ± 1.0 0 to 4	.37±.55 0 to 2	.49 ± .60 0 to 2	.67± 1.1 0 to 4
Cataract surgery							
yes	29 (48.3)	12 (48.0)	17 (48.6)	10 (40.0)	19 (54.3)	21 (53.8)	8 (38.1)
no	31 (51.7)	13 (52.0)	18 (51.4)	15 (60.0)	16 (45.7)	18 (46.2)	13(61.9)
< year ago	3 (5.0)	1 (4.0)	2 (5.7)	1 (4.0)	2 (5.7)	2 (5.1)	1 (4.8)
> year ago	26 (43.3)	11 (44.0)	15 (42.9)	9 (36.0)	15 (42.9)	19 (48.7)	7 (33.3)
Perceived eyesight							
better than most	27 (46.6)	13 (54.2)	14 (41.2)	9 (36.0)	18 (54.5)	20 (54.1)	7 (33.3)
about the same	31 (53.4)	11 (45.8)	20 (58.8)	16 (64.0)	15 (42.9)	17 (45.9)	14(66.7)
Medications*	3.18±2.0 1 to 9	3.91±21.2 1 to 8	2.62±1.7 1 to 9	3.25±2.1 1 to 9	3.13± 2.0 1 to 8	3.09±2.2 1 to 9	3.38±1.5 1 to 6

*gender difference

Those 67-79 years of age were more likely to be diagnosed with ‘other’ (e.g., cancer, shingles) medical problems (χ^2 = 4.51, p=.03) and experience involuntary movement in the upper body (χ^2 = 4.42, p=.04) compared to their older counterparts. Compared to couple drivers, sole drivers were more likely to be diagnosed with hearing problems (χ^2 = 4.17, p = .04) and other medical problems (χ^2= 6.45, p = .01).

Table 4.4 Selected Experiences and Training

General Driving Habits	Total Sample N = 61	Gender		Age Group		Status	
		Male n=25	Female n=36	<80 n=26	80+ n=35	Sole n=39	Couple n=22
Age got license*	22.1±8.0 15-55	19.5±5.6 15-34	24.0±9.0 15-55	23.6±9.3 15-55	21.0±6.9 16-42	23.2±8.9 16-55	20.0±5.4 15-34
Years driving*†	57.7±10.6 24-76	62.0±7.1 49-76	54.4±11.6 24-75	51.4±9.8 24-64	62.5± 8.5 38-76	58.1±11.6 24-76	56.9±8.6 29-76
Other license*	12 (19.7)	10 (40.0)	2 (5.6)	4 (15.4)	8 (22.9)	9 (23.1)	3 (13.6)
tractor	1 (8.3)	1 (10.0)	0	0	1 (12.5)	1 (12.5)	0
bus	4 (33.3)	3 (30.0)	1 (50.0)	2 (50.0)	2 (25.0)	3 (37.5)	1 (33.3)
truck >11000	3 (25.0)	3 (30.0)	0	0	2 (25.0)	2 (25.0)	1 (33.3)
motorcycle	4 (33.3)	4 (40.0)	0	1 (25.0)	3 (37.5)	3 (37.5)	1 (33.3)
chauffeur	2 (18.2)	1 (10.0)	1 (50.0)	2 (50.0)	0	1 (11.1)	1 (33.3)
Others rely on you to drive							
no	42 (68.9)	15 (60)	27 (75.0)	20 (76.9)	22 (62.9)	26 (66.7)	16 (72.7)
yes	19 (31.1)	10(40)	9 (25.0)	6 (23.1)	13 (37.1)	13 (33.3)	6 (27.3)
Problems Score	.44 ± .67 0 to 3	.64 ± .86 0 to 3	.31 ± .47 0 to 1	.58 ± .70 0 to 2	.34 ± .64 0 to 3	.49 ± .68 0 to 3	.36 ± .66 0 to 2
Someone suggested limit driving							
no	56 (93.3)	22 (88.0)	34 (97.1)	25 (96.2)	31 (91.2)	35 (92.1)	21 (95.5)
yes	4 (6.7)	3 (12)	1 (2.9)	1 (3.8)	3 (8.8)	3 (7.9)	1 (4.5)
Thinking about cessation*							
no	55 (90.2)	20 (80.0)	35 (97.2)	25 (96.2)	30 (85.7)	35 (89.7)	20 (90.9)
yes	6 (9.8)	5 (20)	1 (2.8)	1 (3.8)	5 (14.3)	4 (10.3)	2 (9.1)
Thought about reduction							
no	51 (83.6)	19 (76.0)	32 (88.9)	22 (84.6)	29 (82.9)	32 (82.1)	19 (86.4)
yes	10 (16.4)	6 (24.0)	4 (11.1)	4 (15.4)	6 (17.1)	7 (17.9)	3 (13.6)
Courses†‡							
no	20 (32.8)	7 (28.0)	13 (36.1)	20 (76.9)	0	7 (17.9)	13 (59.1)
yes	41 (67.2)	18 (72.0)	23 (63.9)	6 (23.1)	35 (100)	32 (82.1)	9 (40.9)
MTO							
vision test†‡	37 (61.7)	18 (72.0)	19 (54.3)	2 (8.0)	35 (100)	29 (23.7)	8 (36.4)
rules test†‡	36 (60.0)	18 (72.0)	18 (51.4)	1 (4.0)	35 (100)	28 (73.7)	8 (36.4)
road test	3 (5.0)	1 (4.0)	2 (5.7)	1 (4.0)	2 (5.7)	3 (7.9)	0
medical exam	1 (1.7)	1 (4.0)	0	0	1 (2.9)	1 (2.6)	0

*gender difference; †age group difference; ‡status difference

Table 4.4 highlights driving experience and training. Except for one women (who obtained her license at age 55), most of our sample had decades of driving experience. Older individuals naturally had more experience (t= -4.62, p<.001). Also not surprising, men were more likely than women to have held another class of license (χ^2 = 11.08, p = .001).

Driving problems over the past year were low (mean .44 out of a possible 5). The most common problem was near crashes, reported by 14 (23%) people. Only 3 participants (5%) were involved in a crash, while no one indicated having received a traffic ticket. Few people reported thoughts of reducing (16%) or giving up (10%) driving (although men were more likely than women to admit they were thinking of cessation, χ^2 = 4.93, p = .03).

Sole drivers were more likely to have talked about driving with family members (34% versus 9%; χ^2 = 4.69, p = .03) and to have taken a driving course (82% versus 41%, χ^2 = 10.80, p = .001). Those over 80+, not surprisingly, were more likely to have taken a driving course in the past compared to their younger counterparts (100% vs. 23%, χ^2 = 40.06, p<.001).

4.2 Objective Abilities

Thirty-four people (56%) completed the UFOV subtest 2, while 51 (84%) completed the RPW. Ten people chose not to do the tasks, while 17 people could not complete the UFOV due to software compatibility problems. The average score for each is shown in Table 4.5.

Table 4.5 Lower Body Mobility and Visual Processing Scores

	Total	Gender		Age Group		Status	
Score	**Sample**	**Male**	**Female**	**<80**	**80+**	**Sole**	**Couple**
UFOV							
n	34	15	19	14	20	23	11
mean,SD	171.0±102.9	196.6 (111.5)	150.8 (96.6)	164.0 (127.7)	175.9 (84.7)	186.1 (77.0)	139.5 (142.4)
range	16.67-500	30-500	16.67-250	16.67-500	26.23-283.3	16.67-283.3	23.30-500
RPW							
n	51	18	33	25	26	33	18
mean,SD	6.6 (1.9)	7.2 (2.5)	6.3 (1.29)	6.4(2.07)	6.8(1.65)	6.7 (2.02)	6.4 (1.52)
range	4.2-14.3	4.7-14.3	4.2-9.4	4.2-14.3	4.7-11.0	4.6-14.3	4.2-9.1

Using established cut-offs, only 5 people (15%) scored in the impaired range (>9 sec) on the RPW and only one on the UFOV (>353 ms). The same person approached the RPW cut-off (8.53 sec). There were no significant differences in either RPW or UFOV scores by gender, age group or status.

4.3 Driver Perceptions

Table 4.6 presents the scores on the Driving Comfort Scales (DCSs), Perceived Driving Abilities (PDA) scales as well as ratings of driving nervousness, personal driving importance and barriers to reduction or cessation. All scores were normally distributed, except for the PDA change score (Shapiro-Wilks statistic=.18, p<.001) and DCS-N item #1 (Shapiro-Wilks statistic=.76, p<.001).

Table 4.6 Driver Comfort, Perceived Abilities and other Perceptions

Rating	Total Sample N = 61	Gender		Age Group		Status	
		Male n=25	Female n=36	<80 n=26	80+ n=35	Sole n=39	Couple n=22
DCS-D*	68.9±15.2 30.8-100	74.2±14.4 44.2-98.0	65.2±14.7 30.8-100	68.9±16.2 44.2-100	68.8±14.6 30.8-98.1	67.2 ±15.3 30.77-100	71.8±14.9 44.2-98.1
DCS-N*	54.3±24.8 6.3-100	63.4±25.3 12.5-100	48.0±22.7 6.25-100	54.1±26.6 10.94-100	54.5±23.9 6.25-100	51.5±25.7 6.25 -100	59.3±23.0 17.2-100
DCS-N #1*	83.6±19.8 25-100	90.0± 19.1 25-100	79.2±19.4 50-100	87.5±19.0 50-100	80.7±20.2 25-100	80.1±20.8 25-100	89.8±16.7 50-100
PDA (current)	32.5 ± 6.3 15-45	33.4 ± 6.3 21-45	31.9 ± 6.3 15-44	32.9 ± 7.4 15-45	32.3 ± 5.3 21-43	32.5 ± 6.5 15-44	32.6 ± 6.0 23-45
PDA change	19.1 ± 5.9 2-44	19.0 ± 7.9 2-44	19.1 ± 4.0 15-31	19.4 ± 5.7 2-31	18.9 ± 6.0 7-44	19.0 ± 6.9 2-44	19.4 ± 3.6 15-27
Nervousness†	.47 ± .79 0 to 3	.40 ± .71 0 to 3	.51 ± .85 0 to 3	.73 ± 1.0 0 to 3	.26 ± .51 0 to 2	.47 ± .73 0 to 3	.45 ± .91 0 to 3
Importance							
extremely	39 (63.9)	17 (68.0)	22 (61.1)	18 (69.2)	21 (60.0)	26 (66.7)	13 (59.1)
very	16 (26.2)	4 (16.0)	12 (33.3)	6 (23.1)	10 (28.6)	11 (28.2)	5 (22.7)
moderately	2 (3.3)	1 (4.0)	1 (2.8)	1 (3.8)	1 (2.9)	1 (2.6)	1 (4.5)
somewhat	4 (6.6)	3 (12.0)	1 (2.8)	1 (3.8)	3 (8.6)	1 (2.6)	3 (13.6)
Barriers‡	11.0± 6.0 0 to 21	11.3±6.6 0 to 21	10.8±5.6 0 to 21	10.9±6.6 0 to 21	11.1±5.7 0 to 21	12.3±5.4 0 to 21	8.6± 6.4 0 to 21

Note: Values presented as mean ± SD, range
*gender difference; †age group difference; ‡status difference

Overall, the sample had a moderate level of driving comfort, given the theoretical mean of 50%. While correlated ($r = .82$, $p<.001$), DCS-N scores were significantly lower than DCS-D scores (paired $t = 7.46$, $p<.001$). However, the sample was generally comfortable driving at night in good weather and traffic conditions (DCS-N item # 1), scoring 83% on average out of a possible 100%. The sample also reported fairly high personal driving abilities and perceived little change in these abilities relative to 10 years ago, as well as low levels of nervousness.

The majority of participants felt that driving was extremely or very (91%) important to them personally. During the follow-up interviews, 54 people (89%) said that giving up driving (voluntarily or otherwise) would have a significant affect on their lifestyle. Examples of comments were: "I would feel like a second-class citizen", "I would shoot myself". Most mentioned that they would have to reduce their activities, especially social, recreational and leisure activities. Four explicitly said they would be forced to relocate.

The Barriers to Driving Reduction/Cessation score averaged 11 (SD 6) out of a possible 21. Individual item scores can be found in Appendix M (part C). Maintaining one's current lifestyle was viewed as the primary barrier (rated "very much" by 63%), followed by location of shops and services (59%), difficulty with public transit (47%), not wanting to bother others (42%), availability of others to drive (24%), others counting on them to drive (24%) and physical difficulty getting places (22%). The majority of participants (55, 90%) said in the interview that if they could not or did not feel like driving somewhere themselves, they could get there another way, whether by taxi, family members or friends. All couples said they could get their spouse to drive them (provided they could still drive). Otherwise, they too would rely on other family, friends or taxi. The six people who said they could not get there another way were evenly split across urban and rural-dwellers and gender; most (83%), however, lived alone. Barriers scores were related to ratings of driving importance ($\rho=.26$, $p=.04$).

Scores on the PDA scale were significantly and positively correlated with the DCS-D ($r=.41$, $p<.001$) and DCS-N ($r=.45$, $p<.001$) scores. The PDA change score was also significantly but inversely related to both comfort scores (DCS-D: rho= -.25, $p<.01$; DCS-N: rho = -.37, $p<.01$). Relationships between driving comfort, personal importance of driving, nervousness and barriers are presented in Appendix N. Nervousness was inversely related to DCS-D ($r= -.29$, $p=.03$) and PDA ($r=-.29$, $p=.03$) scores and positively related to PDA change scores (the higher the nervousness, the lower the comfort levels and perceived abilities as well as the higher the perceived changes from 10 years ago).

Men tended to have higher comfort in both day and night time driving ($t=2.39$, $p=.02$ and $t=2.44$, $p=.02$, respectively), including in good weather conditions at night: DCS-N item # 1 ($z=-2.44$, $p=.02$). Driver perception scores (DCS-D, DCS-N, DCS-N item#1, PDA, PDA change) were not significantly different between age groups, with the exception of nervousness ($t=2.17$, $p=.04$); the younger age group (67-79) reported more nervousness when driving. When age was looked at as a continuous variable, age was significantly (and inversely) related to DCS-N item #1 scores (rho= -.32, $p=.01$). Those with higher comfort levels at night in good weather tended to be younger.

Sole drivers reported higher perceived barriers to driving cessation or reduction ($t=2.26$, $p=.03$). Those living in rural areas had higher DCS-N scores (72.1 ± 24.3 versus 51.7 ± 24.0, $t=-2.22$, $p=.05$). There were no significant differences in DCS-D, DCS-N item#1 or PDA scores by area of residence. There were no significant differences in both PDA scores by gender, age group or status. Other characteristics shown in Appendix N (e.g., education, self-rated health, health problems, mobility) were not significantly related to DCS or PDA scores.

Those diagnosed with a vision disorder (cataracts, glaucoma or macular degeneration), however, had significantly lower comfort levels at night (t=2.50, p=.02) and, although not significant, greater perceived abilities (p=.07) and changes in abilities (p=.07). Perceived eyesight was related to perceived changes in abilities (F=4.21, p=.04); those who thought their eyesight was better than most of their peers expressed less change in their abilities. Individuals not taking prescription medications (n=6) also thought their driving abilities were better than those who were (37.8 ± 4.7 versus 31.9 ± 6.2; t=2.86, p=.02).

Driving comfort (day or night) scores were not related to driving experience or training, transportation preferences, or the driving problems score. Those who had talked with a physician about driving had lower scores on the DCS-N (t=2.15, p=.05), DCS-D (t=2.03, p=.06) and PDA (t=3.51, p=.002) scales. Those who had talked with an eye care professional also had lower comfort scores for day (t = 2.30, p = .03), night (t = 3.18, p =.003) and DCS-N item #1 (Shapiro-Wilks statistic = -2.86, p=.004). Perceptions were not significantly related to discussions with family/friends. Those who were thinking about cessation did not have lower DCS scores, however, those who thought about reducing their driving had significantly lower DCS-N scores (t=2.09, p=.05).

4.4 Self-Reported Driving Behaviour

Sources of self-reported driving behaviour data included the driving habits questionnaire, SDF and SDA ratings and the follow up interview. Reported driving habits, preferences and situational ratings are shown in Table 4.7. The sample's preferred mode of travel was driving, particularly as the driver themselves (93%). Participants said they drove five days a week on average, with trips typically lasting 15-30 minutes each way (66%). The sample reported driving on a variety of roadways, primarily in the morning and afternoon.

Table 4.7 Self-reported Driving Habits, Preferences and Situational Ratings

Typical Driving Habits	Total Sample N = 61	Gender		Age Group		Status	
		Male n=25	Female n=36	<80 n=26	80+ n=35	Sole n=39	Couple n=22
# days/week[*]	5.1±1.8 1-7	5.7±1.5 3-7	4.8±1.8 1-7	5.0±1.9 1-7	5.3±1.6 2-7	5.4±1.5 3-7	4.6± 2.0 1-7
Length of trips							
< 15 min	16 (26.2)	9 (36)	7 (19.4)	8 (30.8)	8 (22.9)	8 (20.5)	8 (36.4)
15-30 min	40 (65.6)	13 (52.0)	27 (75.0)	16 (61.5)	24 (68.6)	26 (66.7)	14 (63.6)
30-60 min	3 (4.9)	1 (4.0)	2 (5.6)	1 (3.8)	2 (5.7)	3 (7.7)	0
> 60 min	2 (3.3)	2 (8.0)	0	1 (3.8)	1 (2.9)	2 (5.1)	0
Roadways							
residential	48 (78.7)	17 (68)	31 (86.1)	22 (84.6)	26 (74.3)	30 (76.9)	18(81.8)
main city	49 (80.3)	21 (84.0)	28 (77.8)	10 (38.5)	27 (77.1)	29 (76.9)	20(90.9)
rural	26 (42.6)	13 (52.0)	13 (36.1)	13 (50.0)	16 (45.7)	18 (46.2)	8 (36.4)
freeways	31 (50.8)	15 (60.0)	16 (44.4)	19 (73.1)	1 (3.8)	19 (48.7)	12(54.5)
highways	43 (70.5)	18 (72.0)	25 (69.4)	24 (92.3)	1 (3.8)	28 (71.8)	15(68.2)
Times of Day							
morning	57 (93.4)	24 (96.0)	33 (91.7)	24 (92.3)	33 (94.3)	37 (94.9)	20 (90.9)
afternoon	58 (95.1)	23 (92.0)	35 (97.2)	26 (100)	32 (91.4)	37 (94.9)	21 (95.5)
early evening[‡]	41 (67.2)	18 (72.0)	23 (63.9)	18 (69.2)	23 (65.7)	30 (76.9)	11 (50.0)
at night[*]	17 (27.9)	11 (44.0)	6 (16.7)	9 (34.6)	8 (22.9)	10 (25.6)	7 (31.8)
Change (10 yrs)							
much less often	15 (24.6)	9 (36.0)	6 (16.7)	4 (15.4)	11 (31.4)	9 (23.1)	6 (27.3)
a little less	18 (29.5)	8 (32.0)	10 (27.8)	7 (26.9)	11 (31.4)	13 (33.3)	5 (22.7)
same	18 (29.5)	7 (28.0)	11 (30.6)	8 (30.8)	10 (28.6)	8 (20.5)	10 (45.5)
more often	10 (16.4)	1 (4.0)	9 (25.0)	7 (26.9)	3 (8.6)	9 (23.1)	1 (4.5)
Who drives[*†]							
me	10 (45.5)	10 (90.9)	0	5 (35.7)	5 (14.3)	-	10 (45.5)
my partner	9 (40.9)	0	9 (25.0)	7 (50.0)	2 (5.7)	-	9 (40.9)
shared equally	3 (13.6)	1 (9.1)	2 (5.6)	2 (14.3)	1 (2.9)	-	3 (13.6)
Car servicing[*†‡]							
me	50 (82.0)	24 (96.0)	26 (72.2)	17 (65.4)	33 (94.3)	39 (100)	11 (50.0)
my partner	8 (13.1)	0	8 (22.2)	7 (26.9)	1 (2.9)	-	8 (36.4)
other	3 (4.9)	1 (4.0)	2 (5.6)	2 (7.7)	1 (2.9)	0	3 (13.6)
Preferred mode							
drive yourself	56 (93.3)	25 (100)	31 (88.6)	22 (88.0)	34 (97.1)	38 (97.4)	18 (85.7)
someone drives	4 (6.7)	0	4 (11.4)	3 (12.0)	1 (2.9)	1 (2.6)	3 (14.3)
missing	1 (1.6)	0	1 (2.8)	1 (3.8)	0	0	1 (4.5)
SDF*	30.2 ± 9.0 12-49	33.9 ± 8.6 18-49	27.8±8.6 2-18	30.4 ± 9.7 12-48	30.1 ± 8.7 18 – 49	30.1 ± 9.9 12 – 49	30.4±7.6 14-44
SDA	9.2 ± 4.8 0-19	8.3 ± 5.0 0-19	9.9 ± 4.6 2-18	8.8 ± 4.9 2-18	9.5 ± 4.8 0-19	9.6 ± 5.1 0-19	8.6 ± 4.3 3-18

*gender difference; †age group difference; ‡status difference;
SDF=Situational Driving Frequency; SDA=Situational Driving Avoidance

Sixty-seven percent of the sample also reported typically drive in the early evening, while about a third (28%) said they drive at night. Sole drivers were more likely to drive during the early evening than couples (77% versus 50%, $\chi^2 = 4.63$, p = .03). Men reported higher driving frequency (typical number of days/week; t=2.79, p=.01) and night driving compared to women (44% versus 17%, $\chi^2 = 5.48$, p = .02). Scores on the Situational Driving Frequency (SDF) scale were also higher for men (t=2.69, p=.01). Half the sample (54%) indicated they drove less often than ten years ago, while approximately 30% drive the same amount. A third of the sample reported that they were close enough to walk to shops and services, church, recreation and social activities.

Additionally, participants were asked if they could estimate the number of km they drove over the study week. As shown in Table 4.8, only half the sample (32 or 53%) felt able to do so. Men provided significantly higher estimates of km driven over the week compared to women (t=2.79, p=.01). Similarly, sole drivers reported more km than couple drivers (t=2.54, p=.02). Estimated distance driven was not significantly different by age group.

Table 4.8 Estimated Weekly Kilometers

Rating	Total Sample N = 32	Gender		Age Group		Status	
		Male n=16	Female n=16	<80 n=12	80+ n=20	Sole n=21	Couple n=11
Weekly km*‡	192.4±201.3 6-800	282.2±240.9 50-800	102.6±92.0 6-300	135.9±153.2 6-550	226.3±222.0 16-800	241.2±227.9 16-800	99.2±84.2 6 - 300

Note: Values presented as mean ± SD, range
*gender difference; ‡status difference

4.5 Actual Driving Behaviour

Driving behaviour over the course of the week was measured using two electronic devices installed in each vehicle (CarChip and Otto), supplemented with information from the trip logs and activity diaries. Diaries were also used to examine trips involving other modes of transportation. It is important to note that none of the participants reported that the devices affected their driving behaviour. Several even mentioned that they forgot about the devices.

As shown in Table 4.9, complete driving data was not obtained for the total sample (N=61). Specifically, CarChip data could not be retrieved for three people. One device was not properly reinstalled by a mechanic after servicing, another CarChip was incompatible (wrong model) for the vehicle and the third case was unexplained. Similarly, Otto data could not be retrieved for four *different* participants and only partial data was retrieved for two others. These Otto problems were all related to the same device. Also, one person did not attempt the activity diary; all other participants had entries for each of the seven days. Two people did not use the trip logs (one of whom also was missing CarChip data).

Table 4.9 Sample with Driving Data for Each Tool

	CarChip	Otto	Trip Log	Activity Diary
N	58	55	59	60

Note: One person was missing multiple sources of actual driving behaviour (CarChip and log)

When filling out the activity diaries, people often gave the location of the activity rather than the activity itself (e.g., 'Zehrs' instead of 'grocery shopping') and failed to record their estimated time of travel one-way. The majority of trip logs were completed for corresponding CarChip trips (375, or 91%). The log entries that did exist were occasionally missing the number of stops (28, or 8%), time of day (29, or 8%), or weather (21, or 6%). When weather details were missing, Environment Canada weather archives were consulted.

4.5.1 CarChip versus Otto

Those with missing or partial CarChip or Otto data (n=9) were excluded from this comparison. Significant differences between CarChip and Otto data were found for all aspects of driving exposure except number of trips. Specifically, the Otto tended to provide significantly lower estimates of km (155.6 ± 154.9 versus 174.5 ± 162.8, $t = 4.24$, $p <.001$) and number of stops (12.5 ± 9.5 versus 15.5 ± 10.3, t=5.68, p<.001), but higher estimates of duration (5:07 ± 4:11 versus 4:16 ± 3:06, t=-2.90, p=.005). With respect to distance, the relative difference between the two devices was 18.93 ± 32.19 km (range -10.85 to 191.20). Absolute differences ranged from .09 to 191.20 km (mean 19.70 ± 31.72). Figure 4.1 (plot of the means) and Figure 4.2 (Bland-Altman plot) present graphical representations of the agreement (concordance) between the two measures.

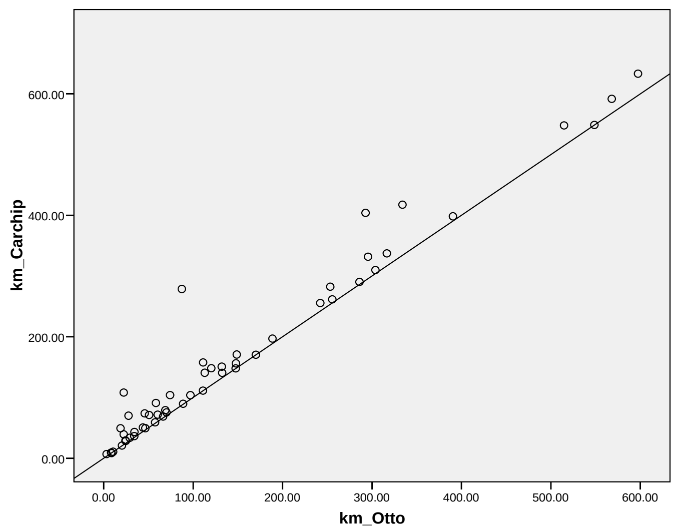

Figure 4.1 Comparison of mean distance (km) between the Otto and CarChip devices

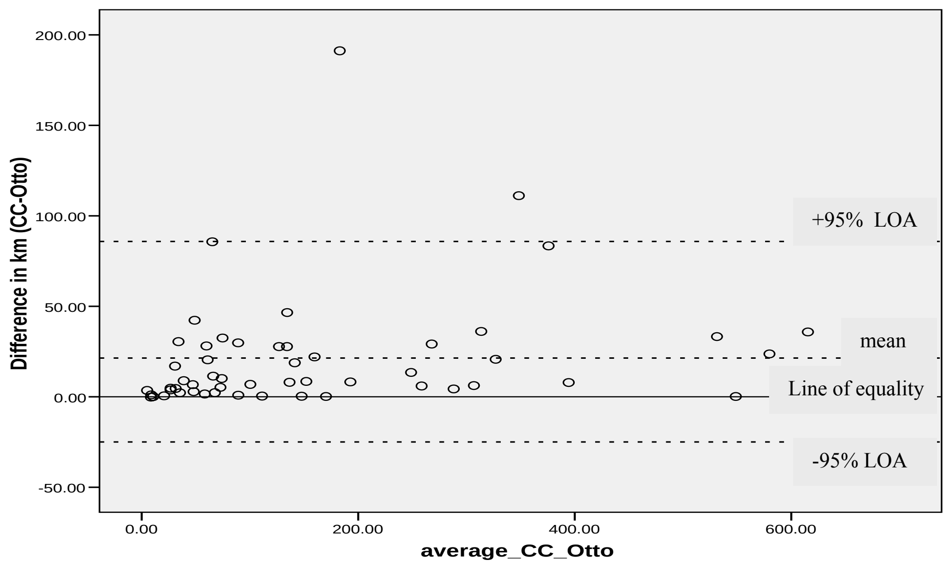

Figure 4.2 Bland Altman plot of difference in distance (Otto – CarChip) versus average values of both measures with 95% limits of agreement

Figure 4.2 shows that some points fell outside the 95% limits of agreement and there was a systematic difference in data recorded by the two devices (majority of points falling above the line of equality). The coefficient of variation (CV) of the difference between CarChip and Otto km was 13.7% and measurement error was 22.8 km. Given the lack of agreement, Otto data was not used to estimate missing CarChip data. CarChip data, considered more accurate, was subsequently used for all analyses pertaining to driving exposure (unless otherwise indicated).

4.5.2 CarChips versus Diaries and Logs

The number of driving trips (t=2.89, p=.005) and stops (t= 2.09, p=.04) differed significantly between the CarChips and activity diaries. CarChips recorded more trips (7.1 ± 4.0 versus 6.3 ± 4.3) and stops (14.9 ± 10.2 versus 13.9 ± 9.6) compared to the self-completed diaries. Similarly, the Otto recorded more trips (7.1 ± 3.7 versus 6.5 ± 4.3; t=2.14, p=.04) than the diaries, but fewer stops (14.5 ± 9.8 versus 12.5 ± 9.6; t=2.51, p=.02). When adjusted for missing values (i.e., when a diary entry was missing, the corresponding CarChip data was excluded and visa versa), the difference between estimated (diary) and actual (CarChip) driving time did not reach significance (4:24 ± 3:45 versus 4:11 ± 3:38; p=.08) and CV=14.9%.

The number of trip log entries (each represented one trip) was significantly lower (6.7± 3.6 versus 7.2± 4.0) than the number of trips according to the CarChip (t = -2.87, p=.006). When corrected for missing logs, the mean number of stops between the CarChip and trip log were similar (12.9± 9.5 versus 12.2± 9.4; p=.15), but had a CV of 21.5%. Mean stops according to both the diaries (12.3 ± 9.1) and trip logs (12.3 ± 9.5) were virtually the same (p=.97) with a CV of 17.2%. Table 4.10 shows the results obtained by the two devices and activity diaries for the 50 people with complete data on all three measures.

Table 4.10 Device and Diary Comparisons

Behaviour	CarChip	Otto	Activity Diary
Distance (km)	173.7 (163.7) 6.8-633.3	155.2 (156.0) 3.3-597.5	-
Duration (hr:min)	4:04 (3:03) 0:07-13:20	5:08: (4:16) 0:08-17:59	4:41 (3:50) 0:15– 19:27
# trips	7.3 (4.0) 0.5-17	7.0 (3.8) 1-16	6.4 (4.4) 0-16
# segments	22.8 (13.8) 2-60	19.5 (12.7) 1-62	22.4 (13.2) 2 - 55
# stops	14.8 (10.1) 1-44	12.5 (9.6) 0 – 46	14.5 (9.8) 1-41

Note: 50 subjects had data for all three of these measures

4.5.3 Exposure

Table 4.11 presents the findings on driving exposure (using CarChip data) and use of other modes of transportation (from the diaries). Trips as the driver represented the highest proportion of all trips (72%), followed by walking (17%), passenger (12%), and then public transport (0.4%). Only one person took public transit and no one took a taxi or used multiple modes of transport in the same trip over the study period. On average, participants drove five days over the week, averaging 1.3 trips per day (1.0 ± .6 over all 7 days) and 2.0 ± .84 stops per trip (ranging from 1 to 5.2). The longest trip made was 259.3 km (2:45), while the shortest was .32 km. The longest trip in km was not the longest in duration; that trip lasted 4:08 and was 258.6 km.

Table 4.11 Driving Exposure and Alternative Transportation Over One Week

Exposure	Total Sample	Gender		Age Group		Status	
		Male	Female	<80	80+	Sole	Couple
# days driven‡	5.2 ± 1.9 1-7	5.5 ± 1.9 1-7	5.0 ± 1.8 1-7	5.1 ± 1.9 1-7	5.2 ± 1.9 1-7	5.7 ± 1.3 3-7	4.2 ± 2.4 1-7
Driving trips/wk‡	7.1 ± 3.9 0.5-17	7.8 ± 4.3 0.5-17	6.6 ± 3.5 1-14	6.7 ± 3.5 1-14	7.4 ± 4.2 0.5-17	8.4 ± 3.7 3-17	5.0 ± 3.4 0.5-13
Stops/wk	14.8 ± 10.1 1-44	16.2 ± 11.6 2-44	13.8 ± 8.9 1-36	13.9 ± 10.1 1 – 42	15.6 ± 10.1 1 - 44	17.9 ± 10.4 4 - 44	9.6 ± 7.1 1-24
Duration (hr:min)‡	4:07 ± 3:06 0:07-13:20	4:46 ± 3:38 0:22-13:20	3:39 ± 2:37 0:07-10:10	3:43 ± 2:48 0:07-10:10	4:25 ± 3:19 0:19-13:20	5:07 ± 3:18 0:32-13:20	2:22 ±1:41 0:07-6:23
Distance (km)‡	164.1±158.4 4.2-633.3	210.8±190.7 8.5-633.3	131.1±123.6 4.2-548.0	149.0±149.2 4.18-548.0	176.4±166.8 6.8 – 633.3	213.5±174.5 10.6-633.3	83.3±79.3 4.2-337.3
Avg radius	7.4 ± 7.5 1.0-45.1	9.4 ± 9.7 1.0-45.1	6.2 ± 5.3 1.8-23.1	7.6 ± 7.1 2.0-26.2	7.4 ± 7.9 1.0-45.1	8.4 ± 8.6 1.0-45.1	5.4 ± 3.6 2.0-14.6
Passenger trips‡	1.1 ± 1.9 0-7	.8 ± 1.7 0-6.5	1.3 ± 1.9 0-7	1.4 ± 2.2 0-7	.9 ± 1.6 0 – 6.5	.4 ± .7 0-2	2.3 ± 2.6 0-7
Walking trips	1.7 ± 2.6 0-10	1.5 ± 2.4 0-7	1.8 ± 2.8 0-10	1.8 ± 2.9 1-10	1.6 ± 2.4 1-8	1.5 ± 2.3 0-8	2.0 ± 3.0 0-10
Public transport	.03 ± .3 0-2	.1 ± .4 0-2	0	0	.1 ± .3 0-2	0	.1 ± .4 0-2
Trips all modes	9.9 ± 4.0 3-22.5	10.3 ± 4.1 3-17	9.6 ± 3.9 5-22.5	9.9 ± 4.0 5-22.5	9.8 ± 4.0 3-17	10.2 ± 3.7 4-17	9.4 ± 4.4 3-22.5

Notes: Exposure data from CarChip, other modes of transportation data taken from activity diaries. Data represented as means ± SD, range. N=58 for # days driven, driving trips/wk, stops/wk, duration, distance, avg radius/trip, and trips all modes. N=60 for all other variables.
‡ Status difference

Sole drivers drove more days (t = 2.88, p=.008), hours (t=3.57, p=.001) and kilometers (t=3.87, p=.001) and took more trips (t = 3.39, p = .001) over the week compared to couple drivers. Conversely, couples made proportionately more of their driving trips with a passenger (48% versus 22%; t= -2.66, p=.01) and took more trips as a passenger (t = -3.45, p=.002). Men drove a greater distance (km) than women (bordering on significance; t = 1.80, p = .08).There were no significant differences in any aspect of driving exposure (including radii and mileage discussed below) by age or month of study participation.

In the follow-up interviews over half the sample (34, 56%) said that their driving behaviour over the study week was typical of their usual behaviour. Of those who said the previous week was not typical (27 or 44%), six (22%) said they drove more than usual, while 21 (78%) drove less than usual. A variety of reasons were provided for driving more than usual (e.g., long trips not normally taken, spouse illness and attending special events). Those who said they drove less than usual sometimes went fewer places (but not fewer trips) and some took fewer trips. Reasons included: loaning their car to family members; too hot to go out; getting ready to go away; poor health; and lots of activities in their building.

Twelve people noted that there were trips they were going to take that week, but decided not to in the end. Reasons cited were: personal illness (n=3); spousal illness (n=1); cancellations by friends/family (n=2); fog (n=1); flat tire (n=1); too much driving as volunteer (n=1); took part in condo activities instead (n=1); and an unexpected dinner (n=1).

Two people (3.3%) noted that they had driving problems over the week. In their own words, the problems were confidence-related. One person experienced nervousness and tension due to being in an unfamiliar area. Another was cut-off when trying to exit the freeway.

4.5.3.1 Radius

The radii of distances traveled from home were calculated using GPS Otto data (n=55). The average radius across all Otto trips (n=393) was 7.7 ± 13.7 km (range .08 to 113.7). The average radius per trip per person was 7.4 ± 7.5 km (range 1.0 to 45.1). Over the week, the majority of participants (70%) made at least half their trips, while 14 people (25%) made all their trips within 5 km of their residence.

When the radius was extended to 10 km, 52 (95%) made at least half their trips, while 27 (49%) made all their trips within this parameter. Only 5 people (9%) made at least 50% of their trips over 10 km from their homes; four of them lived in rural areas (St. Agatha, Freelton and Bamberg). The Bamberg couple drove more than 10 km from their home for all eight trips over the week. Interestingly, the husband drove on only one of the trips which began or ended at home. His wife drove into town on the other trips, while he drove around town while she was working. Overall, compared to couple drivers, sole drivers traveled a greater maximum radius from home (t=-2.94, p=.005). Differences in the average radius per trip between the two groups did not reach significance (t=-1.82, p=.07).

4.5.3.2 Low Mileage Bias

The number of km driven over the study week was extrapolated to obtain an estimate of annual driving distance. Participants were then divided into high, middle and low mileage groups using the cut-points associated with the low-mileage bias (i.e., < 3 000; 3000-13 999; ≥14 000), as explained in the analysis section. As shown in Table 4.12, 17 people (29%) fell below the low mileage cut-point. Of these 17 people, 8 reported in the interview that the week driving was not typical of their usual driving (all said they drove less than usual). There were no significant age or gender differences (gender was close: p=.07). Household status was significant (χ^2 = 8.22, p=.02). A greater proportion of couple drivers were in the low (versus high) mileage group (46% versus 5%), while more sole drivers were in the high (versus low) mileage group (33% versus 19%).

Table 4.12 Actual and Self-reported Behaviour by Mileage Cut-offs (n = 58)

Characteristic	Mileage Cut-off			F (p)
	Low n = 17	Middle n = 28	High n = 13	
Average radius	3.1 ± 1.4 1.0-6.9	5.5 ± 3.2 2.0-14.6	16.5 ± 10.9 6.7-45.1	21.39 (<.001)
Maximum radius	4.9 ± 1.7 1.8-7.6	12.6 ± 13.4 3.2 -73.60	55.7 ± 35.2 15.3-113.7	27.73 (<.001)
# Trips	3.3 ± 2.2 .5-7.0	8.0 ± 2.8 2-14	10.3 ± 4.3 5-17	21.99 (<.001)
Frequency Index	2.8 ± 1.6 1-6	7.3 ± 2.4 4-13	12.0 ± 3.1 6-16	48.40 (<.001)
SDF Score	24.6± 6.3 14-38	29.5± 7.8 12-44	40.5±7.8 22-49	16.78 (<.001)
SDA Score	10.0± 4.8 3-18	10.4 ± 4.1 3-17	5.2±3.2 0-13	7.29(.002)

When the three mileage groups were compared, there were significant differences in radius and number of trips (F values provided in Table 4.12). Post hoc comparisons (Tukey) revealed that those in the low mileage group traveled closer to home with a smaller average ($p<.001$) and maximum ($p<.001$) radius, made fewer trips ($p<.001$) and had a lower frequency index ($p<.001$) than those in the high mileage group. Although the radius was not different, the low mileage group also took significantly fewer trips compared to the middle group ($p<.001$). The middle group had lower average ($p<.001$) and maximum ($p<.001$) radii as well as frequency index scores ($p<.001$) compared to the high group, but there was no significant difference in number of trips. Those in the low mileage group also had lower SDF (<.001) and higher SDA ($p=.008$) self-ratings than those in the high mileage group.

The low mileage group comprised a higher proportion of urban versus rural dwellers (33% versus 0%), whereas the high mileage group was the reverse (57% rural versus 18% urban; $\chi^2=6.67$, $p=.04$). Location of residence was related to multiple aspects of driving exposure. As expected, those in rural areas drove more km (374.5 ± 213.5 versus 135.2 ±

126.8; t= -2.90, p=.03) and a greater average radius from home per trip (16.7 ± 12.6 versus 5.9 ± 5.1; t= -2.40, p=.05). There were no significant differences in maximum radius, number of trips or stops over the week for urban versus rural dwellers.

4.5.4 Driving Patterns

Driving patterns were examined based on when and where people drove. This section presents the findings concerning “when” people drove (time of day, days of the week, weather conditions), followed by “where” people drove (types of roadways, intersections, turns and trip purposes) over the week.

4.5.4.1 When

4.5.4.1.1 Days and Times

As detailed in Appendix O, participants drove mostly at the end and beginning of the week (Friday and Monday), followed by Tuesday, Saturday and Wednesday. The lowest mileage was on Sundays. However, there were no significant differences in distance (F=.74, p=.62), duration (F=.62, p=.72) or number of trips (F=.58, p=.75) by day of the week. Similarly, driving exposure (km) was not significantly different between weekend and weekdays when adjusted for number of days (25.25 ± 28.21 versus 18.95 ± 25.05; t= 1.42, p=.16). There were no significant differences by gender, age group or status.

Also shown in Appendix O, participants drove mostly in the afternoon (12:00pm to 4:59pm) and morning (dawn to 11:59am), followed by evening (5:00pm to dusk) and then at night (dusk to dawn). There were significant differences in exposure (km) by time of day (F=3.26, p=.02). Tukey post-hoc comparisons showed that the primary difference was afternoon versus night (p=.02); morning versus night driving was close to significant (p=.07).

People also tended to drive significantly more during off-peak hours (9 am to 4 pm, 7 pm to 6 am) than peak hours (6 am to 9am and 4 pm to 7 pm) (paired t= -6.88, p <.001).

Only 16 people in the sample (26%), two of whom lived in rural areas, drove at night over the one-week monitoring period. Profiled in Table 4.13, these individuals drove between one to five days of the week at night and anywhere from 2.7 to 129.4 km (average 25 km across all night trips). Only five people (31%) started their trip at night (i.e., full trip), while only four (25%) drove more than one day of the week at night at some point during their trip. There was a significant gender difference in number of km (t=2.24, p=.05), segments (t=2.50, p=.03) and duration (t=2.91, p=.02), with men doing more night driving than women. There were no significant differences by age group or status. The number of km driven at night was positively related to the average (r=.43, p=.001) and maximum (r =.45, p<.001) radius driven. There were no significant differences in km driven at night by month of study participation.

Table 4.13 Night Driving over the Study Week

	Total Sample	Gender		Age Group		Status	
		Men	Women	<80	80+	Sole	Couple
	N=16	n=9	n=7	n=8	n=8	n=11	n=5
Km*	25.4±34.1 2.7-129.4	39.0±41.0 6.1-129.4	8.0 ± 6.0 2.7-17.2	25.9±42.4 2.7-129.4	24.9±26.4 2.9-85.2	31.7± 39.8 2.9-129.4	11.5 ± 8.0 2.7-22.2
Time* (hr:min)	0:30± 0:24 0:06-1:28	0:42±0:26 0:13-1:28	0:15±0:08 0:06-0:25	0:28± 0:24 0:06-1:28	0:33±0:26 0:09-1:28	0:35±0:27 0:09-1:28	0:20±0:11 0:06-0:34
Trips	.9 ± .7 .2-2.5	1.04 ± .81 .3-2.5	.62 ± .30 .2-1.0	.87 ±.61 .2-2.0	.85± .74 .3-2.5	.89 ± .73 .3-2.5	.78 ± .50 .2-1.5
Segs*	2.0 ± 1.2 1-5.6	2.5 ±1.4 1-5.6	1.3 ± .5 1-2	1.9 ± 1 1-3	2.2 ± 1.5 1-5.6	2.0 ±1.3 1-5.6	2.0 ± 1.0 1-3
Days	1.5 ± 1.1 1-5	1.9 ± 1.4 1-5.0	1.0 ± 0 1-1	1.4 ± .7 1-3	1.6 ± 1.4 1-5	1.6 ± 1.3 1-5	1.2 ± .5 1-2

*gender difference

Compared to those who did not drive at night over the study period (45/61 or 74%), these night drivers drove greater distances (p=.06), longer durations (t=-2.20, p=.04) and made more stops (t=-2.14, p=.04) overall. A greater proportion of “night” versus “non-night” drivers were in the high (54% versus 46%) versus the low (6% versus 94%) mileage groups, $\chi^2 = 8.51$, p=.01. Non-night drivers also reported higher situational avoidance (t=3.38, p=.002) and lower situational frequency (t=-2.03, p=.05). Differences in perceptions between “night” and “non-night” drivers are presented in section 4.7.3.

4.5.4.1.2 Adverse Weather Conditions

Appendix P shows the daily weather reports for the study period (June to October, 2007). Thirty-four trips were taken (by 25 individuals) when it rained at some point. The majority (22, or 65%) of such trips were started when it was already raining, while in 12 (35%) instances, the rain started sometime during the trip. The total distance driven in the rain averaged 17.9 ± 14.5 km per person who drove in such conditions (range: .16 to 51.6 km). Archives were consulted to determine the type of rain (e.g., drizzle, rain, heavy rain, thunderstorms). Only two people drove in heavy rain or thunderstorms; one person made one trip, while the other made two trips (separate days) in such conditions. There were no significant gender, age or status differences related to driving on rainy days. Three trips (by three different people) reportedly occurred in foggy conditions, averaging 21.4 km ± 27.8. Weather archives, however, defined fog as visibility of less than 1 km lasting for at least an hour, and did not show foggy conditions in the region for those days.

Weather conditions were also examined for the days participants did not drive. There were 106 instances in which subjects did not make at least one driving trip on a given day. The majority of these instances (86, or 81%) occurred on days with favorable conditions (i.e., no rain or fog), while 20 (19%) occurred on rainy days.

4.5.4.2 Where

4.5.4.2.1 Roadways

Everyone with GPS data (n=55) drove on city streets at least once during the week. The majority also drove on residential streets (52, 95%), just over half drove on rural roads (32, 58%), while 24 (44%) drove on highways and 21 (38%) on freeways. The majority of trip segments were on city streets (88%), followed by residential streets (50%), then rural roads (13%), highways (7%) and freeways (5%).

4.5.4.2.2 Left-hand Turns

GPS data was also examined with respect to left- versus right-hand turns. As might be expected (based on the amount of city driving), participants made both left and right turns during most trips, in general and at intersections (Table 4.14). Overall, the sample made more right versus left turns on average.

Table 4.14 Left and Right Turns

	# lefts turns	# right turns	# lefts intersec	# right intersec	# left at lights	#left no lights/ stop signs*	# left at stop signs
Mean (SD)	6.6 (3.1)	7.2 (3.3)	5.4 (3.2)	5.5 (2.8)	2.6 (1.5)	2.3 (1.3)	1.7 (1.4)
Range	2 - 16	2.5 - 16.5	1.4 - 20	1.6 - 13.5	.27 - 10	0 - 6	0 - 8

*The driver was not controlled by a stop sign, but there may have been stop signs controlling the intersecting road

There was little evidence of “self-restricted” behaviour, specifically by making three right turns to avoid a left turn. However, it was impossible to determine how routes were planned (i.e., based on efficiency, preference or avoidance). Location of residence is likely important as residential areas tend to have more controlled intersections (stop signs) than arterial routes.

4.5.4.2.3 Trip Purposes

Trip purposes were identified by matching activity diary entries with CarChip data. Verbatim descriptions in diaries were reviewed and then grouped into categories based on interview data, the published literature and committee suggestions. Table 4.15 shows the categories selected (e.g., religious, shopping/errands) and the types of activities included in each (e.g., going to church, grocery shopping).

The ‘other’ category was created for activities that did not fit well with existing categories (e.g., hospital visits) and appeared to entail a high level of commitment. According to participants, commitment was usually the deciding factor concerning whether or not to forgo or postpone a trip. Missing trips (n=59) were defined as those recorded by the CarChip but not in the activity diary.

The greatest number of stops and trips made over the week were for shopping and errands. On average, trips were associated with 1.47 ± .74 different purposes (categories), ranging from 1 to 5. Looking at trip purposes individually (i.e., regardless of category), most stops were made for grocery shopping (14%), followed by general shopping (12%), active leisure (7%) and volunteering (6%). The fewest trips were to “help others grocery shop” and “going to movies with others” (one trip, or 0.2%, each).

At the participant level (n=57), the proportion of trips (by category) per person over the week was highest for shopping and errands (43%), followed by social and entertainment (19%), helping others (8%), active leisure (7%), medical (7%), volunteer (5%), religious (5%), other (4 %) and work (2%).

Table 4.15 Driving Trip Purposes

Category	Inclusions	Total Stops* (N=873)	Total Trips† (N=589)
Shopping and errands	shopping, grocery shopping, hairdresser/barber, tailor, pharmacy, filling prescription, gas, picking up coffee, picking up food (take out), banking, postal, other errands	382 (43.8%)	217 (40.0%)
Social and entertainment	visiting friends, visiting family, coffee with others, eating with others, out to eat alone, playing cards, movie with others, shopping with others, library, event, racetrack/casino, daytrip, other (art gallery, arboretum)	148 (17.0%)	105 (19.4%)
Volunteer work	organized work done for others that was unpaid	65 (7.4%)	37 (6.8%)
Helping Others	take shopping, take grocery shopping, drive to appointments, pick up and/or drop off, drop something off at someone's house, other (including help build deck, sign granddaughter up for camp, water plants, house maintenance, take son to karate class)	56 (6.4%)	42 (7.7%)
Active leisure	golfing, lawn bowling, walking, hiking, swimming	49 (5.6%)	46 (8.5%)
Religious	going to church, bible study	34 (3.9%)	30 (5.5%)
Other	visit spouse in nursing home, visit cemetery, take dog to vet, visiting friends/family at hospital, funeral, bereavement therapy group, vote	29 (3.3%)	26 (4.8%)
Medical	doctor, optometrist/eye, physiotherapy, chiropractor, dentist, other (flu shot)	27 (3.1%)	25 (4.6%)
Paid work/school	full- or part-time paid work, school	22 (2.5%)	14 (2.3%)
Missing	CarChip data but no corresponding activity diary information	61 (7.0%)	47 (8.7%)

*number of stops made for that purpose over entire study period
†total trips for that purpose (could combine multiple stops from the same or other categories)

When probed in the interview (n=60) about trips they would postpone if the weather was poor or they didn't feel like driving, most people said that they would postpone shopping and errands and/or social and recreational trips (90%). Specifically, nine people (15%) said they would postpone or forego everything (including medical appointments). One person said:

“when you are retired you don’t have to do anything”, while others commented that they stock up at grocery store in the event they can’t go out for one or two days. Six people noted that they postpone everything except doctor appointments, two others would postpone anything that is “not imperative”, while one would postpone anything without an appointment. Thirty-four (57%) specifically mentioned postponing social, recreational, or shopping/errands, whereas four (7%) noted anything out of town. Others would not volunteer (n=3) or drive others (n=1). Six (10%) explicitly said they would not postpone anything.

When asked which trips they felt “compelled to do” even if they didn’t want to do it (due to weather or otherwise), 44 people (73%) mentioned medical appointments (doctor, specialist, dentist, eye doctor). A few qualified their response (e.g., only specialists in town or only those hard to get). Several people noted they are very reluctant to give up doctor appointments as they are hard to get or there are cancellation charges. Some mentioned they would continue to volunteer (n=7), drive others (n=3), go to church activities (n=3), grocery shop (n=2), performances (n=1) or visit ill friends (n=1). Nine people (15%) did not feel compelled to do anything (even doctor appointments, saying they had few aside from routine check-ups). Interestingly, the woman who visited her husband daily at the nursing home said she could skip a visit as she sees him so often.

Based on the qualifying responses above, trip categories were further collapsed into ‘obligatory’ versus ‘discretionary’. Obligatory trips included anything involving a “commitment”, including: paid work/school, volunteer work, medical, helping others and those in the ‘other’ category. Discretionary trips, meanwhile, included: religious services or events, shopping and errands, social and recreational and active leisure.

Number of discretionary (versus obligatory) trips was more strongly associated with km driven (r =.62, p<.001 versus r =.40 p=.002), number of trips (r =.35, p=.008 versus r =.16, p=.24) and number of trips at night (r =.89, p<.001 versus r =.56 <.001) over the study period. Although not significantly related to average radius per trip overall, discretionary trips were significantly related to maximum radius driven from home (r =.28, p=.04), whereas obligatory trips were not (r=.09, p=.54). Interestingly, those with an average radius of less than 5 km (n=28), made significantly fewer trips for social and entertainment activities (t=3.37, p=.002) and active leisure (e.g., golfing) (t=2.21, p=.03), but more trips for medical purposes (t=-2.27, p=.03) than those whose average radius was greater than 5 km. There were no other significant differences in the various trip types between the two groups.

The low mileage group (n=17) made significantly fewer discretionary (2.7 ± 1.9 versus 8.6± 3.8; t=7.80, p<.001) and obligatory (1.4 ± 1.7 versus 3.0 ± 2.4; t= 3.01, p=.004) trips overall, compared to those with an estimated annual mileage above 3000 km (n = 41). Although not significant, this group had a lower proportion of discretionary trips (68% versus 76%) and a higher proportion of obligatory trips (32% versus 24%). Within the low mileage group, people still made more discretionary than obligatory trips (paired t = 2.61, p=.02).

Sole drivers (versus couples) made significantly more discretionary trips (p = .001), as well as trips for religious purposes (p=.01), shopping/errands (p=.003) and social or entertainment (p=.02). While there were no significant differences in number of trips or purposes by gender or age group, social/entertainment trips neared significance (p=.06), with men tending to make more such trips than women. Differences between rural and urban dwellers emerged for religious (t=2.34, p=.03) and obligatory trips (t= -2.30, p=.05). Specifically, those living in rural areas took more (and a higher percentage of all trips) trips for religious purposes and more committed trips.

4.5.5 Passengers

A total of 137.5 trips (33% of all trips) involved at least one passenger (up to four), averaging 2.37 ± 2.53 trips over the study week (ranging from 0 to 9 trips per person). Per person, the proportion of all trips with a passenger averaged 32% ± 35 (ranging from 0 to 100% or all of their trips). Passengers (n = 166) were most often spouses (49%), followed by friends (32%), other relatives (13%), others (4%) and grandchildren (2%). One passenger (1%) was undefined in the trip log.

There were no significant differences in number of trips with passengers by age group; however, there were differences by gender and status. Of those who drove with passengers at least once, men made proportionately more trips with passengers in general (63% ± 31 versus 22% ± 28; $t=2.31$, $p=.03$) and with their spouse as a passenger (3.5 ± 2.5 versus .94 ± 2.0; $t=3.41$, $p=.002$). Compared to sole drivers, couples also made proportionately more trips with passengers in general (49% ± 43 versus 22% ± 25; $t=-2.70$, $p=.01$) and with their spouse in particular (3.5 ± 2.2 versus 1.3 ± 2.46; $t=-2.71$, $p=.01$) but fewer trips with a friend (.5 ± 1.0 versus .7 ± 1.1; $t = 3.07$, $p=.005$).

4.6 Comparison of Actual and Self-reported Driving Behaviour

Comparisons of actual and self-reported driving behaviour are presented in this section. Exposure, including distance driven and length of trips is presented first, followed by situational and general driving patterns.

4.6.1 Exposure

4.6.1.1 Weekly Distance Driven

As described in Section 4.5, 32 participants (53% of the sample) provided an estimate of the number of km they drove over the study week. CarChip data was available for 31 of these 32 individuals. Participant estimates (196.2 ± 203.4 km, range 6.0 to 800), were not significantly different (p=.97) from the kilometers recorded by the CarChips (195.3 ± 188.3, range 6.8 to 633.3 km). However, participants tended to both over and underestimate km, with variability of estimates increasing as the distance actually driven increased (Figure 4.3). The CV was 44.5% and a measurement error of 77.5 km. Bland-Altman plots (Figure 4.4) show a few points falling outside the limits of agreement.

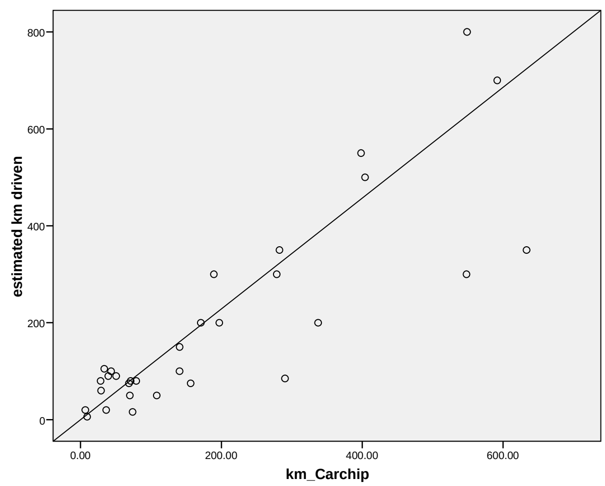

Figure 4.3 Plot of Estimated versus Actual Distance (km) with line of equality

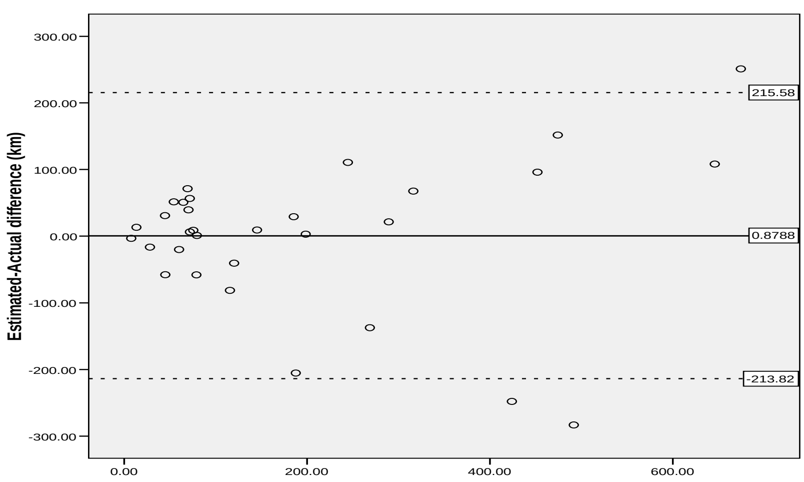

Figure 4.4 Bland Altman Plot with 95% limits of agreement of difference in distance (Estimated – Actual) versus average values of both measures.

Note: The mean difference and line of equality are almost equal (.88 versus 0)

4.6.1.2 Trip Duration or Length of Trips

Self-reported duration ("How long are most of your driving trips each way?"; less than 15 min, 15 to 30 min, 30-60 min, or over 60 min?) was compared to the highest proportion of actual trip lengths. Actual trip lengths were grouped into the same categories for comparison (shown in Table 4.16). Self-reported and actual duration were not significantly related (ρ = .19, p=.16). While trip duration corresponded with typically reported behaviour for about a third of the sample (22/58 or 38%), over half the sample overestimated their trip lengths (33/58, or 57%); very few underestimated (3, or 5%) their trip lengths.

Table 4.16 Trip Length: Actual versus Self-report

Self-report (most trips)	Highest proportion of actual trip lengths				Total
	<15	15-30	30-60	>60	
<15	13	2	1	0	**16**
15-30	28	7	2	0	**37**
30-60	2	1	0	0	**3**
>60	0	1	1	0	**2**
Total	**43**	**11**	**4**	**0**	**58**

*κ could not be computed given the lack of values for trips >60 minutes

4.6.2 Situational Frequency and Avoidance

The modified 11-item SDF scale (self-ratings) and the corresponding Frequency Index of actual behaviour are described in Section. 3.7.3 and Appendix J. Paired t-tests showed that people actually drove in these challenging situations more often over the week than they reportedly usually do (mean scores 7.1 ± 3.9 versus 5.6 ± 4.8; t=3.06, p=.003). Specifically, 34 people (63%) had higher Frequency Index scores, while 17 (31%) had higher self-reported frequency scores (Figure 4.5 shows the graphical representation of the means against each other). Only three people (6%) scored identically on both measures. The CV was 39% and measurement error was 2.5. It is noteworthy that the sample did not drive (or report typically driving) in challenging situations very often; the means were low in relation to the theoretical mean (6 or 7 versus 11).

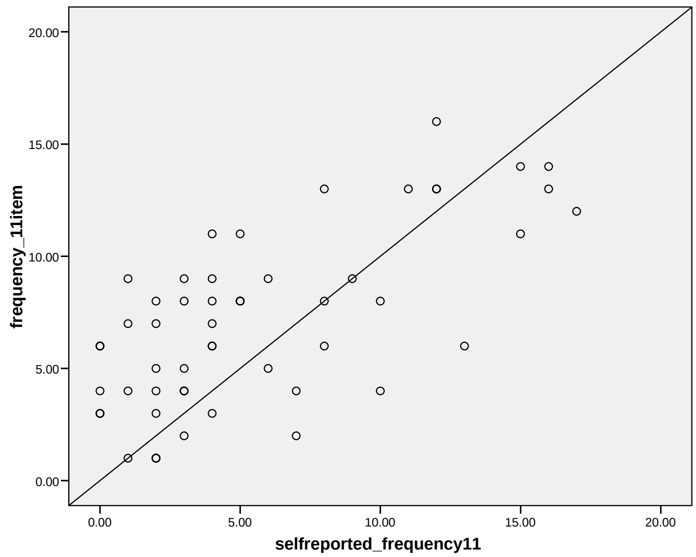

Figure 4.5 Actual versus Self-reported Frequency Index

Appendix Q shows the level of agreement (and κ) for each of the 20 situations on the SDA scale (e.g., driving at night), concerning whether people said they tried to avoid the particular situation when possible (yes/no) and whether they actually drove in the situation over the study period (yes/no). Various patterns are described below.

Night, Dawn or Dusk Driving (Items 1,2)

As previously mentioned, 16 people drove at night during the study period. Eleven of the 16 (69%) did not indicate that they typically tried to avoid night driving (κ indicated significant agreement between self-report and actual behaviour). Additionally, km driven at night was significantly lower (t= 2.26, p=.05) for "avoiders" (8.8 ± 6.8 versus "non-avoiders" (35.8 ± 38.6). While there was no significant difference in the number of trips at night (p=.21), there was a significant difference in the number of trip segments (t= 2.49, p=.03). Based on the average number of segments (2.4 ± 1.3 versus 1.3 ± 0.4), it appears that those who usually avoided night driving tended to drive directly home.

No one drove at dawn (the first appearance of light in the sky as the sun rises), while 9 people (15%) drove at dusk (twilight, or time at which the sun is below the horizon in the evening). Only one out of these nine people said they usually tried to avoid the situation.

Bad Weather (Items 3, 4, 5, 6)

Bad weather conditions over the study period included rain and fog. While 25 people drove in such conditions, the majority of them (19, or 79% - one person didn't complete the avoidance rating) reported that they usually try to avoid driving in bad weather. Distance (km) driven in bad weather was higher, although not significantly ($p=.24$), for non-avoiders (30.4 ± 17.7) than avoiders (18.4 ± 21.3). All three people who drove in fog said that they usually try to avoid this situation if possible.

Only two people drove in heavy rain. One person (who made one trip in rain) usually tries to avoid this situation. The other, who made two trips, does not. While no one drove in heavy rain at night, four people drove in general rain at night. Half ($n=2$) said they try to avoid the situation when possible, whereas the other half did not. The distance (km) driven in rain at night was higher for non-avoiders than avoiders (12.2 ± 7.7 versus 2.3 ± 2.7), although the sample sizes are too small to examine significance.

Long trips and unfamiliar routes (Item 9 and 10)

Only one person drove more than two hours one way. She did not report trying to avoid the situation when possible. Five people (8%) drove in unfamiliar areas or through detours. While all five only made one such trip, three said they do not try to avoid the situation when possible.

Heavy traffic or rush hour (Items 11 and 12)

Most of the sample (46, or 85%) drove in rush hour in town at least one day of the week. The majority (27, or 59%) of people who drove in city rush hour reported avoiding the situation when possible. The days driven in rush hour in town were higher (but not significantly) for non-avoiders compared to avoiders (3.6 ± 1.6 versus 3.1 ± 1.5; p=.27).

Sixteen people (29%) drove at least once in rush hour on a highway or expressway. Although slightly more of these people (9 or 56%) reported trying to avoid the situation when possible, they actually drove fewer days in highway rush hour compared to the non-avoiders (1.1 ± 0.3 versus 2.1 ± 1.2), with the difference bordering on significance (t=2.18, p=.07).

Left-hand turns (Items 13 and 14)

Each person with GPS data (n=55) turned left at traffic lights and when there were no lights or stop signs; only three (6%) noted that they try to avoid left turns at traffic lights. Thirteen people generally try to avoid left turns with no lights or stop signs and correspondingly made fewer left turns with no lights/stop signs compared to non-avoiders (14.0 ± 11.3 versus 19.7 ± 15.2). The difference, however, was non-significant (p=.16). Ten people reported generally avoiding only one type of left turn (without lights/stop signs), while three people avoid both types of left turns. Of the 10 people who avoided only lefts with no lights/stop signs, eight made more left turns at lights.

Highways (Items 16 and 18)

Only six people drove on highways with three or more lanes and speed limits of 100 km/h or greater. All of them said that they do not try to avoid such highways. It is important to note that the KW Conestoga expressway did not fall into this category of highway (although divided with three lanes each way, the speed limit is only 90 km/hr).

Twenty-three people with GPS data drove on two lane highways. Again, none of them checked that they generally avoid two lane highways. In fact, only two people of the total sample reported trying to avoid such highways.

Rural Areas at night (Item 19)

Three people drove in rural areas at night (one trip each). Two of them said they did not try to avoid the situation.

Driving with passengers who may be distracting (Item 20)

Thirty-seven people drove with a passenger at least once over the week, but it is uncertain if these passengers were distracting (participants were not asked). Most of those who drove someone else (29, or 78.4%) are self-reported non-avoiders. The number of trips with passengers was significantly higher ($t=3.23$, $p=.004$) for non-avoiders (4.4 ± 2.2, $n=27$) than for avoiders (2.3 ± 1.4, $n=8$).

Trip Purposes

Relationships between trip purposes and self-ratings of situational driving frequency and avoidance are shown in Table 4.17; proportions of trips by category are in Appendix R. Situational frequency ratings were significantly related to volunteer, active leisure, shopping/errands and social/entertainment trips (the higher the frequency score, the higher the number of trips in each category). When grouped, SDF scores were also positively related to both obligatory and discretionary trips. However, only the proportion of volunteer trips was significantly related to situational frequency ($r =.27$, $p=.04$).

The only trip category significantly related to both SDF and SDA scores was social/entertainment. That is, higher frequency and lower avoidance (of challenging situations), related to more trips were taken for social/entertainment purposes. The relationship between avoidance and the proportion of all trips taken for social and entertainment purposes was also significant in the appropriate direction ($r = -.33$, $p=.01$).

Table 4.17 Trip Purposes and Self-reported Behaviour

Trip purpose	Frequency	Avoidance
Religious	-.01 (.96)	.07 (.60)
Work/school	-.01 (.93)	-.12 (.37)
Volunteer	.34 (.01)	-.21 (.13)
Active leisure	.27 (.04)	-.03 (.84)
Shopping/errands	.35 (.01)	-.05 (.70)
Social/entertainment	.40 (.002)	-.37 (.005)
Medical	-.02 (.91)	-.07 (.62)
Helping others	.25 (.06)	.02 (.90)
Other	.05 (.72)	.04 (.79)
Obligatory	.34 (.01)	-.14 (.31)
Discretionary	.43 (.001)	-.20 (.14)

Note: Values are represented by Pearson r (p-value)

4.6.3 Other Driving Patterns

4.6.3.1 Days and Time of day driven

The number of days typically driven in a week (self-reported) was compared to the number of days actually driven over the study period. The means were very close (self-report = 5.1 ± 1.8; actual = 5.2 ± 1.9). According to paired t-tests, the difference was not significant ($t = -.29$, $p = .77$) and the CV = 17.4%. There was an exact match for 30 people (52%). The largest discrepancy (5 days) was a participant who became ill and was advised by his physician not to drive.

According to Table 4.18, those who reported typically driving during early evening and at night (self-reports) actually drove during these times at least once during the study week. The same relationships were not found for driving in the morning or afternoon. The results based on Kappa statistics must be interpreted cautiously given the uneven distribution of observations across groups (personal communication, Dr. Bédard).

Table 4.18 Self-reported and Actual behaviour: Time of Day

Self-report	Times actually drove		κ (p)
	No	Yes	
Morning			
No	1	3	.16 (.23)
Yes	4	50	
Afternoon			
No	0	3	-.06 (.68)
Yes	3	52	
Evening			
No	14	5	.42 (.001)
Yes	11	28	
Night			
No	39	5	.54 (<.001)
Yes	6	11	

4.6.3.2 Roadways

Table 4.19 shows actual and self-reported roadways driven. Except for rural roads (which approached significance), there was poor agreement between roadways typically driven (self-report) and actually driving on such roads over the study period.

Table 4.19 Self-reported versus Actual Roadways Driven

Self-report	Actually drove on roadway		κ (p)
	No	Yes	
Residential			
No	0	12	-.10 (.35)
Yes	3	40	
Main City			
No	0	11	*
Yes	0	44	
Rural			
No	16	14	.25 (.06)
Yes	7	18	
Freeway			
No	18	8	.14 (.28)
Yes	16	13	
Highway			
No	9	7	-.001 (.99)
Yes	22	17	

*κ not computed as at least one variable must be in each cell

4.7 Associations between Perceptions, Abilities and Behaviour

While the study included various measures of driver perceptions (such as importance of driving, nervousness, barriers to reductions), the DCS and PDA scales are the primary measures of interest. This section presents associations between driver comfort and perceived abilities with objective driving abilities, self-reported and actual driving behaviour.

4.7.1 Objective Driving-related Abilities

Shown in Table 4.20, neither driving comfort or perceived abilities scores were related to scores on the two measures of driving–related abilities, or associated level of impairment for the RPW test (p>.71). Given there was only one person with impairment in UFOV scores, correlations between UFOV impairment and perceptions were not examined.

Table 4.20 Association between Perceptions and Objective Abilities

Task Score	N	DCS-D	DCS-N	DCS-N#1	PDA	PDA change
UFOV	34	-.25 (.15)	-.12 (.50)	-.10(.50)	-.06(.65)	-.05(.73)
RPW	51	-.03 (.82)	-.07 (.65)	-.11(.54)	.19(.29)	.04(.82)

Note: values are Pearson r (p) except for UFOV, DCS-N#1 and PDA change (Spearman ρ (p))

With respect to the most germane abilities, UFOV scores were not related to the PDA attention sub-scale scores (sum of items 8 and 11 on both PDA and PDA change). However, RPW scores were related to PDA item #12 (able to get in/out of car) (r=-.41, p=.003) in the expected direction (lower RPW scores, higher perceived ability to get in/out of the car). Interestingly, four out of the five people with lower body mobility impairments considered themselves to have very good or good abilities on item #12.

Although in the expected direction, neither UFOV nor RPW scores were significantly related to self-reported situational behaviour (SDF or SDA scores). As shown in Table 4.21, UFOV scores were not related to the primary measure of exposure (i.e., km), but were significantly related to duration, as well as average and maximum radii. In contrast RPW scores were not related to any of these measures, but were significantly related to night driving (distance and duration). Neither UFOV or RPW scores discriminated between the three mileage groups.

Table 4.21 Associations between Abilities and Actual Behaviour

Behaviour	RPW N=51	UFOV n=32
Distance (km)	-.05(.76)	.28 (.12)
Duration	-.09(.53)	.39 (.03)
Radius (avg)	.28 (.06)	.40 (.03)
Radius (max)	.25 (.08)	.49 (.006)
# trips	-.23 (.11)	.39 (.03)
# stops	-.19(.21)	.11 (.55)
# days	-.25(.08)	.06 (.76)
Night (km)	.56(<.001)	.18 (.32)
Night (duration)	.40 (.004)	.18 (.32)
Frequency Index	-.10(.53)	.49 (.008)
Low mileage bias	-.05 (.74)	.11(.54)

Note: Both lower RPW and UFOV scores are better

4.7.2 Self-reported Driving Behaviour

Table 4.22 shows the relationships between driver perceptions and self-reported driving behaviour. Scores on the DCSs and PDA (current) scale were significantly related to situational frequency and avoidance scores, as well as usual night driving.

Scores on the DCS (both day and night) were also significantly related to typically driving on freeways and highways (higher comfort, more driving on such roads). Additionally, DCS-N scores were related to driving on rural roads and estimated weekly km driven. Neither comfort nor perceived abilities were related to typical trip lengths, morning or afternoon driving or driving on residential roads or main city streets.

Table 4.22 Perceptions and Self-reported Behaviour

Characteristic	N	DCS-D	DCS-N	DCS-N #1	PDA	PDA Change
Week Study Period						
Distance						
Pearson r (p)	31	.29 (.11)	.39 (.03)	.21(.25)	.26(.15)	-.10(.63)
Situational ratings						
Avoidance						
Pearson r (p)	60	-.48 (<.001)	-.59 (<.001)	-.31(.02)	-.51(<.001)	.21 (.10)
Frequency						
Pearson r (p)	60	.45 (<.001)	.58 (<.001)	.54(<.001)	.51(<.001)	-.13 (.32)
Typical driving						
Roads						
rural						
no	35	66.7 (15.9)	47.3 (24.0)	79.3 (22.3)	32.4 (6.9)	19.7 (4.7)
yes	26	71.8 (13.9)	63.6 (23.5)	89.4 (14.4)	32.9 (5.3)	18.4 (7.3)
t-value (p)		-1.33 (.19)	-2.66 (.01)	-1.74(.08)	-.33(.74)	-.60(.55)
freeways						
no	30	64.7 (15.4)	45.5 (23.9)	76.7 (21.7)	31.6 (6.9)	20.2 (4.9)
yes	31	72.9 (14.0)	62.7 (23.2)	90.3 (15.4)	33.5 (5.5)	18.1 (6.7)
t-value (p)		-2.19 (.03)	-2.85 (.006)	-2.65(.008)	-1.18(.24)	-1.35(.18)
highways						
no	18	60.2 (13.8)	37.7 (21.2)	75.0 (24.3)	30.4 (7.4)	21.7 (5.3)
yes	43	72.5 (14.3)	61.2 (23.2)	87.2 (16.7)	33.5 (5.5)	18.1 (5.9)
t-value (p)		-3.13 (.004)	-3.83 (.001)	-1.89(.06)	-1.57(.13)	-2.34(.02)
Time						
early evening						
no	20	65.3 (12.4)	46.1 (22.7)	77.5 (24.2)	30.7 (6.0)	19.0 (4.3)
yes	41	70.6 (16.2)	58.2 (25.2)	86.6 (16.9)	33.5 (6.2)	19.2 (6.6)
t-value (p)		-1.40 (.17)	-1.89 (.07)	-1.35(.18)	-1.75(.09)	-.09(.93)
at night						
no	44	65.1 (13.8)	46.4 (22.8)	79.6 (20.4)	31.9 (6.4)	19.3 (4.9)
yes	17	78.7 (14.3)	74.7 (17.6)	94.1 (14.1)	34.9 (5.0)	18.8 (8.2)
t-value (p)		-3.38 (.002)	-5.18 (<.001)	-2.77(.006)	-2.09(.04)	-.63(.53)

4.7.3 Actual Driving Behaviour

As shown in 4.23, scores on the DCS-N were significantly related to most of the indicators of actual driving behaviour (other than number of trips and days driven) in the expected direction (i.e., higher comfort level regarding night driving was related to greater driving behaviour). Scores on the DCS-D and DCS-N item #1 were also positively related to the average radius per trip (those with lower comfort drove closer to home).

Table 4.23 Perceptions and Actual Driving Behaviour

Behaviour	DCS-D	DCS-N	DCS-N #1	PDA	PDA Change	Barrier
Distance (km)	.24	.43*	.36†	.36†	-.16	.31§
Duration	.16	.39†	.35†	.38†	-.15	.30§
Radius (avg)	.27§	.40†	.38†	.22	-.05	.21
# trips	.05	.21	.26§	.34†	-.15	.32§
# stops	.18	.34†	.35†	.37†	-.17	.30§
# days	-.01	.14	.24	.29§	-.20	.31§
Night (km)	.29§	.35†	.23	.15	-.18	.30§
Night (duration)	.29§	.40*	.23	.13	-.17	.27§
Frequency Index	.17	.39†	.38†	.38†	-.11	.34†

Note: all values presented as Pearson r, with the exception of DCS-N#1 and PDA change which are presented as Spearman ρ. N=58, except for radius (n=55).
*p<.001; †p<.01; §p<.05

Perceived current driving abilities scores (PDA) were significantly and positively related to exposure (the higher the perceived abilities, the greater the weekly distance traveled): time spent driving, number of trips, stops and days driven and frequency of driving in challenging situations. Similarly, perceived barriers were significantly related to all aspects of driving behaviour, except for average radius per trip. Those who perceived a greater number of barriers to reducing driving exhibited greater driving behaviour. None of the indicators of driving behaviour were significantly associated with PDA change or the driving nervousness scores.

Table 4.24 shows the scores on the driver perception measures and objective tests for the three mileage groups. As can be seen, only the DCS scores (Day, Night and item # 1 on the DCS-N, as well as current PDA scores discriminated between these groups.

Table 4.24 Low Mileage Bias, Driver Perceptions and Objective Abilities

Characteristic	Mileage Cut-off Low n = 17	Middle n = 28	High n = 13	F (p)	Post-Hoc (Tukey's)
DCS-D	64.7 ± 15.9	68.3 ± 14.7	77.4 ± 13.7	2.80 (.07)	-
DCS-N	41.5 ± 21.0	53.2 ± 24.8	75.1±17.4	8.52 (.001)	Low/high (<.001) Middle/high (.01)
DCS-N item #1	72.1 ± 24.8	86.6 ± 15.9	96.2 ± 9.4	10.0 (.007)	(Kruskal Wallis)
PDA	31.2 ± 5.8	32.0 ± 5.9	37.2 ± 5.4	4.74 (.01)	Low/high (.02) Middle/high (.02)
PDA change	19.7 ± 3.7	19.3 ± 4.8	17.9 ± 9.7	1.77 (.41)	-
RPW	7.2 ± 1.7	6.1 ± 1.3	7.2 ± 2.9	2.26 (.12)	-
UFOV	177.9 ± 151.7	151.0 ± 88.9	196.8 ± 62.4	.47 (.63)	-
Barriers	9.0 ± 5.7	11.2 ± 5.5	13.6 ± 7.0	2.21 (.12)	-
Nervousness	.3 ± .5	.5 ± .9	.5 ± .9	.68 (.51)	-

Driver perceptions were also related to the driving distance and duration at night, although the relationships were not as strong as with overall km. Those who drove at night had significantly higher DCS-D scores (75.6 versus 66.5, t=-2.17, p=.04) and DCS-N scores (70.9 versus 48.4, t=-3.71, p=.001), with differences approaching significance for DCS-N item #1 scores (90.6 versus 81.1, t=-1.92, p=.06). Perceived abilities, driving nervousness and barrier scores did not differ significantly between those who drove at night over the week and those who did not. Also, DCS-N scores correlated significantly with the 11-situation Frequency Index score (r = .40, p=.003). In all cases, driving behaviour was more strongly related to DCS-N compared to DCS-D scores. DCS scores, however, were not related to the proportion of km driven by time of day.

Table 4.25 displays the relationship between driver perceptions and trip purposes. Only number of trips taken for volunteer and for social/entertainment purposes was significantly associated with either perceived comfort or abilities scores. When trips were categorized as obligatory versus discretionary, relationships with DCS-N #1 (driving at night under good conditions) and PDA scores were also significant. When the proportion of all trips was examined by purpose, only the percent of volunteer trips correlated with perceptions (DCS-N item #1 and PDA).

Table 4.25 Perceptions and Trip purposes

Trip purpose	DCS-D	DCS-N	DCS-N #1	PDA	PDA Change
Religious	-.06 (.66)	-.13 (.32)	.08 (.56)	-.08 (.57)	-.02 (.89)
Work/school	.05 (.69)	.18 (.18)	.08 (.58)	-.02 (.89)	-.14 (.29)
Volunteer	.14 (.31)	.18 (.17)	**.30 (.03)**	**.29 (.03)**	.004 (.98)
Active leisure	-.08 (.55)	.06 (.64)	.23 (.08)	.11 (.41)	-.13 (.34)
Shopping/errands	-.04 (.76)	.03 (.80)	.14 (.30)	.24 (.07)	-.08 (.55)
Social/entertainment	.24 (.08)	**.38 (.003)**	.22 (.09)	**.30 (.02)**	-.16 (.24)
Medical	.07 (.59)	.05 (.73)	.11 (.40)	.16 (.24)	-.20 (.14)
Helping others	-.01 (.92)	.05 (.71)	.23 (.08)	.09 (.49)	-.02 (.88)
Other	-.20 (.14)	-.13 (.34)	.12 (.37)	.15 (.26)	-.03 (.84)
Obligatory	.03 (.83)	.17(.20)	**.30 (.02)**	**.34 (.01)**	-.05(.74)
Discretionary	.05 (.70)	.19 (.15)	**.29 (.03)**	**.29 (.03)**	-.14 (.28)

Note: All values are Pearson r (p-value) with the exception of DCS-N item#1 and PDA change [which are Spearman ρ (p-value)].

With respect to alternative modes of transport, none of the driver perception scores (DCSs, PDAs, nervousness, barriers) were significantly related to the number of trips using public transit, riding as a passenger or walking over the week.

4.8 Comparisons of Sole versus Couple Drivers by Gender

While household status and gender differences have been noted throughout the Chapter, this section looks specifically at the influence of gender (and traditional roles) within sole versus couple drivers. For couples, we also wanted to examine shared driving patterns and level of comfort in their partner's driving (compared to their own driving).

Table 4.26 shows the differences in driving behaviour (actual and self-reported) and perceptions for men and women according to whether they were sole drivers or part of a driving couple. Sole versus couple differences were far more evident than gender differences, particularly with respect to actual driving behaviour. Both male and female sole drivers had higher levels of driving exposure over the week, including distance (km), duration, number of stops and trips compared to couples. When divided into mileage groups, only 8% of sole male drivers fell into the low group, compared to 46% of the men in couples ($\chi^2 = 8.11$, p=.02). Although the same trend existed in women drivers, the relationship was not significant.

Table 4.26 Comparison of Men and Women by Status

	Men		(p)	Women		(p)
	Sole (n=14)	Couple (n=11)		Sole (n=25)	Couple (n=11)	
Actual Behaviour						
Distance (km)	301.9±206.5	103.2± 94.5	<.01	163.5± 134.1	63.4±58.2	<.01
Duration (hr:m)	6:43±3:52	2:49±1:48	<.01	4:12±2:28	1:56±1:33	<.01
Radius (avg)	11.6±11.8	5.9±3.4	.11	6.6± 5.8	4.9±3.8	.35
Radius (max)	36.4±36.9	11.2± 14.8	<.05	19.9± 25.6	7.9±4.8	<.05
# trips	10.1±4.4	5.3±3.2	<.01	7.5±3.0	4.6±3.8	<.05
# stops	21.4±12.4	10.4± 7.1	<.05	16.3±8.7	8.9±7.5	<.05
# days	6.1±1.2	4.6± 2.4	.08	5.5±1.3	3.7±2.4	<.05
Night (km)	23.0±38.4	2.6± 6.8	.07	1.1±3.2	2.7±5.6	.39
Night (time)	0:24±0:31	0:04± 0:11	<.05	0:02±0:05	0:05±0:09	.39
Frequency Index	10.2±4.3	6.0±4.0	<.05	6.5±3.2	5.6±4.0	.58
Self-Reported Behaviour						
SDF	33.2±10.6	34.7±5.8	.65	28.6±9.2	26.1± 6.9	.38
SDA	8.7±5.7	7.7±4.2	.62	10.1±4.7	9.4± 4.4	.65
Perceptions						
DCS-D	72.0±12.4	77.0±16.8	.41	64.6±16.3	66.5±11.1	.68
DCS-N	59.4±26.8	68.6±23.6	.37	47.1±24.5	50.1±19.1	.70
DCS-N item#1	85.7±23.4	95.5±10.1	.28	77.0±19.0	84.1± 20.2	.29
PDA	33.4±5.8	33.6±6.9	.94	32.2±6.8	31.5± 5.1	.73
PDA change	18.5±10.1	19.7±4.1	.40	19.3± 4.4	19.0± 3.2	.84
Nervousness	.4 ±.5	.5±.9	.76	.5±.8	.5± .9	.79
Barriers	12.5± 6.8	9.7±6.4	.31	12.3± 4.6	7.6± 6.5	.05

Self-reported driving behaviour (SDF and SDA ratings) and perceptions, with the exception of barrier scores, were not significantly different by household status for either gender. Perceived barriers to reduction or cessation were significantly higher for sole women drivers compared to women in couples; scores for men were in the same direction. While not significant, sole drivers (of both genders) had lower comfort scores (day and night). Sole men drivers also tended to rate their abilities lower than ‘coupled’ men.

While driving exposure was different for sole versus couple drivers (both genders), driving patterns were quite similar. Differences are highlighted below for men and women, respectively. Male sole drivers drove more km during weekdays compared to male couple drivers (t=2.76, p=.01), but the proportion of time and distance spent driving in the morning, afternoon, evening and night was not significantly different. The frequency of driving in challenging situations (Frequency Index scores) was higher for male sole drivers (p=.03). Specifically, sole men made more left-hand turns (t=2.73, p=.01) and trip segments on both rural roads (t=2.26, p=.04) and two-lane highways (t=2.26, p.04). A higher percentage of sole participants also drove in rush hour (χ^2=4.20, p=.04; 57% versus 13%) and on a freeway (χ^2 =6.04, p=.01; 79% versus 25%) at least once during the study week. For women, sole drivers drove more km during both the weekdays (t=2.50, p=.02) and on weekends (t=2.20, p=.04), in peak hours (t = 3.08, p=.05). More trip segments were driven on city streets and made a higher proportion of trips lasting more than 2 hours in total (2.72, p=.01).

Within sole and couple drivers, the number of trips made with passengers was not significantly different between men and women. Finally, it is noteworthy that all the sole drivers (whether men or women) reported taking their vehicles in for servicing themselves. As reported below, traditional gender roles were quite apparent in couples when it came to servicing their vehicles.

4.8.1 Perceptions and Behaviours within Couples

As previously noted, a total of 11 driving couples (comprising 22 individuals) took part in the study. Table 4.27 displays their comfort ratings (DCS scores, both self- and ratings of their partner), PDA scores and selected driving behaviour for the total sample of couples and by gender. Although not significant, men had higher personal comfort scores on both the

Day and Night DCSs, had lower comfort in their partner's driving and took more driving trips (but fewer trips overall using all modes of transportation) than females. However, the proportion of trips with passengers was significantly higher for men than women (77% versus 25%). Frequency scores (via the SDF scale, 11 items) were also higher (t=2.52, p=.02) for men than women (7.5 ± 5.0 versus 4.4 ± 4.2); however, this was not reflected in their actual driving behaviour over the week (no significant differences in Frequency Index scores).

Table 4.27 Perceptions and Behaviour of Men and Women in Couples

Characteristic/Ratings	Total (N=22)	Gender		t (p)
		Male	Female	
DCS-D (self-rating)	71.8 (14.9) 44.2-98.1	77.0 (16.8) 44.2-98.1	66.5 (11.1) 50.0-82.7	1.74 (.10)
DCS-N (self-rating)	59.3 (23.0) 17.2-100	68.6 (23.6) 29.7-100	50.1 (19.1) 17.2-73.4	2.05 (.06)
Partner DCS-D	80.4 (15.5) 48.1-100	79.1 (15.3) 52.5-98.1	81.6 (16.4) 48.1-100	-.38 (.71)
Partner DCS-N	74.6 (17.1) 40.6-100	74.1 (14.9) 53.1-93.8	75.1 (19.9) 40.6-100	-.14 (.89)
PDA	32.6 (6.0) 23.0 – 45.0	33.6 (6.9) 23.0 – 45.0	31.5 (5.1) 24.0 – 41.0	.85 (.41)
PDA change	19.4 (3.6) 15.0 – 27.0	19.7 (4.1) 15.0 – 27.0	19.0 (3.2) 15.0 – 26.0	-.07 (.95)
# driving trips	5.0 (3.4) 0.5-13	5.4 (3.06) 0.5-10	4.6 (3.8) 1-13	.56 (.58)
Distance driven (km)	83.3 (79.3) 4.2-337.3	103.2 (94.5) 8.5-337.3	63.4 (58.2) 4.2-192.5	1.19 (.25)
# trips with passenger	2.5 (2.6) 0-7	3.4 (2.2) 0-7	1.7 (2.6) 0-7	1.59 (.13)
Proportion of trips with passenger	.5 (.5) 0 – 2.0	.8 (.5) .0 - 2.0	.3 (.4) 0-1.0	2.63 (.02)
# trips as passenger	2.3 (2.6) 0-7	1.4 (2.4) 0-6.5	3.3 (2.4) 0-7	-1.80 (.09)
# trips all modes	8.9 (4.8) 0-21	8.3 (2.9) 3-14	10.5 (5.5) 5-22.5	-1.19 (.25)
Frequency Index	5.8 (3.9) 1-13	6.0 (4.0) 2-13	5.6 (4.1) 1-11	.19 (.86)

When couples drove together, traditional roles appeared (i.e., the husband often preferred to drive and the wife let him). Ten individuals reported that they typically drive (all ten were men) when they travel with their spouse. Nine others (all women) reported that their spouse typically drives and three individuals reported that the driving was shared equally (two women, one man). However, there were three couples where roles were adjusted given a change in circumstances. Specifically, in two couples the women drove more often given the onset of temporary illness (both cardiac related) of their husbands, who were told not to drive by their physicians at the beginning of their participation in the study. In the third case, the female actually drove considerably less than her husband; however, it was because her husband had been diagnosed with Alzheimer's Disease but desperately still wanted to drive. She would always be the passenger (never let him drive alone) but actually preferred to be the driver. She restricted his driving to familiar, routinely traveled areas close to home.

Traditional roles were very apparent within couples regarding car servicing. Specifically, 91% of men said they take the car in for servicing (1 man commented that someone other than themselves or their partner does this task), whereas only one woman (9%) has this responsibility. Eight of the other women (73%) have their spouse take the car in and two have someone other than their spouse take care of the servicing.

Table 4.28 shows how each partner rated themselves and their spouse on the DCSs. There were thirteen (out of 44) occasions when someone rated themselves higher than their partner; 10 (77%) of such ratings were by the husband. The three women who rated themselves higher had husbands who had either problems driving at night or been advised to temporarily stop driving for medical reasons. When one partner rated themselves higher, 92.3 percent (12/13) of the time their spouse was in agreement (rating themselves lower). Individuals tended to rate their comfort in their own driving lower than their confidence in their partners' driving in both day (paired t=-2.49, p=.03) and night (paired t=-3.57, p=.005). Also, the relationship between couple's own DCS-D scores bordered on significance with how their partner rated their confidence in them on the partner DCS-D (r=.43, p=.06) and partner DCS-N (r=.41, p=.06) scales.

Table 4.28 DCS Self and Partner Ratings

		DCS-D			DCS-N		
Couple	**Partner**	**Self-rating**	**Partner rating**	**Higher rating**	**Self-rating**	**Partner rating**	**Higher rating**
1	Husband	44.2	92.3	Partner	29.7	93.8	Partner
	Wife	55.8	80.8	Partner	28.6	82.8	Partner
2	Husband	66.7	76.9	Partner	50.0	70.0	Partner
	Wife	57.7	88.5	Partner	17.2	59.4	Partner
3	Husband	67.3	53.9	Self	46.9	56.3	Partner
	Wife	50.0	94.2	Partner	45.3	81.3	Partner
4	Husband	59.6	52.5	Self	42.2	60.9	Partner
	Wife	59.6	67.3	Partner	35.9	65.6	Partner
5	Husband	92.3	88.5	Self	76.6	82.8	Partner
	Wife	80.8	84.6	Partner	64.1	79.7	Partner
6	Husband	88.5	84.6	Self	100	53.1	Self
	Wife	63.5	100	Partner	56.3	100	Partner
7	Husband	78.9	94.2	Partner	79.7	93.3	Partner
	Wife	82.7	59.6	Self	73.4	40.6	Self
8	Husband	98.1	98.1	Equal	68.8	79.7	Partner
	Wife	73.1	91.3	Partner	70.0	84.4	Partner
9	Wife	60.4	48.1	Self	33.3	45.3	Partner
	Husband	73.1	69.2	Self	73.4	60.9	Self
10	Husband	96.2	76.9	Self	100	89.1	Self
	Wife	78.9	94.2	Partner	68.8	96.9	Partner
11	Husband	82.7	82.7	Equal	87.5	75.0	Self
	Wife	69.2	88.5	Partner	57.8	90.6	Partner

For daytime driving, mean comfort levels of partners were lowest when their spouse was driving in heavy rain (72%), an unexpected storm (72%), when others tailgate (74%), seem distracted (74%), or pass on a non-passing lane (75%). For nighttime situations, people rated their comfort the lowest in their partner when other drivers pass on a non-passing lane (64%), in heavy rain (65%), in winter conditions (66%), when there is glare from lights (66%) and when other drivers seem distracted (68). The ratings were lower at night.

Most drivers (18 or 73%) were thinking about being the passenger when rating their comfort level in their spouse; three others were thinking of their spouse alone and one person considered both situations when completing the ratings. Only four people (18%), all of whom were thinking about being a passenger, said that their ratings may have been different if they thought about their spouse driving in the opposite condition (e.g., their partner was alone). Three of these people noted that the ratings would have likely been lower if they had been thinking of their spouse driving alone.

Ratings by individuals' partners (i.e., how they were rated by their partner) on the DCS-N were significantly related to their situational avoidance (SDA) scores ($r=-.47$, $p=.03$) and number of trips made at night ($r=.42$, $p=.05$). How they were rated on the DCS-D was not significantly related to participants' self-perceptions (e.g., PDA scores) or driving behaviour (e.g., km, radius, mileage group). Interestingly, partners' comfort in participants' day driving was inversely related to thoughts about driving reduction ($r=-.42$, $p=.05$); lower comfort ratings by their partner was related to participants' thoughts about driving reduction.

4.9 Relative Influence of Factors on Actual Behaviour

Multivariate regression analyses were conducted with two measures of exposure (km driven and average radius per trip) to examine the relative influence of various factors found to be related to actual driving behaviour in the bivariate analyses. The regression with distance (km) will be presented first, followed by the analysis repeated with average radius per trip. Only those with CarChip data (n=58) were included.

4.9.1 Distance (km)

Based on bivariate associations (presented in Section 4.7.3 and Appendix S) and the sample size available (n=58), the following variables were selected as independent variables: (1) household status; (2) gender; (3) PDA scores; (4) barrier scores; (5) location of residence;

and (6) DCS-N scores. DCS-N was selected over DCS-N item #1 given that the former is a multi-item measure (versus single item) and has a slightly higher correlation with the dependent variable. Self-rated health was not included in the model since there were few people who rated their health as poor or fair. Self-rated eyesight compared to others was also excluded as it would have reduced the sample size considerably, while last physician was not included given only one person responded "more than one year ago" and the correlation was not significant (p=.61).

After completing backwards linear regression (6 variables, N=56 after removing those with missing values), the final model included status, gender, DCS-N, perceived abilities and location of residence and accounted for 59% of weekly km driven. However, after reviewing the residual plots (Appendix T), the assumption of constant variance was not met. A log transformation was performed (natural log of the dependent variable) and the analyses were re-run. While improved, the residual versus predicted plot was still showing a U-shape (Appendix T). The problem was regulated with a square-root transformation.

The final model (III in Table 4.29) suggests that location of residence, household status, perceived abilities and gender (in that order) account for the most variance in the square-root of km driven. Together, the variables accounted for 57% of the square-root of weekly km driven. The adjusted R^2 was .53, suggesting that the model would account for 53% of square-root km if derived from the general population.

Table 4.29 Regression Models: Square-root of kilometers driven

Model	Predictors	R2	Change R2 (p-value)	Variable removed
I	Status, gender, DCS-N, PDA, barrier score, location of residence	.595		Barrier score
II	Status, gender, DCS-N, PDA, location of residence	.588	-.007 (.36)	DCS-N
III	Status, location of residence, PDA, gender	.568	-.020 (.13)	

N=56

Table 4.30 shows the relative contribution of all independent factors in the model, as indicated by the standardized beta values (degree of importance of each variable). In the presence of other variables, residential location was the most highly related to km driven, followed by household status, then perceived abilities followed by gender. Specifically, being a sole driver, rural dwelling, male and having high perceived abilities were related to higher square root of km driven.

Table 4.30 Final Regression model: Square-root Kilometers Driven

Variable	Coefficient (B)	95%CI	Standardized Beta (β)
Constant	10.75	2.08 to 19.42	
Status	-4.90	-7.18 to -2.62	-.40 (<.001)
Location of residence	4.12	2.35 to 5.89	.43 (<.001)
Gender	-2.71	-4.97 to -.45	-.23 (.02)
Perceived abilities	.331	.14 to .52	.33 (.001)

R^2 = .57; Adjusted R^2=.53; F-ratio = 16.77(p<.001); N=58.

The residual plots were suggestive that the assumptions of normality, constant variance and linearity were reasonable. All residuals are within ± 2.0, with 90% falling within ± 1.96. Cook's distance values were within acceptable limits (<1.0), suggesting no influential cases or outliers. There was no evidence of multicolinearity according to the tolerance and VIF values (Table 4.31) met the desired criteria (<10 for VIF and > 0.25 for tolerance).

Table 4.31 Collinearity Statistics

Variable	Tolerance	VIF
Status	.98	1.02
Location of residence	.99	1.01
Perceived abilities	.97	1.03
Gender	.96	1.04

4.9.2 Average Radius per Trip

Similar to above, bivariate relationships with average radius were also examined. The independent variables selected to enter into the model were location of residence, walking proximity to church/ social/recreation activities, DCS-D and DCS-N scores. A log transformation was required (residual plots shown in Appendix T).

Table 4.32 displays the backwards selection process resulting in the final model (III) while Table 4.33 shows the relative contribution of all independent factors in the model. The model accounted for 38% of the variance in the log of the average radius per trip. The log of the average radius was most influenced (in the presence of other variables) by location of residence. DCS-N scores accounted for about 36% of the variance in the dependent variable.

Table 4.32 Regression Models: Log of the Average Radius per Trip (n=56)

Model	Predictors	R^2	Change R^2 (p-value)	Variable removed
I	location of residence; DCS-D; DCS-N; proximity to church, social, recreational	.40	.40(<.001)	DCS-D
II	location of residence; DCS-N; proximity to church, social, recreational	.39	-.008 (.41)	Proximity
IV	location of residence, DCS-N	.38	-.008 (.42)	

Table 4.33 Final Regression Model Average Radius per trip

Variable	Coefficient (B)	95%CI	Standardized Beta (β)
Constant	.40	.22 to .58	
Location of residence	.19	.09 to .30	.41 (<.001)
DCS-N	.005	.002 to .008	.36 (.002)

R^2 = .38; Adjusted R^2=.36; F-ratio = 16.34 (p<.001); n=56

Again, the residual plots (Appendix T) suggest that the regression assumptions are reasonable and there is no evidence of influential points or multicolinearity (Table 4.34).

Table 4.34 Collinearity Statistics

Variable	Tolerance	VIF
Location of residence	.92	1.08
DCS-N	.92	1.08

Chapter 5 Discussion

5.1 Introduction

Consistent with Bandura's Social Cognitive Theory (1977) and Rudman et al.'s (2006) framework, driver perceptions (particularly comfort level) may play a key role in self-regulation. While there is some evidence to support these associations (e.g., MacDonald et al., 2008), prior studies have relied on self-reports of driving behaviour. The primary purpose of this study was to extend this research by examining driver perceptions in relation to measures of actual driving behaviour. Additionally, we wanted to explore the influence of driver perceptions relative to other factors such as gender, age and location of residence. While gender differences in older drivers are well documented, household status (i.e., sole versus couple drivers) has not been previously examined with respect to driver perceptions or actual driving behaviour.

Using a convenience sample of 61 English-speaking older drivers living in South-Western Ontario, this study examined driver perceptions (comfort level and perceived abilities) in relation to actual behaviour, compared perceptions and behaviour of sole versus couple drivers, investigated the correspondence between self- and partner-rated comfort levels and compared actual and self-reported behaviour. This chapter begins by addressing the primary study limitations. Subsequent sections discuss the findings concerning driving behaviour, relationships with perceptions and differences between sole versus couple drivers. Gender, age and rural/urban differences are discussed throughout. The chapter ends with overall conclusions and directions for further research.

5.2 Study Limitations

All studies, including the present, have limitations, which must be considered when interpreting the study findings. Three of the primary limitations of this study (the monitoring period, small sample size and limited driving performance data) are addressed below. Additional limitations are noted throughout the chapter.

5.2.1 Monitoring and Interpreting Behaviour

Similar to others using electronic devices (Huebner et al., 2006; Marshall et al., 2007), the driving of each participant was monitored for seven consecutive days. Half the sample (56%) reported that their driving behaviour was typical, however, some reported driving more (n=6) and others less (n=21) than usual over the study period. There was more daylight during this time of year (late spring to fall) and according to trip logs and archives, the weather was reasonably good (i.e., no long stretches of bad weather) over the study period. Archive data, based on readings from the closest weather tower, may not accurately describe the conditions experienced, especially when people travelled through several jurisdictions.

In any case, the present study provides only a snapshot of driving behaviour over one-week between early June and late October in S.W Ontario. As we only had 7 sets of electronic devices, it was not possible to extend the monitoring period to examine fluctuations in driving behaviour or seasonal variation. Sabback and Mann (2005) found that older drivers in Western New York reported fewer driving trips in the winter than those in Florida. It is certainly possible that drivers in Ontario might restrict their driving more in the winter and further studies are required to seasonal and geographic variation.

5.2.2 Sample Size and Representativeness

Participants were restricted to English-speaking older adults' aged 70 years and older (except for two of the spouses) living in South-Western Ontario. Inclusion criteria stipulated that participants had to be either the only driver in the household or, if part of a driving couple, had to share a single vehicle. Having more than one vehicle was the primary reason couples were excluded. Also, vehicles had to be 1996 or newer and a non-hybrid model, which excluded a few other individuals. While the vehicle year restriction will be less of an issue in future studies, compatibility of devices (CarChip) with hybrid vehicles may become more problematic as such vehicles become more widely available.

The sample was relatively small (N=61) and was reduced further due to missing data from the CarChips (n=58) and Ottos (n=55). As such, general analyses (particularly multivariate regression modeling) were limited. Additionally, there were only 8 people from rural areas and 11 couples, limiting sub-group comparisons. People who volunteer for driving studies may be more motivated to drive and likely consider themselves as good drivers. Ontario drivers may be particularly motivated given the mandatory in-person license renewal process for those 80+ and road testing of those 70+ involved in an at-fault collision. Of interest, we found that younger seniors in our sample reported more "nervousness" when driving. Ontario older drivers may be more functional than those in other jurisdictions (passed licensing requirements) or may already be restricting their driving (natural selection process).

Drivers are more likely to self-regulate as age increases (Persson, 1993). The present sample (average age 80), was older than those in many prior studies (early to mid 70's) (e.g., Baldock et al., 2006; Marottoli et al., 2000; Owsley et al., 2003; Parker et al., 2001; Ragland et al., 2004; Vance et al., 2006). This was likely due to the high proportion (44%) of the sample recruited from the MTO group sessions.

5.2.3 Limited Driving Performance Data

Due to the burden already placed on participants, the study protocol included only two objective measures of functional driving abilities (UFOV and RPW), both of which have been shown to be predictive of crash risk (Ball et al., 2006; Marottoli et al., 1994; Owsley et al., 1998; Staplin et al., 2003). Given the time required for the other assessments and interviews (up to 1.5 hours) as well as frequent problems with the UFOV, some people chose not to (n=10) or could not (n=17) do the tasks. Such problems reduced the sample size considerably (i.e., only 34 with UFOV scores) for related analyses.

A more extensive battery of functional tests (such as vision), as well as other measures of driving performance (driving records, on-road or simulator assessments), would have permitted a more thorough investigation of driving safety. Unfortunately, the scope of the study and subject burden, together with available resources precluded inclusion of such measures. Performance assessments, however, also have limitations. For instance, crash statistics do not reflect near-crashes, dangerous driving behaviours and unreported events (Fox, Bowden & Smith, 1998). Moreover, crashes are infrequent events and drivers may not think that they were at fault (Eby et al., 2003). On-road assessments, meanwhile, are time consuming, require trained examiners, can be stressful for older drivers (Freund, Gravenstein, Ferris & Shaheen, 2002) and are usually conducted in "optimal" conditions which may not detect decrements in abilities (Eby et al., 2003). Simulator assessments, on the other hand, may be unrealistic, requires the use of an unfamiliar apparatus and can cause "simulator sickness" (Ranney, Pulling, Rush & Didrikson, 1986).

5.3 Driving Behaviour

This section begins with a discussion of the correspondence between measures of driving behaviour, including the in-vehicle measures and the objective versus self-reported measures. Exposure and patterns of behaviour are discussed next.

5.3.1 Correspondence between Measures

5.3.1.1 CarChips, Ottos, Logs and Diaries

Actual driving behaviour was assessed using two electronic in-vehicle devices (CarChip and Otto) and two self-completed tools (trip logs and activity diaries). This multi-method approach permitted verification (i.e., who was driving the vehicle), creation of multiple variables (e.g., radius, round trips and stops), and context (e.g., trip purposes). Triangulating several data sources provided more meaningful information than could be captured with any of these methods on their own, as discussed below.

While the CarChips were primarily used to quantify exposure and the Otto to examine patterns, the two devices were able to record similar information, including: date; time of day; distance; and duration. Consistent with a priori expectations, Otto devices recorded fewer km and stops than CarChips, likely due to the time it takes for the GPS receiver to lock into satellite signals (Huebner et al., 2006).

The inconsistencies between these recording devices have implications for data derived solely from the Otto (i.e., turns made and roadways, areas and radius driven). The frequency of certain roadways driven may be underestimated, particularly for city and residential streets as the Otto likely misses information at the beginning of trips and segments. Radius estimates were not expected to be appreciably affected; the Otto did not seem to miss a significant number of trips and it was possible to identify with certainty if participants started from their home. Because recordings for exposure were systematically lower, Otto data were not substituted in the three cases with missing CarChip data.

Unexpectedly, we found that the Ottos recorded more time (hrs) than the CarChips. This difference may be due to the power source supplying the Otto. Some vehicles have a "live" cigarette lighter or power socket, which means that the socket will supply power, whether the vehicle is turned on or not (Persen Technologies, 2008).

The trip logs and activity diaries provided context to objective driving data. The trip logs were used to verify the driver, number (and relationship) of passengers, and ascertain whether the study participant drove the entire trip or only part way. Participants were also asked to note the weather conditions for each trip, providing their interpretation (e.g., a few people described heavy rain when actually lighter rain according to archives) and/or conditions that may not have been noted in Environment Canada weather archives (e.g., fog). The activity diaries, meanwhile, provided a description of out-of-home activities over the week and car use relative to other modes of transport. Additionally, linking trip purposes to the CarChip data helped the researcher join segments into full trips.

Used in isolation, however, the trip logs and activity diaries would be limited. In terms of exposure, the logs could only be used to estimate number of trips and stops. According to our findings, the logs underestimated the actual number of trips and stops without CarChip data to verify their number and accuracy. Also, the logs could only address a limited number of driving patterns (e.g. weather conditions and time of day). Although activity diaries can capture more driving-related information than the logs, details about the location and estimated travel durations were often missing. Consistent with previous reports (e.g., Kiernan et al., 1999; Murakami & Wagner, 1999; Wolf et al., 2001), many of our participants felt that the daily diaries were quite onerous to complete.

5.3.1.2 Actual versus Self-reported Behaviour

Although self-reported driving distance has been widely used as an indicator of exposure, the validity or accuracy of these estimates is uncertain (Owsley et al., 1999; Staplin et al., 2003). In their study with older drivers (mean age 73), Huebner and colleagues (2006) had 19 people drive with a CarChip installed in their vehicle for one week. Although mean distance according to self-reports and CarChips was not significantly different, participants both over- and under-reported the distance they actually drove (coefficient of variation was 34% and measurement error was 110 km). The authors concluded that self-reports did not accurately represent the distance driven.

Similarly, our sample both over- and under-estimated their weekly km. While the means were close (within 1 km), there was a large coefficient of variation (45%) and measurement error (77 km), suggesting that self-estimates were inaccurate relative to actual km driven (Huebner et al., 2006). Furthermore, only half the sample said they could provide an estimate. Had the entire sample been pressured to provide a "guesstimate", the discrepancy between self-reported and actual distance driven may have been even greater.

Significant differences were found for other aspects of actual behaviour, including the frequency of engaging in challenging situations. People tended to report more restricted driving patterns on a general basis (typically drive less frequently in challenging situations) than they actually drove over the week. As discussed previously, it is possible that the week was not representative of their usual driving patterns.

Agreement between specific SDA items and whether or not people drove in the corresponding situations was significant for only three situations (i.e., at night in general, night in bad weather and freeways with speeds of 100 km/hr or greater), two of which pertained to night driving. Those who reportedly try to avoid night driving when possible tended not to drive at night over the study week. Prior studies have similarly found that night driving is the situation most often avoided by older adults (e.g., Sabback and Mann, 2005: Benekohal et al., 1994). While the present study compared reported and actual driving patterns, these preliminary findings must be interpreted cautiously given the small sample size, time of the year (i.e., more daylight), and weather conditions. Additionally, it is unclear whether certain situations were purposefully avoided or simply not encountered (e.g., no compelling reason to go out at night) over the one-week study period.

5.3.2 Exposure

Exposure has been quantified in several ways, including number of trips, days and distance driven. The latter seems to be the most commonly used indicator (e.g., Burns, 1999; Huebner et al., 2006; Marottoli & Richardson, 1998; Parker et al., 2001), especially when pertaining to self-regulation (e.g., Stutts, 1998) and crash risk (e.g., Lyman et al., 2002; Maycock, 1997; Ryan et al., 1998).

Comparatively, the current sample drove less (mean 164 km) than found in previous studies using CarChips. Marshall et al. (2007) reported that their sample (20 older drivers living in Ottawa, average age of 78 years) drove an average of 186 km driven per week, even though their data were collected in February. Conducted in similar seasons to the present study, Huebner et al.'s (2006) Winnipeg sample (60 to 86 years of age, average 73 years) drove a much higher distance over the week (average 340 km). Both the Marshall et al. (2007) and Huebner et al. (2006) samples had a high proportion of men (75% and 70%, respectively), which may partly explain the greater distances. Travel to cottages over the summer and fall period by the Winnipeg sample may also explain their substantially greater driving distance (personal communication, Dr. Porter).

The average number of trips per day by the current sample was comparable to available estimates for older drivers in general. Based on large national surveys, average daily trip estimates of older drivers have ranged from one or less (Davey & Nimmo, 2003; Straight, 1997) to 3.4 (Collia et al., 2003). On any given day of the week, our sample averaged one trip (# trips/ 7 days). On days when they actually drove (average 5 days per week), the mean number of trips increased slightly to 1.3. From the literature, it is unclear whether the majority of trips by older drivers are simple (i.e., reach destination, then return home) (Collia et al., 2003) or complex (i.e., more than one stop before returning home) (Mollenkopft et al., 1997). The current sample appeared to trip-chain, making an average of 2 stops per trip.

As expected, men drove more than women (although not significantly) and rural residents drove more than those living in urban areas (Bauer et al., 2003; Burkhardt & McGavock, 1999; Glascow & Blakely, 2000; Mollenkopf et al., 2004; Benekohal et al., 1994; Collia et al., 2003; Rosenbloom, 1999). Rural-dwellers, however, did not make more trips or more stops, suggesting that greater exposure (km) may be due to longer distances to destinations, rather than driving to more places in one trip. Prior studies have shown mixed results concerning number of trips for rural versus urban living older drivers (Mollenkopf et al., 2004; Pucher & Renne, 2005; Hildebrand et al., 2004). Our study findings must be interpreted cautiously given the small number of rural participants (n=8). Furthermore, it is unclear whether these trends would be seen in more remote areas (e.g., Northern Ontario).

For North American seniors, driving is the primary and preferred mode of transport

(Burkhardt & McGavock, 1999; Eby et al., 2003; Benekohal et al., 1994). If they cannot be the driver, older adults prefer to be the passenger in a personal vehicle (Kostyniuk & Shope, 2003; Rosenbloom, 1988; Ritter, Straight & Evans, 2002; Straight, 1997), particularly women (Burkhardt & McGavock, 1999; Golob & Hensher, 2007; Kostyniuk & Shope, 2003). Consistent with these studies, current participants primarily drove (and preferred to drive) themselves to activities. In contrast, walking was the second most commonly used mode of travel over the week, possibly due to the sample's high physical functioning and location of residence (mostly urban). Traveling as a passenger was the third highest mode of transport used, albeit passenger trips were only marginally lower than walking trips. Consistent with previous findings, women were passengers more often than men.

5.3.2.1 Radius

Many jurisdictions that offer restricted licenses impose limits on distance traveled from home (Stutts, 2000; Marshall et al., 2002). Radius may also be an important indicator of self-regulation, although it has not been widely examined to date.

The critical radius size (i.e., the point where radius becomes "too restrictive" to one's quality of life) likely depends on where the person lives in relation to services and activities. In both Canada and the US, access to grocery stores for most people has been estimated to be within 1.44 km (Smith, 1991) to 3 km (Bertrand, Therien, & Cloutier, 2008) from home. Data from the 1995 Nationwide Personal Transportation Survey (Davey & Nimmo, 2003) showed that older Americans traveled, on average, almost 8 km to church, 11 km to the doctor and 10.5 km for personal or family business. Love and Lindquist (1995) noted that 80% of seniors in Illinois had a hospital within 7.7 km, while Lin (2004) reported access to the nearest pharmacy (also in Illinois) within 1.4 km.

This is one of the first studies to actually quantify radius driven by older adults using GPS technology. Our sample drove about 7.4 km per trip (however, the average radius driven was higher for rural versus urban drivers). A quarter of the sample had fairly restricted travel over the week (less than a 3 km radius on average per trip), whereas the average radius for half the sample was less than 5 km per trip. Those with a limited radius may be restricting their recreational activities, as we found that those with an average radius of 5 km or less made fewer trips for social and entertainment as well as for active leisure, but made more trips for medical purposes compared to those whose average radius from home was greater than 5 km. Traveling close to home over the study week was also related to low mileage.

5.3.2.2 Low Mileage Bias

While older drivers have been shown to have an increased crash rate per kilometer driven (Chipman et al., 1993; Ryan et al., 1998), some researchers (e.g., Hakamies-Blomqvist, 2002; Langford et al., 2006) have argued that low annual mileage (i.e., ≤ 3000 km) may explain increased crash risk, regardless of age. Both studies (and others, such as Alvarez et al., 2008) found that those with low annual mileage had higher crash rates than those with an annual mileage greater than 14000 km. These studies, however, are limited by the use of self-reported distances and crash rates (Staplin et al., 2008).

For exploration purposes, the present sample was categorized into the three mileage groups by extrapolating actual weekly distance driven. Current participants were evenly distributed across groups by gender and age. While about half of sole and couple drivers were in the middle category, more couple drivers were in the ‘low mileage’ and more sole drivers in the ‘high mileage’ group. The low mileage group also traveled closer to home (smaller average radius) and had a lower frequency of engagement in challenging situations (lower

Frequency Index). As mentioned, such extrapolations may not accurately capture annual driving distance. Weekly estimates may be conservative given the favorable weather conditions of the study period and previous findings showing reduced driving in winter conditions (Keall & Frith, 2006; Sabback & Mann, 2005). On the other hand, it is possible that some Canadian seniors (e.g., snowbirds) may actually drive greater distances in the winter months (to get to their destination and once there).

In any case, further research is required to examine the low mileage bias with respect to actual driving and safety records. Odometer readings and the use of electronic devices (accompanied by trip logs to verify the driver of the vehicle) are more objective ways to measure this potential bias. Examining driving exposure according to regional conditions and types of roadways is also important, since as Keall and Frith (2006) argued crash rates are particularly high in dense urban areas.

5.3.3 Patterns

Generally, the driving patterns of our sample were similar to prior findings with older drivers. Specifically, the sample tended to do most of their driving during the day (mornings and afternoons) outside of rush hour, on city roads, and in familiar areas (Benekohol et al., 1994; Burns, 1999; Collia et al., 2003; Hakamies-Blomqvist & Wahlström, 1998; Keall & Frith, 2006). The least amount of driving was done at night. Those who did not drive at night also appeared to be restricting in other ways (higher situational avoidance scores, low mileage and low average radius).

Contrary to expectations, current participants frequently negotiated left turns (both at intersections and in the middle of blocks). Left turns are considered more challenging and are often avoided by older drivers in general (Benekohol et al., 1994; Burns, 1999). Consistently, few of our participants reportedly try to avoid left hand turns when possible (on the SDA scale) and about half the sample noted that they typically make left turns at intersections "very often" (at least 4 days a week) on the SDF scale.

Out-of-home activities have been examined in several ways, including: essential versus non essential (doctor's appointments, pharmacy and grocery shopping versus going to library, other errands) (Bauer, Rottunda & Adler, 2003), basic versus optional (shopping versus going to café) (Heyl, Wahl & Mollenkopft, 2005) and productive versus consumptive (volunteer work versus eating out with friends) (Klumb & Maier, 2007). Although general groupings (e.g., social and entertainment, shopping) were derived from the literature (e.g., Fricke & Unsworth, 2001), it was clear from our interviews that decisions to make a trip (versus postpone or forgo) were highly dependent on the perceived level of commitment. In general, people felt strongly about activities to which they made a commitment (e.g., helping others, volunteer work, medical appointments). As such, trips were also grouped based on commitment (i.e., discretionary versus obligatory).

Consistent with prior findings (Hoenig et al., 2006), most trips by our sample were made for shopping and errands, followed by social and entertainment. This is not surprising as many participants (74%) felt they generally had money to do most things. Similar to Siren and colleagues (2004), our participants noted in the interviews that social and entertainment trips would be the first to go if they had to give up or reduce driving. Supporting these comments, those with a smaller average radius took fewer trips for entertainment (and more for medical purposes). Despite their importance, leisure trips often decrease with age to accommodate completion of instrumental activities of living (Siren et al., 2004).

5.4 Functional Abilities and Medical Conditions

The sample as a whole demonstrated good visual information processing speed (UFOV) and lower body mobility (RPW), with few scoring in the 'impaired range'. The mean UFOV score (171 ms) was less than half and only one person score above the cut-off (353 ms). Similarly, only 5 people were considered 'impaired' on the RPW.

As expected based on findings by MacDonald et al. (2008), objective abilities were not related to driver perceptions (DCS or PDA scores) or the primary indicator of driving exposure (km driven). Unexpectedly, significant relationships emerged between UFOV scores, driving duration and radii. These relationships were not in the expected direction (i.e., poorer executive functioning was associated with higher radii and duration) and may be spurious (i.e., due to the number of calculations). In any case, it is debatable whether drivers are able to discern decrements in executive functioning pertaining to their driving ability.

Conversely, mobility problems may be more noticeable. Previously, we found that RPW scores were associated with perceived abilities to get in and out of the car and move from the gas to the brake (MacDonald et al., 2008). One might speculate that older adults with mobility problems may rely more on driving (compared to walking or public transit). While poorer lower body mobility was associated with more night driving, a similar association did not appear for daytime driving.

As one may expect, visual abilities may more directly influence driving comfort, especially at night. Those reporting a diagnosed vision disorder (cataracts, glaucoma or macular degeneration) expressed significantly lower driving comfort at night, while those who perceived their eyesight to be about the same as their peers reported greater decline in their abilities (from 10 years ago) compared to those who perceived their eyesight to be better than others. MacDonald et al (2008) also found that those reporting a diagnosed vision condition had significantly lower driving comfort at night. The same relationships did not emerge for other health indicators (e.g., self-rated health, diagnosis score). As noted by MacDonald et al. (2008), the relationship between health and driving comfort may depend on the severity of the condition and whether or not is has been corrected.

5.5 Perceptions and Behaviour

Similar to behaviour, driver perceptions were assessed using several tools, including the DCS and PDA scales as well as ratings of nervousness, barriers to reduction or cessation and personal driving importance. Although driving comfort and perceived abilities were the primary indicators of interest, relationships with the other perception ratings were examined. The first part of this section discusses general findings on driver perceptions, followed by associations between driver perceptions and behaviour.

5.5.1 Driver Perceptions

Similar to previous studies (Myers et al., 2008b; MacDonald et al., 2008), DCS-D scores were significantly higher than DCS-N scores ($p<.001$). The nervousness score was also related to DCS scores in the expected direction. Driving comfort levels, however, were not related to perceived barriers or ratings of personal driving importance. As depicted in Rudman et al.'s (2006) model (refer to Figure 1.1), symbolic and practical importance of driving may play a role in self-regulation (particularly reluctance to stop driving). Persons who place a higher importance on driving (e.g., more barriers to reduction or cessation, fewer transportation alternatives) may continue to do so despite personal level of discomfort in challenging situations.

In the current sample, women had significantly lower driving comfort levels (both day and night). Previously, Myers et al. (2008b) found a significant gender difference (but only at night), while MacDonald et al. (2008) did not find any significant differences. Nonetheless, women scored lower than men on the DCS in both these studies. Using different measures of confidence, George et al. (2007) found that female stroke patients had significantly lower driving confidence than their male counterparts. Conversely, Marottoli and Richardson (1998) did not find gender differences in driving confidence when adjusting for usual driving (men drove in more high-risk conditions). Similar to MacDonald et al (2008), there were no significant gender differences in perceived or actual abilities. Other studies have shown mixed findings regarding gender and perceived abilities. Windsor et al. (2008) reported that men were more likely to have higher perceived abilities than women, while others have found that gender differences emerge overall, but disappear when accounting for driving behaviour (i.e., men tend to drive in more challenging situations) (Groeger & Brown, 1989; McKenna, 1991). The discrepant findings may also be due to the varying measures used to assess perceptions.

Consistent with previous studies (Macdonald et al., 2008; Myers et al., 2008b), age was not significantly related to driving comfort levels or perceived abilities. Younger seniors, however, reported more physical nervousness when driving than those 80 years and older, similar to the findings of MacDonald et al (2008). These findings may be due to the higher proportion of men in the older age group; in general, men may be less sensitive to situation-specific driving stress or tension, irrespective of age (Westerman & Haigney, 2000) or less likely to report traffic-related stress (Hakamies-Blomqvist & Wahlström, 1998).

Driver perceptions in urban versus rural drivers have not been previously examined. In this sample, drivers living in rural areas had higher DCS-N scores compared to those living in urban areas. Rural drivers may be used to driving more at night. Only two out of eight participants who lived in rural areas, however, drove at night over the week, which precluded comparisons with urban dwellers.

5.5.2 Relationships with Behaviour

The current study provides further evidence that driving comfort levels are positively related to situational driving frequency (Marottoli & Richardson, 1998; Parker et al., 2001) and inversely related to situational avoidance (Baldock et al., 2006; MacDonald et al., 2008; Myers et al., 2008b). MacDonald et al. (2008) showed cross-sectionally and prospectively that situational frequency and avoidance ratings were particularly related to DCS-N and DCS-N item #1 (comfort in night driving under optimal conditions). Marottoli and Richardson (1998) and Parker et al. (2001) also found an association between confidence level and self-reported miles driven. The primary objective of this study was to determine whether these associations would hold up with measures of actual (versus self-reported) driving behaviour.

Consistent with expectations, distance driven over the week (km) was significantly and positively related to comfort scores at night (both total DCS-N and item #1) and perceived abilities. While, distance (km) driven over the week was positively and significantly related to perceived driving abilities, it was not related to actual abilities (based on UFOV and RPW scores). Such findings support Bandura's theory (1977) that self-perceptions may be a stronger determinant of behaviour than actual abilities. Interestingly, distance driven at night was significantly related to higher comfort levels for both daytime and nighttime driving. Those who did not drive at night reported lower driving comfort overall, not just in night driving.

Individuals who drive close to home may be self-restricting. In support of this assumption, a smaller average radius was associated with lower comfort levels (both day and night). In the presence of other variables, nighttime comfort levels were still significant and influential in the average radius driven. Average and maximum radii per trip were also significantly related to the distance driven at night (smaller average radius was related to fewer km driven at night). This may suggest that those who don't go far from home also don't drive at night, possibly mediated by nighttime comfort levels. Both the average and maximum radii traveled from home were inversely related to the overall situational avoidance (SDA) score and trying to avoid night driving when possible (single item). Those who had thought about reduction drove a smaller average and maximum radius per trip. Not surprisingly, location of residence (urban versus rural) carried the most influence (in the presence of other variables) on the log of the average radius per trip.

As noted, radius was related to mileage categories (low, middle and high). Scores on the DCS-N, DCS-N item #1 and the PDA scale discriminated between the low, middle and high mileage groups. Those in the low group had significantly lower comfort at night (situational and in good weather) as well as poorer perceived abilities compared to those in the high mileage group (lowest crash risk). Those in the middle group also had lower DCS-N and PDA scores than the high mileage group.

Actual behaviour was also examined in the context of challenging situations (i.e., the composite Frequency Index). Consistent with a priori expectations, more frequent driving in challenging situations (higher Frequency Index scores) was related to higher levels of driving comfort at night (both DCS-N and DCS-N item #1 scores) and better perceived abilities. However, these relationships (i.e., between perceptions and actual frequency) were not as strong as with the self-reported SDF (full and 11-item) scores ($p<.001$). This may be due to the limited sample of driving behaviour (e.g., only week).

5.6 Sole versus Couple Drivers

Based on the literature (Chipman et al., 1998; Golob & Hensher, 2007), we expected that sole drivers would drive more overall and in challenging situations (e.g., night driving) more often than couples. As expected, sole participants did in fact drive more km than couple drivers. This is likely because they had no one else in the household to drive them and they did not want to bother others (according to responses on the Barriers items). Although in the expected directions, Frequency Index scores over the week were not significantly different for the two groups, which may be due to the limited amount of objective data (one week).

One of the unique aspects of the current study was to examine differences in driver perceptions and behaviour by household status. Despite driving more kilometers and in more difficult situations, sole drivers had lower comfort scores than couple drivers. Due to limited transportation alternatives (many indicated they would have no other way to get somewhere if they could not drive), sole drivers may feel more compelled to drive despite lower comfort levels. Couples, on the other hand, can rely more on their partner to share the driving particularly in situations in which they feel less comfortable.

When other variables were controlled for, both household status and gender were found to influence exposure (square-root of km driven). Household status accounted for more variance than gender in the model, suggesting that gender may not be as influential as originally thought. Chipman and colleagues (1998) reported that gender and marital status exert strong and independent influences on whether older adults continue to drive. The findings of the present study, however, suggest that if people are the sole household driver, they may drive more than those who have a partner who also drives.

Although the gap is expected to narrow (Burkhardt & McGavock, 1999), older men typically drive more than women. As expected, men drove more km than women overall, but the difference was more pronounced in older couples (Golob & Hensher, 2007). Further exploration within couples revealed that husbands tended to be the driver when spouses traveled together. Individual 'case studies' illustrated that traditional gender roles may not hold when circumstances change (e.g., husband became ill).

When asked to rate their comfort in their spouse's driving, ratings were generally quite high (and higher than ratings of their own comfort levels). People may have been reluctant to rate their partner poorly, which has been seen in previous research where older adults were asked to score their partners (friends, spouses or acquaintances) on a driving-related assessment (Myers et al., 2008a). Alternatively, people may have believed that their partner is a good driver or better than themselves (if their own health was declining). Some also commented that if they and their partner could no longer drive, they would have no way of getting around (positivity bias).

When later questioned about rating their spouses, the majority (82%) said they were thinking about being the passenger while their spouse was driving (as opposed to their spouse driving alone). The majority also said that their ratings would have been the same if they thought about their partner in either case. For both day and night (although lower for night), comfort level in their partner was lowest when driving in poor weather (i.e., heavy rain, winter conditions, unexpected storm) or situations created by other drivers (i.e., other drivers pass on non-passing lane, tailgate and don't signal or seem distracted). Similarly, in their study on technology and co-piloting in older driving couples, Vrkljan and Polgar (2007) found that couples generally felt positive towards their driving partner; however, anxiety level increased when traveling as the passenger on highways, at night and through unfamiliar areas. The authors speculated that this may be due to the dependency of the driver on the passenger to assist with navigation-related tasks in these situations.

According to Bandura's Social Cognitive Theory, the influence of others (through verbal persuasion and actions) may affect behaviour. For example, Vrkljan and Polgar (2007) found that drivers and co-pilots worked together using assistive technology as a navigation tool, which in turn, could potentially increase the number of trips to unfamiliar places. In the current study, couples were not told the results of their spouses ratings; however, the partner DCS-N scores, was significantly related to the number of trips at night (i.e., the higher the comfort level of their partner in their driving, the more km a person drove at night). Lower ratings from one's partner on the DCS-N were related to higher self-reported situational avoidance scores. Personal scores on the DCS-D were positively related (bordered on significance) to partner ratings on both the day and night partner DCSs. While only 11 couples were included in this study, further examination of partner influences on driving behaviour is warranted.

5.7 Conclusions and Future Directions

Despite the limitations, this study replicated and extended previous work examining self-reported behaviour to further our understanding concerning the process of self-regulation in older drivers. In particular, this study afforded the opportunity to explore a multitude of factors potentially important to self-regulation (see Figure 1.1) in combination and in relation to ***actual*** driving behaviour.

Rudman et al. (2006) highlighted the importance of driving comfort in understanding self-restriction and cessation. Although we could not determine causality or directionality, driving comfort scores were significantly related to driving exposure and engagement in challenging situations. The DCS scores also discriminated between those who had recently thought about driving reduction (lower comfort was related to thoughts of reduction). Both perceptions and actual driving behaviour were also related to certain interpersonal factors (e.g., household driving status and partner perceptions). Furthermore, when examining several factors in combination, perceptions (perceived abilities and comfort in night driving) still significantly influenced driving exposure. The multivariate analyses also showed the relative importance of factors such as location of residence and household status. These findings confirm the importance and interplay of environmental and personal factors in influencing actual behaviour.

Only a small proportion of the sample (17%) reported that they had seriously thought of reducing the amount they drive. Based on their actual driving patterns, this sample may already be restricting their driving and thus do not feel the need to regulate further. For instance, participants tended to drive in less challenging situations (e.g., daytime and outside rush hour). Moreover, the sample perceived a number of barriers to cessation or reduction (including limited transportation alternatives) and had high ratings of personal driving importance. Together, these perceptions may have outweighed thoughts of driving reduction.

Current study findings also provided further support for the driving comfort scales. The developers of the DCS scales (Myers et al., 2008b) speculated that nighttime comfort levels might be expected to progressively decline possibly before daytime driving comfort is appreciably affected. Consistent with this supposition, DSC-N scores were more discriminative and strongly related to behaviour than DCS-D scores. Furthermore, those with very low comfort during the daytime (50% or less) demonstrated more restricted driving (e.g., smaller radius and less frequent engagement in challenging situations).

The present findings need to be replicated with larger samples (healthy and clinical) to permit more comprehensive multivariate regression modeling and further comparison of sub-groups (e.g., rural versus urban). Future studies could also consider a longer monitoring period (e.g., over one month), to provide a better representation of typical driving behaviour. Seasonal and geographic comparisons are also needed (Sabback & Mann, 2005) to examine fluctuations in the driving behaviour and avoidance specific climates (e.g., snow may be more extreme in some areas). It should be noted, however, that extending the monitoring period will also increase the complexity of data handling.

Our work to date has been conducted with primarily healthy older drivers. George et al. (2007) found that individuals with stroke had poorer driving confidence. More research is needed concerning the perceptions and driving behaviour of various clinical populations (e.g., persons with stroke, Parkinson's disease, vision disorders and early dementia), including the influence of spouses and co-pilots. Our preliminary work shows that there may be important differences between sole versus couple drivers. While, it would be interesting to examine couples with more than one household vehicle, data handling would be quite complex.

MacDonald (unpublished thesis, 2007) reported preliminary evidence that baseline comfort scores and changes in comfort scores may be predictive of self-restriction and driving cessation. Prospective studies with large samples are vital to determine if there is a causal or mediating relationship between driver perceptions and behaviour. Rudman's model of the process of self-regulation (Figure 1.1) speculates that while multiple factors may influence personal level of comfort, comfort level directly affects one's decision to stop driving. It is also plausible that self-restriction (e.g., no longer driving on highways or at night) can in turn influence comfort levels. The reciprocal relationship between perceptions and behaviour is consistent with Bandura's Social Cognitive Theory. Studies must also incorporate safety indicators (e.g., driving records) to determine if self-restrictions reduce or increase crashes.

Future studies could use GIS information in conjunction with GPS measures to examine driving behaviour relative to proximity of services. Studies examining route-choice using a mixed-methods approach would also be able to address purposeful avoidance as well as how and why older drivers choose specific routes over others. Environmental factors (described in Rudman et al.'s model), particularly transportation alternatives as well as effects of age-based renewal and restricted licensing, also require further examination. In terms of conditional licensing, monitoring actual driving behaviour via in-vehicle devices could be used to assess self-regulation, context of events (e.g., crashes) and compliance with restrictions imposed by licensing bodies.

In summary, this was the first study to examine perceptions of older drivers in relation to actual driving behaviour. By using a mixed-methods approach, we were able to gain a richer understanding of driving behaviour and the process of self-regulation. Qualitative interview data helped to verify quantitative results (from driving and survey methods) and enhance our understanding of individual circumstances (e.g., the mini case studies of each couple). Study results confirmed prior findings (regarding associations with self-reported driving) and extended our knowledge base by demonstrating that perceptions (both personal and those of others) are important to actual driving behaviour. The current findings also provide new insight into the importance of household status (sole versus couples) and location of residence, as well as the utility of certain variables (e.g., average and maximum radii).

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Appendix A: Information Letter and Consent Forms

Dear Driver,

My name is Robin Blanchard and I am a graduate student in the Department of Health Studies and Gerontology at the University of Waterloo. Over the past few years, I have been involved in several studies working with older drivers. The current study, described below, is for my doctoral dissertation and is being conducted under the supervision of Professor Anita Myers. Basically, the purpose is to learn more about new devices that record driving information, as well as factors that influence people's driving patterns.

I am looking for volunteers who are aged 70 or over and driving at least once a week. Both individuals and couples (where one is over age 70 and the other is over age 65) can participate. Participation in this study involves a one-week commitment (scheduled at your convenience) over the summer or the fall.

This study has three parts: (1) a short interview to obtain background information; (2) monitoring your usual driving for one week using electronic devices that will be temporarily installed in your car, and having you complete short trip logs and daily activity diaries; and (3) a follow-up interview and some driving-related questionnaires.

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

With your permission, I will also install two removable devices in your car. One is a CarChip which you may have heard about. This small device plugs into a port under your steering wheel. The other is called the Otto Driving Companion, which can fit into the palm of your hand and will be secured on your dashboard using temporary adhesive strips. Together, these devices store data from your car's computer and record the following information for each trip: time the car is turned on, distances and speed traveled. In addition, the Otto uses GPS (Global Positioning Systems) to record vehicle location. We will use this data, combined with local maps, to examine driving patterns (e.g., if people combine several activities on one trip) and verify the accuracy of these recording devices compared to the trip logs and diaries. You will not have to touch or do anything with these devices, nor will they affect your car in anyway. And, don't worry, we will not record or report any speeding or other infractions.

Over the week, I will ask you to fill out a trip log that will be left in your car to help us identify the driver of each trip and provide extra information about each trip (e.g., passengers, number of stops, weather conditions). The log should not take more than a minute or two to fill out each time. I will also ask you to complete a sheet at the end of each day with respect to out-of-home activities, basically the approximate time and purpose of the activity (e.g., shopping). This should only take about five to ten minutes.

At the end of the week, I will return to your home (or meet you at a location of your choice) at your convenience for a second visit lasting 60 to 90 minutes. At this time, I will remove the devices from your car and collect your trip logs and activity diaries. I will also ask you to complete a few short questionnaires on your usual driving habits, preferences and comfort levels and conduct a short interview about your experiences over the past week. With your permission, we would like to tape-record this interview so as not to miss any important information. Partners will complete all forms and interviews separately and out of earshot of each other.

If you choose, you may also complete two short tasks on lower body mobility and visual attention which I will show you. For the lower body mobility task, you will be asked to walk 10 feet, turn around and walk back again. The visual attention task is computer-based (I will bring a laptop computer) and asks you to identify various objects and shapes on the computer screen. Again, partners will complete these tasks individually and out of view of each other.

Participation in this study is totally 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, paper and tape data will be kept secure and confidentially destroyed five years after the study has ended. To maintain confidentiality, no individual will be identified by name in my dissertation or resulting publications. Results will be summarized across all the study participants. The information will help us and other researchers to better understand issues important to older drivers and the accuracy of various strategies for assessing driving patterns.

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. Please take this letter home with you. If you have any questions or would like to volunteer for the study, please contact me at (519) 888-4567 extension 36810.

Sincerely,

Robin Blanchard, PhD Candidate
Dept of Health Studies & 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, ext. 36005.

Consent for Participation

Ms. Blanchard's doctoral thesis study has been explained to my satisfaction and I have had the opportunity to ask questions. I understand 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 or to complete the questionnaires, monitoring of driving behaviour, rating forms, interview and/or abilities tasks.

I understand 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 understand that this project has reviewed 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 are in the letter of information I have been given).

Participant's name (please print): _______________________________________

Participant's signature: _______________________________ Date: ___________

Researcher's signature: _______________________________ Date: ___________

Permission to Contact for Future Studies

In the future, we will likely be conducting further studies with older drivers at the University of Waterloo. If you would like to receive information about such studies, 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 let me know about further studies with older drivers. I understand that I am under no obligation to participate in future studies should I be contacted. Contact information will be kept secure (in a locked file cabinet) and not be 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.

Name (print):____

Address: ____

Phone number:______________________ E-mail:_________________________

Signature:__________________________ Date:_______________________

Researcher's Signature:____________________________ Date: ______________

Consent to Audio-tape the Discussion

We require your permission in order to audio-tape the discussion. The reason for taping the discussion is to make sure that we do not miss or forget any important information later during analysis. Your name will be removed from the discussion when we transcribe the audio-tape. Any quotes used will be anonymous. The tapes will be kept in a locked cabinet and destroyed, along with these consent forms, five years after the study has ended. All results will be summarized across groups.

The reasons for audio-taping the discussion session have been explained to my satisfaction and I have had the opportunity to ask questions. I understand that I must agree, before the audio-tape is turned on.

I give my consent for audio-taping the discussion session I am taking part in today.

Participant's name (please print): ___________________________

Participant's signature: _______________________ Date: _______

Researcher's signature: _______________________ Date: _______

Appendix B: Recruitment Script

Potential Participant Screening and Scheduling Record Sheet

Name of Participant: ____
Date:_________________

Phone Number: __________________________________

Attempts to Contact (if they initiated contact and left a message re: study interest):

1. Date________ Time ________ Reached: ___ Subject ___Other: Specify__________________________

2. Date________ Time ________ Reached: ___ Subject ___Other: Specify_________

3. Date________ Time ________ Reached: ___ Subject ___Other: Specify_________

4. Date________ Time ________ Reached: ___ Subject ___Other: Specify_________

If participant is not there or not a good time to talk, preferred date/time to call back:________
Questions:
1) ***Go over study purpose and protocol***. Ask if they have any questions.
2) ***Assure the participants meet the study criteria***:

a) Are you living with your spouse or partner? _____ yes _____ no

b) How old are both you and your partner? _______ and _______

Note (for researcher only): both over 65 years? _____ yes _____ no

at least one over the age of 70? _____ yes _____ no

c) Do you both have a valid Ontario driver's license? _____ yes _____ no

d) How many vehicles are in your household? ____________________

If more than one, they are no longer eligible

Is the vehicle a hybrid? _____ yes _____ no

Vehicle Make and Model: ____

3) Willingness to Participate: ___ No Reason:__________________________________

___Yes Appointment Date and Time:________________
Address: ____

5) Where did you hear about the study? ____

Appendix C: Interview Script

Name(s): ___________________________________ **Date: ____________________**

Part A: Driving over the past week

1. Did the **equipment** installed in your car **affect your driving** behavior in any way?

__ No __ Yes

[If yes]: **How so?** ____

____

2. Was last week **typical of your usual driving** with respect to how much you drove, when, where, passengers? ___ Yes ___ No

[If no]: **What was different?**

____

____

Regardless, **verify if there were any special circumstances** such as person or family illness, visitors, special events, long trips:

____

3. Last week, were there **any trips you were going to take but decided not to**? __ No__Yes

If yes, get them to elaborate (probe: purpose of those trips, reasons for not going(e.g.,weather)

____

____

4. Can you **estimate the number of km** you drove this past week? ___ Yes ___ No

Do you want to try and guess? ___(# **km**) or __ can't estimate

5. Over the past week, did you have **any problems** when driving? ___ No ___ Yes

If yes, **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)

Part B: Activity and Trip Logs

I looked over your trip logs and activity sheets and want to clarify a few things with you. (*questions will vary depending on their activities to get at travel demands & lines will be added to record responses if they prefer not to have the interview taped).*

Start with specific questions

e.g., **I noticed you went to** [e.g., baby-sit grandchildren]. Do you do this often? ___ No ___ Yes

Would you **still drive** [to your children's house to baby-sit] if you were feeling tired or the weather or road conditions were bad? ___ No ___ Yes

General questions

1. Think about the activities you do away from home that **you** drive to. Which **activities might you not do or postpone** if you did not feel like driving (e.g., tired) or the weather was bad?

____

2. Are there any activities (that you drive to) that 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, would this have a significant affect on your lifestyle? ___ No ___ Yes

If yes, what do you think would be affected the most?________________________________

Comments:

<u>For Couples only:</u>

1. On the form you just filled out (**partner Driving Comfort Scales),** how do you feel about **rating your comfort in your partner's** driving?

2. When doing these ratings, **were you thinking about being the passenger** (when your partner was driving) **or about your partner driving alone**? Or both? Would this make a difference? **Do you prefer to be the driver or passenger?** and why

Any other comments?

Thank them for completing the interview.

Appendix D: Background and Driving Habits Questionnaires

Note: both questionnaires are given to participants in size 14 font and 1.5 spacing

Background Questionnaire

Part A. Please tell us about yourself.

1. Are you? ___ male or ___ female

2. Your **age**: _____

3. Did you **complete**: high school? ___ No ___ Yes or
   college or university? ___ No ___ Yes

4. Do you **live in**? ____ a private home ____ apartment or condo or
   ____ a retirement or seniors' complex

5. Do you live? ___ alone ___ with spouse or partner ___ with family members or ___ 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 but have nothing left for extras

Part B. 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 or macular degeneration (**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, how long ago? ____ within the 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. Are you currently taking **any prescribed medications**? ___ No ___ Yes (specify how many: _____)

13. 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 note if any questions are unclear.

Driving Habits Questionnaire

Please tell us about your general 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

   If yes, which one(s) (check all that apply)
   ___ tractor-trailer/RV ___ bus ___ truck/vehicle more than 11,000kg

   ___ ambulance ___ motorcycle

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 **normally** drive? _____

5. **How long** are most 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 (before dark) ___ at night (after 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. When you drive with your partner, **who typically drives?**
    ____ Me ____ My partner ___ Shared equally
    Note: This question will be removed on the questionnaire given to single drivers.

12. To what extent **do you worry about car related expenses**?
    (gas, maintenance or repair costs, license and insurance costs)

____ Often ____ Sometimes ____ Rarely ____ Never

13. Who takes your household vehicle in for **regular servicing**?
____ Me ____ My partner ____ Other (specify:________________)

Note: The response option "My partner" will be removed on the questionnaire given to single drivers.

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**?
____ Yes ____ No

20. Have you taken **any driving courses**? ___ No ___ Yes
If so, about **how long ago?** _________________________

21. In the past five years, have you been asked by the provincial Ministry of Transportation **to take**
a vision test? ___ No ___ Yes
a rules test? ___ No ___ Yes
a road test? ___ No ___ Yes
or a medical examination? ___ No ___ Yes

22. Using the scale, rate the extent to which each of following presents a **barrier or challenge to reducing** when and where you drive? (insert #)

1 = very much so 2 = somewhat 3 = minimally 4 = not at all

Maintaining your present lifestyle (places you want to go) _____

Location of shops and services, relative to where you live _____
Availability or convenience of public transportation _____
Other people counting on you to drive them _____
Availability of friends or family to drive you _____
Not wanting to bother others for rides _____
Physical difficulty walking to places or using public transport _____

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. While driving, **do you ever find yourself (due to nervousness)**………?
Tightly gripping the steering wheel? ___ No ___ Yes
Feeling your palms sweat or heart race? ___ No ___ Yes
Feeling your shoulders tighten? ___ No ___ Yes

25. 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
Getting lost? ___ No___ Yes
Traffic violations with loss of demerit points? ___ No ___Yes

26. 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

Thank-you for completing the questionnaire.

Appendix E: 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 over 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 over 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? _____%

Instructions
Driving Comfort Scales© - For Partners

Please rate <u>your</u> level of comfort in <u>your partner</u> when he or she is driving in the following situations. Choose one option from the scale (0, 25, 50, 75 or 100 %) and write it beside each situation.

If your partner <u>does not normally</u> drive in the situation, imagine how comfortable you would be if he/she absolutely had to go somewhere and found him/herself in the situation.

In your ratings, consider your confidence <u>in your partner's</u> abilities and driving skills, as well as the <u>situation itself</u> (including other drivers).

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

'How **comfortable** are you in **your partner** when he/she is driving in the **daytime**…?'

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

Even if your partner **<u>does not normally drive at night</u>**, imagine that he/she was out in the afternoon, got delayed and it was dark on his/her way back.

In your ratings, consider your confidence <u>in your partner's</u> abilities and driving skills, as well as the <u>situation itself</u> (including other drivers).

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

'How **comfortable** are you in **your partner** when he/she is driving **at night** …?'

Appendix F: Perceived Driving Abilities Scales

3. 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)	☐	☐	☐	☐

Appendix G: Situational Driving Frequency and Avoidance Rating Scales

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

	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?	☐	☐	☐	☐	☐

2. 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 <u>no</u> 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	☐

Appendix H: Trip Logs

University of Waterloo Driving Study: Trip Log

Date: Mon / Tues / Wed / Thurs / Fri / Sat / Sun (circle one)

Time of day of trip: __________ am / pm (circle one)

Driver Name (if you are **not** taking part in the study, please note 'np'): ______________

Vehicle ID: [filled in for them]

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

Type of passenger(s) (check all that apply):	☐	☐	☐	☐	☐
	Partner	Friend	Grandchild	Other relative	Other

Number of stops before returning home:	☐	☐	☐	☐	☐
	0	1	2	3	4

I drove (check one): ____ the entire trip ___ only the way there ___ only the way home

If you drove only one way, what is your relationship (e.g., friend, spouse) with the person **who drove** the other way? _________________________________

Please note the **weather conditions** of your trip (e.g., sunny, foggy, rainy, thunderstorms, etc.)

____

____

____

Trip Log Guidelines

Please leave this log in **this** vehicle and fill it out after **each** time you drive (this vehicle). Please complete a new entry every time you leave and return home. Further explanation of each question is provided below.

Driver name: Please identify the driver of each trip. If **someone other than you or your partner** drives the vehicle, please ask that person to write np (non-participant) for driver name and note the time of day. They do not have to fill out the rest of the log.

Vehicle ID: This will be filled out for you. We are coding each vehicle used in the study so we can link the trip information to the appropriate vehicle.

Number 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.

Type of passenger: Identify your relationship with each passenger (e.g., partner). If you had more than one passenger, you will have to check more than one type of passenger.

Number of stops: Note all the stops you made from the time that you left your home to when you returned home.

To account for trips where more than one person may have driven, we are asking you to note if you drove the entire trip or one way only. If you drove only one way, please note **your relationship** to the person **who drove the other way**.

Weather conditions: Please note **all** the weather conditions of your trip. Try to provide as much detail as possible.

Appendix I: Activity Diaries

Attached are seven sheets (one for each day of the week). This should only take you a few minutes to fill out at the end of the day. Or, if you prefer, you can also do this throughout the day (after you get home from each trip).

An example is attached to assist you.

Start by **noting the time you got up that day** and **end by noting when you went to bed.** Just block off the times you were at home (we don't need details on what you were doing).

Using the example provided, please tell us the **approximate times you went out**, **where you went, how you got there (e.g., by car or walking), what you did and when you returned home.**

Each time you leave your home, please **note <u>all the places you went</u>** (e.g., Seniors' Centre, grocery store, gas station), as well as the **<u>locations</u>** (e.g., streets, intersection).

If you went by car, please indicate who drove. Also try and estimate the time spent traveling to each location (one way).

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

Robin Blanchard

(519) 888-4567, extension 36810 or
(519) 880-1543

Date: Name:

Time of Day	Activity	Location		If change in location,		Time spent travelling (one way)
		Place	Address	Mode	Who drove	
0:00 0:30 1:00						
1:30 2:00						
2:30 3:00						
3:30 4:00						
4:30 5:00						
5:30 6:00						
6:30 7:00						
7:30 8:00						
8:30 9:00						
9:30 10:00						
10:30 11:00						
11:30 12:00						
12:30 13:00						
13:30 14:00						

Note: The diary given to participants continues to 23:30

Appendix J: Scoring of Scales and Composite Ratings

Score	Items	Scoring	Possible Range
Driving Comfort Scales*			
DCS-D	13 items	**0%** Not at all comfortable **25%** **50%** Moderately comfortable **75%** **100%** Completely comfortable	0% - 100%
DCS-N	16 items	**0%** Not at all comfortable **25%** **50%** Moderately comfortable **75%** **100%** Completely comfortable	0% - 100%
Perceived Abilities Scales			
PDA	15 items	**0** poor **1** fair **2** good **3** very good	0-45
PDA Change	15 items	**0** a lot worse **1** a little worse **2** the same **3** better	0-45
Situational Driving Behaviour Ratings			
Frequency (SDF)	14 items	**0** (never); **1** (rarely: < once a month); **2** (occasionally: > once a month but not weekly); **3** (often: 1-3 days/wk); **4** (very often: 4-7 days/wk)	0 - 56
Self-reported Fequency-11 (SDF-11)	11 items	**0** (< weekly); **1** (often: 1-3 days/wk); **2** (very often: 4-7 days/wk)	0-22
Frequency Index (actual)	11 situations	**0** (< weekly); **1** (often: 1-3 days/wk); **2** (very often: 4-7 days/wk)	0-22
Avoidance (SDA)	20 items	# of items checked (avoided) (1 point per check)	0 - 20
Background Questionnaire			
Diagnosis	Question 7	# of items checked (1 point per check)	0 - 11
Physical index	Question 8	# of items checked (1 point per check)	0 - 12
Upper body index	Question 8 [(1)strength in torso/hips; (2) stiffness in spine/back; (3) stiffness in neck; (4) feeling upper body; (5) involuntary movement, upper body]	# of items checked (1 point per check)	0 – 5

Score	Items	Scoring	Possible Range
Lower body index	Question 8 [(1) balance; (2) initiating movement; (3) strength in torso/hips; (4) strength in legs; (5) stiffness in spine/back; (6) feeling in lower body; (7) involuntary movement, lower body	# of items checked (1 point per check)	0 - 7
Driving Habits Questionnaire			
Barriers	Question 22	**0** (not at all); **1** (minimally); **2** (somewhat); **3** (very much)	0 - 21
Nervousness	Question 24	# of items checked (1 point per check)	0 - 3
Driving problems	Question 25	# of items checked (1 point per check)	0 - 5
Personal driving importance	Question 26 (1 item)	**0** (not that important); **1** (somewhat); **2** (moderately); **3** (very much); **4** (extremely)	0 - 4

*scoring is the same for both self and partner ratings

Note: DCS-D and DCS-N= Driving Comfort Scales, Day and Night; PDA = Perceived Driving Abilities; SDF = Situational Driving Frequency; SDA=Situational Driving Avoidance

Appendix K: Definitions of Trip Variables and Areas

Term	Definition	Source
Afternoon	12:00pm to 5:00 pm	Otto device
City road	Main arterial roads, speed limits of 50 to 60 km hour with several stop lights	Committee
Dawn	First appearance of light in the sky as the sun rises in the morning	Dictionary*
Dusk	Twilight, or time at which the sun is below the horizon in the evening	Dictionary
Evening	5:01 pm to dusk	Otto device
Freeway	Multi-lane, divided highways, usually with speed limits 90+ km/hour	Committee
Highway	Roadways with speed limits generally greater than 70 km/hour; denoted by highway sign on maps	Committee
Morning	Dawn to 11:59 am	Otto device
Night	Dusk to dawn when no sunlight is visible	Dictionary
Residential road	Minor arterial roads with speed limits of ≤ 50 km/hr, usually no stop lights; intersections are uncontrolled or controlled by stop signs	Committee
Rural road	Roads in rural areas, usually denoted by regional road on maps	Committee
Segment	Period traveling in between stops	Committee
Trip	A single outing starting and ending at one's home	Dictionary, Literature, Committee

*Definition according to Merriam-Webster's Online Dictionary

Appendix L: Definition and Measurement of Driving Behaviour Components

Component	Proposed to Examine	Examined	Measure
Exposure (amount)	1) distance driven - actual km - estimated km per week	 √ √ -radius from home (min, max, avg) -low mileage bias	 CarChip Interview Otto CarChip
	2) number of trips - actual - self-reported	√ √	CarChip Logs, Diaries
	3) duration of trips - study week (actual) - typical (self-reported)	√ √	CarChip DHQ #5
	4) overall changes in driving frequency from 10 years ago	√	DHQ #8
Patterns (where)	1) Places driven: - destinations (e.g., Rec Centre) - purposes (e.g., visiting)	X (diaries incomplete, maps not coded) √	Diaries, Otto, maps Diaries
	2) Route Characteristics - road type (e.g, hwy, city) - actual - typical road types - Route features, (e.g., left turns)	 √ √ √	 Otto and maps DHQ #6 Otto and maps

Component	Proposed to Examine	Examined	Measure
Patterns (when)	1) Trips conditions: - time of day (e.g. day/night) -actual -typical (self-report)	√ √	Otto; sunrise/sunset SDF, SDA, DHQ
Habits	1) Speed (average, min, max) - avg speeds compared to roadway speed limits	X (unavailable outside KW)	Otto
	2) Aberrant behaviours (e.g., crashes, near misses) - past year - study week	√ √	DHQ #25 Interview

Note: DHQ = Driving Habits Questionnaire; SDF=Situational Driving Frequency; SDA= Situational Driving Avoidance; Diaries = Activity Diaries; Logs =Trip Logs

Appendix M: Additional Sample Characteristics and Perceptions

A) Health Characteristics

Health Characteristics	Total Sample	Gender		Age Group		Status	
		Male	Female	<80	80+	Solo	Couple
	N = 61	n=25	n=36	n=26	n=35	n=39	n=22
# days activity	3.81± 2.4	3.46± 2.6	4.06± 2.2	3.68± 2.9	3.91± 2.4	3.76± 2.3	3.9±2.5
(range)	0 to 7	0 to 7	0 to 7	0 to 7	0 to 7	0 to 7	0 to 7
Exercise classes							
yes	21 (34.4)	8 (32.0)	13 (36.1)	10 (38.5)	11 (31.4)	14 (35.9)	7 (31.8)
no	40 (65.6)	17 (68.0)	23 (63.9)	16 (61.5)	24 (68.6)	25 (64.1)	15(68.2)
# days/wk	2.65± 1.4	3.91± 2.2	2.77± 1.6	2.90± 1.7	2.4 ± 1.1	2.92± 1.6	2.14± .90
(range)	1 to 6	1 to 8	1 to 6	1 to 6	1 to 4	1 to 6	1 to 3
Falls							
yes	8 (13.1)	2 (8.0)	6 (16.7)	4 (15.4)	4 (11.4)	5 (12.8)	3 (13.6)
no	53 (86.9)	23 (92.0)	30 (83.3)	22 (84.6)	31 (88.6)	34 (89.2)	19(86.4)
>1	3 (4.9)	1 (50.0)	2 (5.6)	1 (25.0)	2 (5.7)	3 (7.7)	0
injured	1 (1.6)	0	1 (2.8)	0	1 (2.9)	1 (2.6)	0
prob getting up	2 (3.3)	1 (50.0)	1 (2.8)	0	2 (5.7)	1 (2.6)	1 (33.3)
Diagnosed with							
arthritis, rheum, osteo	37 (60.7)	13 (52.0)	24 (66.7)	17 (65.4)	20 (57.1)	25 (64.1)	12(54.5)
Parkinsons, MS, stroke	1 (1.6)	0	1 (2.8)	1 (3.8)	0	0	1 (4.5)
high BP/chol, heart	33 (54.1)	17 (68.0)	16 (44.4)	14 (53.8)	19 (54.3)	18 (46.2)	15(68.2)
Diabetes	4 (6.6)	3 (12.0)	1 (2.8)	3 (11.5)	1 (2.9)	2 (5.1)	2 (9.1)
asthma/breath prob	4 (6.6)	2 (8.0)	2 (5.6)	1 (3.8)	3 (8.6)	1 (2.6)	3 (13.6)
back prob	14 (23.0)	7 (28.0)	7 (19.4)	8 (30.8)	6 (17.1)	9 (23.1)	5 (22.7)
foot prob	8 (13.1)	2 (8.0)	6 (16.7)	5 (19.2)	3 (8.6)	6 (15.4)	2 (9.1)
hearing prob‡	18 (29.5)	10 (40.0)	8 (22.2)	5 (19.2)	13 (37.1)	15(38.5)*	3 (13.6)
cataracts	21 (34.4)	9 (36.0)	12 (33.3)	9 (34.6)	12 (34.3)	16 (41.0)	5 (22.7)
glaucoma	5 (8.2)	2 (8.00	3 (8.3)	1 (3.8)	4 (11.4)	3 (7.7)	2 (9.1)
mac degen	1 (1.6)	0	1 (2.8)	1 (3.8)	0	1 (2.6)	0
sleeping disorders	5 (8.2)	2 (8.0)	3 (8.3)	1 (3.8)	4 (11.4)	3 (7.7)	2 (9.1)
other† ‡	6 (9.8)	4 (16.0)	2 (5.6)	5 (19.2)	1 (2.9)	1 (2.6) †	5 (22.7)
Problems							
staying awake	4 (6.7)	3 (12.0)	1 (2.9)	1 (4.0)	3 (8.6)	2 (5.1)	2 (9.5)
balance	6 (10.0)	3 (12.0)	3 (8.6)	3 (12.0)	3 (8.6)	4 (10.3)	2 (9.5)
initiating movt‡	2 (3.3)	2 (8.0)	0	2 (8.0)	0	0	2 (9.5)
persistent pain	6 (10.0)	3 (12.0)	3 (8.6)	3 (12.0)	3 (8.6)	3 (7.7)	3 (14.3)
limited str torso	7 (11.7)	5 (20.0)	2 (5.7)	3 (12.0)	4 (11.4)	3 (7.7)	4 (19.0)
limited str legs/feet	9 (15.0)	4 (16.0)	5 (14.3)	4 (16.0)	5(14.3)	6 (15.4)	3 (14.3)
lack feeling upper	2 (3.3)	1 (4.0)	1 (2.9)	1 (4.0)	1 (2.9)	1 (2.6)	1 (4.8)
lack feeling lower	1 (1.7)	0	1 (2.9)	1 (4.0)	0	0	1 (4.8)
stiffness neck	12 (20.0)	4 (16.0)	8 (22.9)	7 (28.0)	5 (14.3)	6 (15.4)	6 (28.6)
stiffness spine	9 (15.0)	3 (12.0)	6 (17.1)	6 (24.0)	3 (8.6)	7 (17.9)	2 (9.5)
invol upper†	9	1 (4.0)	2 (5.7)	3 (12.0)	0	2 (5.1)	1 (4.8)

Health Characteristics continued	Total Sample	Gender		Age Group		Status	
		Male	Female	<80	80+	Solo	Couple
	N = 61	n=25	n=36	n=26	n=35	n=39	n=22
Glasses for driving							
all the time	40 (66.7)	18 (72.0)	22 (62.9)	14 (.0)	26 (74.3)	26 (66.7)	14(66.7)
sometimes	11 (18.3)	3 (12.0)	8 (22.9)	7 (28.0)	4 (11.4)	7 (17.9)	4 (19.0)
never	9 (15.0)	4 (16.0)	5 (14.3)	4 (16.0)	5 (14.3)	6 (15.4)	3 (14.3)
Medications							
yes	53 (89.8)	23 (92.0)	30 (88.2)	21 (84.0)	32 (94.1)	36 (78.9)	17(81.0)
no	6 (10.2)	2 (8.0)	4 (11.8)	4 (16.0)	2 (5.9)	2 (5.3)	4 (19.0)
Last physician visit							
within past 6 months	47 (79.7)	21 (84.0)	26 (76.5)	18 (72.0)	29 (85.3)	30 (78.9)	17(81.0)
past year	11 (18.6)	3 (12.0)	8 (23.5)	7 (28.0)	4 (11.8)	7 (18.4)	4 (19.0)
> 1 year	1 (1.7)	1 (4.0)	0	0	1 (2.9)	1 (2.6)	0

*gender difference
†age group difference
‡status difference

B) Driving Experiences and Habits

Driving Habits, Experiences	Total Sample	Gender		Age Group		Status	
		Male	Female	<80	80+	Sole	Couple
	N = 61	n=25	N=36	N=26	N=35	N=39	n=22
Commuted							
no	44 (74.6)	16 (64.0)	28 (82.4)	21 (80.8)	23 (69.7)	26 (70.3)	18(81.8)
yes	15 (25.4)	9 (36.0)	6 (17.6)	5 (19.2)	10 (30.3)	11 (29.7)	4 (18.2)
missing	2 (3.3)	0	2 (5.6)	0	2 (5.7)	2 (5.1)	0
Can walk to							
weekly shops, errands	20 (33.3)	7 (28.0)	13 (37.1%)	11 (42.3)	9 (26.5)	10 (26.3)	10 (45.5)
church, social, recreation	20 (33.3)	6 (24.0%)	14 (40.0%)	9 (36.0)	11 (31.4)	12 (31.6)	8 (36.4)
Suggested you limit driving							
no	56 (93.3)	22 (88.0)	34 (97.1)	25 (96.2)	31 (91.2)	35 (92.1)	21 (95.5)
yes	4 (6.7)	3 (12)	1 (2.9)	1 (3.8)	3 (8.8)	3 (7.9)	1 (4.5)
if yes, family	4 (100)	3	1 (100)	1 (100)	3 (100)	3 (100)	1 (100)
if yes, friends	0	0	0	0	0	0	0
if yes, physician	0	0	0	0	0	0	0
if yes, eye care	0	0	0	0	0	0	0
Reasons to drive							
shop/errands	58 (96.7)	23 (92.0)	35 (100)	25 (100)	37 (97.4)	37 (97.4)	21 (95.5)
appointments	59 (98.3)	25 (100)	34 (97.1)	24 (96.0)	38 (100)	38 (100)	21 (95.5)
visiting	57 (95.0)	23 (92)	34 (97.1)	24 (96.0)	33 (94.3)	36 (94.7)	21 (95.5)
religious service	38 (63.3)	16 (64.0)	22 (2.9)	13 (52.0)	25 (71.4)	25 (65.8)	13 (59.1)
rec/social events	52 (86.7)	20 (80.0)	32 (91.4)	23 (92.0)	29 (82.9)	34 (89.5)	18 (81.8)
other	34 (56.7)	14 (56.0)	20 (57.1)	18 (72.0)	16 (45.7)	20 (52.6)	14 (63.6)
Problems							
accidents	3 (4.9)	2 (8.0)	1 (2.8)	2 (7.7)	1 (2.9)	2 (5.1)	1 (4.5)
near misses	14 (23.0)	8 (32.0)	6 (16.7)	7 (26.9)	7 (20.0)	10 (25.6)	4 (18.2)
back into things	2 (3.3)	1 (4.0)	1 (2.8)	1 (3.8)	1 (2.9)	2 (5.1)	0
get lost	8 (13.1)	5 (20.0)	3 (8.3)	5 (19.2)	3 (8.6)	5 (12.8)	3 (13.6)
violations	0	0	0	0	0	0	0
Physician asked if drive							
no	48 (81.4)	22 (88.0)	26 (76.5)	22 (88.0)	26 (76.5)	29 (78.4)	19 (86.4)
yes	11 (18.6)	3 (12.0)	8 (23.5)	3 (12.0)	8 (23.5)	8 (21.6)	3 (13.6)
Talked about driving with							
eye care prof	21 (35)	7 (28.0)	14 (40.0)	9 (34.6)	12 (35.3)	15 (39.5)	6 (27.3)
family‡	15 (24.6)	5 (20.8)	10 (27.8)	7 (26.9)	8 (23.5)	13 (34.2)	2 (9.1)
friends	11 (18.6)	4 (16.0)	7 (20.6)	4 (15.4)	7 (21.2)	9 (24.3)	2 (9.1)

C) Driver Perceptions

Rating	Total Sample N = 61	Gender Male N=25	Gender Female N=36	Age Group <80 N=26	Age Group 80+ N=35	Status Single N=39	Status Couple N=22
Nervousness							
trip wheel	16 (26.7)	6 (24.0)	10 (28.6)	9 (34.6)	7 (20.6)	12 (31.6)	4 (18.2)
palms/ heart	4 (6.7)	1 (4.0)	3 (8.6)	3 (11.5)	1 (2.9)	2 (5.3)	2 (9.1)
tight shoulders†	8 (13.3)	3 (12.0)	5 (14.3)	7 (26.9)	1 (2.9)	4 (10.5)	4 (18.2)
Barriers Lifestyle							
Not at all	15 (25.4)	7 (29.2)	8 (22.9)	7 (29.2)	8 (22.9)	5 (13.2)	10 (47.6)
Minimally	1 (1.7)	0	1 (2.9)	0	1 (2.9)	1 (2.6)	0
Somewhat	6 (40.7)	2 (8.3)	4 (11.4)	2 (8.3)	4 (11.4)	3 (7.9)	3 (14.3)
Very much so	37 (62.7)	15 (62.5)	22 (62.9)	15 (62.5)	22 (62.9)	29 (76.3)	8 (38.1)
Location							
Not at all	16(27.1)	7 (29.2)	9 (25.7)	7 (29.2)	9 (25.7)	7 (18.4)	9 (42.9)
Minimally	2 (3.4)	0	2 (5.7)	1 (4.2)	1 (2.9)	1 (2.6)	1 (4.5)
Somewhat	6 (10.2)	3 (12.5)	3 (8.6)	0	6 (17.1)	4 (10.5)	2 (9.1)
Very much so	35(59.3)	14 (58.3)	21 (60.0)	16 (66.7)	19 (54.3)	26 (68.4)	9 (42.9)
Public Transport							
Not at all	15(25.9)	6 (25)	9 (26.5)	7 (29.2)	8 (23.5)	7 (18.9)	8 (38.1)
Minimally	9(15.5)	5 (20.8)	4 (11.8)	4 (16.7)	5 (14.7)	4 (10.8)	5 (23.8)
Somewhat	7 (12.1)	0	7 (20.6)	3 (12.5)	4 (11.8)	6 (16.2)	1 (4.8)
Very much so	27 (46.6)	13 (54.2)	14 (41.2)	10 (41.7)	17 (50.0)	20 (54.1)	7 (33.3)
Counting on you							
Not at all	28(47.5)	12 (50.0)	16 (45.7)	11 (45.8)	17 (48.6)	16 (42.1)	12 (57.1)
Minimally	9 (15.3)	3 (12.5)	6 (17.1)	4 (16.7)	5 (14.3)	7 (18.4)	2 (9.5)
Somewhat	8 (13.6	2 (8.3)	6 (17.1)	4 (16.7)	4 (11.4)	3 (7.9)	5 (23.8)
Very much so	14 (23.7)	7 (29.2)	7 (20.0)	5 (20.8)	9 (25.7)	12 (31.6)	2 (9.5)
Availability others							
Not at all	18(30.5)	8 (33.3)	10 (28.6)	8 (33.3)	10 (28.6)	10 (26.3)	8 (38.1)
Minimally	16 (27.1)	5 (20.8)	11 (31.4)	6 (25.0)	10 (28.6)	10 (26.3)	6 (28.6)
Somewhat	11(18.6)	5 (20.8)	6 (17.1)	4 (16.7)	7 (20.0)	7 (18.4)	4 (19.0)
Very much so	14(23.7)	6 (25.0)	8 (22.9)	6 (25.0)	8 (22.9)	11 (28.9)	3 (14.3)
Bother others							
Not at all	18 (30.5)	7 (29.2)	11 (31.4)	5 (20.8)	13 (37.1)	11 (28.9)	7 (33.3)
Minimally	7 (11.9)	3 (12.5)	4 (11.4)	3 (12.5)	4 (11.4)	3 (7.9)	4 (19.0)
Somewhat	9 (15.3)	1 (4.2)	8 (22.9)	4 (16.7)	5 (14.3)	6 (15.8)	3 (14.3)
Very much so	25 (42.4)	13 (54.2)	12 (34.3)	12 (50.0)	13 (37.1)	18 (47.4)	7 (33.3)
Physical difficulty							
Not at all	34 (58.6)	12 (52.2)	22 (62.9)	17 (70.8)	17 (50.0)	20 (54.1)	14 (66.7)
Minimally	5 (8.6)	2 (8.7)	3 (8.6)	1 (4.2)	4 (11.8)	5 (13.5)	0
Somewhat	6 (10.3)	3 (13.0)	3 (8.6)	1 (4.2)	55 (14.7)	4 (10.8)	2 (9.5)
Very much so	13 (22.4)	6 (26.1)	7 (20.0)	12 (50.0)	8 (23.5)	8 (21.6)	5 (23.8)

Appendix N: Associations between Driver Perceptions and Additional Characteristics

Characteristic	N	DCS-D	DCS-N	DCS-N#1	PDA	PDA Change
Type of Residence						
private home	32	69.79 (16.78)	57.75 (26.81)	86.72(21.05)	33.63(5.48)	19.31(6.01)
apartment/condo	18	69.11 (14.68)	49. 47 (24.86)	80.55(18.30)	31.94(6.53)	18.78(6.24)
seniors' complex	11	65.73 (11.21)	51.99 (18.79)	79.54(18.77)	30.64(7.61)	19.18(5.40)
F-value (p)		.29 (.75)	.69 (.51)	3.01(.22)	1.09(.34)	.47(.79)
Living Arrangement						
alone	32	65.27 (15.63)	47.78 (25.44)	76.56(21.00)	31.78(6.63)	18.53(5.86)
spouse	27	72.37 (14.22)	60.60 (23.19)	15.73(3.02)	33.0(5.55)	20.04(6.09)
family members	2	78.85 (2.72)	72.66 (5.52)	100(0)	40.0(4.24)	16.50(2.12)
F-value (p)		2.13 (.13)	2.64 (.08)	9.54(.008)	1.80(.18)	1.60(.45)
Education						
high school						
No	14	71.69 (9.85)	57.48 (26.47)	82.14(24.86)	32.50(4.80)	17.29(3.85)
Yes	47	68.02 (16.40)	53.31 (24.62)	84.04(18.38)	32.62(6.63)	19.68(6.30)
t-value (p)		1.03 (.31)	.53 (.61)	-.06(.96)	-.07(.94)	-1.04(.30)
college						
No	27	66.11 (14.64)	50.03 (27.41)	80.56(22.29)	32.78(5.12)	18.63(3.33)
Yes	34	71.05 (15.42)	57.63 (22.55)	86.03(17.61)	32.44(7.04)	19.53(7.34)
t-value (p)		-1.28 (.21)	-1.16 (.25)	-.87(.38)	.22(.83)	-.34(.74)
Overall Health						
Good/Excellent	57	68.75 (14.82)	25.47 (3.37)	83.33(19.67)	32.33(6.14)	19.18(6.01)
Poor/Fair	4	70.47 (22.14)	15.95 (7.98)	87.50(25.00)	36.25(7.09)	18.50(4.36)
t-value (p)		-.15 (.89)	.58 (.60)	-.59(.55)	-1.08(.35)	-.41(.68)
Cane/Walker						
No	52	70.24 (14.03)	56.06 (23.85)	85.10(18.03)	32.37(5.94)	19.58(5.74)
Yes	9	60.90 (19.61)	43.92 (29.67)	75.0(27.95)	33.89(7.90)	16.56(6.42)
t-value (p)		1.37 (.20)	1.16 (.27)	-.99(.32)	-.55(.59)	-1.06(.29)
Walk ¼ Mile						
No	7	63.46 (12.06)	48.43 (16.03)	78.57(17.25)	31.29(3.63)	18.43(3.78)
Yes	54	15.47 (2.10)	55.02 (25.83)	84.26(20.20)	32.76(6.48)	19.22(6.13)
t-value (p)		-1.22 (.26)	-.94 (.37)	-1.0(.32)	-.90(.39)	-.46(.65)
Physical Activity						
Pearson r	58	.08 (.54)	.09 (.52)	-.07(.60)	-.07(.59)	-.07(.58)
Trip length						
< 15 min	16	71.27 (16.39)	54.88 (28.29)	82.81(21.83)	31.50(6.57)	20.19(5.62)
15-30 min	40	67.22 (13.93)	52.25 (22.45)	82.50(19.77)	32.45(6.09)	18.53(4.03)
30-60 min	3	62.18 (19.36)	51.54 (33.28)	91.67(14.43)	35.67(6.11)	19.0(3.61)
> 60 min	2	92.31 (2.72)	93.75 (2.21)	100(0)	39.50(2.12)	23.0(29.70)
F-value (p)		2.21 (.10)	1.86 (.15)	2.22(.53)	1.26(.30)	.76(.86)
Importance of driving						
Spearman Rho (p)	61	.14(.28)	.13(.31)	.21(.11)	.23(.07)	-.001(.99)
Nervousness						
Pearson r	60	-.29 (.03)	-.18 (.17)	-.09(.50)	-.29(.03)	.26(.04)
Barriers						
Pearson r	59	-.09(.48)	.00(.99)	.16(.22)	.05(.73)	-.07(.60)

Appendix O: Actual Driving Patterns (when)

Pattern	Total Sample	Gender		Age Group		Status	
		Male	Female	<80	80+	Single	Couple
	N = 58	N=24	N=34	N=26	N=32	N=36	N=22
Km by time of day							
Morning	64.53 (79.10) 0-387.22	83.33 (90.93) 0-387.22	51.27 (67.88) 0-262.01	63.84 (80.64) 0-262.01	65.1 (79.13) 0-387.22	83.23 (93.17) 0-387.22	33.95 (30.66) 0-92.54
Afternoon	78.74 (73.72) 0-296.00	95.32 (90.49) 5.64-296.0	67.03 (57.78) 0-231.92	67.71 (66.98) 0-231.92	87.70 (78.68) 5.64-296.0	100.64 (77.8) 5.64-29.6	42.89 (49.95) 0-220.35
Evening	11.92 (23.21) 0-127.46	13.41 (28.77) 0 to 127.46	10.87 (18.74) 0 to 77.90	8.28 (14.08) 0 to 47.96	14.88 (28.47) 0 to 127.46	16.98 (28.13) 0 to 127.46	3.66 (5.31) 0 to 19.31
Night (dark) *	7.01(20.92) 0 to 129.39	14.62 (30.94) 0 to 129.39	1.64 (4.15) 0 to 17.22	7.97 (25.52) 0 to 129.39	6.23 (16.68) 0 to 85.23	9.70 (25.91) 0 to 129.39	2.62 (6.06) 0 to 22.21
Km peak travel							
Peak (6 am-9am, 4pm-7pm)	38.26 (50.71) 0-281.48	45.52(65.83) 0 –281.48	33.13(36.83) 0 – 134.55	33.59 (39.39) 0-134.55	42.06 (58.69) 0-281.48	51.25(58.57) 0-281.48	17.01(22.36) 0 – 68.24
Off-peak (9am-4pm, 7pm-6am)	125.30(120.25) 4.18-482.70	163.66(141.85) 8.53-482.70	98.22 (95.53) 4.18-467.86	115.12(119.16) 4.18-467.86	133.56(122.39) 6.76-482.70	161.46(131.96) 10.64-482.70	66.11 (65.69) 4.18-269.12
Trips per day							
Monday	1.00 (.88) 0-3	1.17 (.92) 0-3	.88 (.84) 0-3	.92 (.80) 0-3	1.06 (.95) 0-3	1.19 (.89) 0-3	.68 (.78) 0-2
Tuesday	1.06 (1.1) 0-6	1.10 (1.06) 0-5	1.03 (1.14) 0-6	1.04 (1.18) 0-6	1.08 (1.05) 0-5	1.21 (.95) 0-5	.82 (1.30) 0-6
Wednesday	1.08 (.89) 0-3	1.25 (.94) 0-3	.96 (.84) 0-3	1.08 (.74) 0-3	1.08 (1.0) 0-3	1.26 (.98) 0-3	.77 (.61) 0-2
Thursday	1.14 (.78) 0-3	1.19 (.84) 0-3	1.10 (.74) 0-3	1.10 (.60) 0-2	1.17 (.90) 0-3	1.33 (.83) 0-3	.82 (.57) 0-2

Pattern	Total Sample	Gender		Age Group		Status	
		Male	Female	<80	80+	Single	Couple
	N=58	N=24	N=34	N=26	N=32	N=36	N=22
Friday	1.0 (.75) 0-3	1.21 (.78) 0-3	.88 (.73) 0-3	1.04 (.82) 0-3	1.00 (.72) 0-2	1.22 (.72) 0-3	.68 (.72) 0-3
Saturday	.88 (.73) 0-3	.92 (.72) 0-3	.85 (.74) 0-3	.73 (.60) 0-2	1.00 (.80) 0-3	1.00 (.76) 0-3	.68 (.65) 0-2
Sunday	.95 (.87) 0-4	1.04 (.86) 0-3	.88 (.88) 0-4	.81 (.94) 0-4	1.06 (.80) 0-3	1.17 (.91) 0-4	.59 (.67) 0-2
km per day							
Monday	27.60 (46.49) 0-259.27	36.44 (55.17) 0-259.27	21.36 (38.91) 0-182.18	30.37 (61.81) 0-259.27	25.35 (29.67) 0-101.71	38.32 (55.57) 0-259.27	10.05 (14.07) 0-44.26
Tuesday	24.97 (41.33) 0-258.62	24.76 (30.44) 0-105.41	25.11 (48.01) 0-258.62	28.48 (53.07) 0-259.27	22.11 (29.17) 0-107.99	33.45 (48.95) 0-259.27	11.08 (17.81) 0-70.97
Wednesday	20.01 (28.56) 0-148.39	27.41 (37.37) 0-148.39	14.78 (19.17) 0-83.04	16.53 (20.55) 0-83.04	22.53 (33.77) 0-148.39	25.31 (34.12) 0-148.39	11.32 (12.10) 0-41.52
Thursday	25.64 (45.09) 0-281.15	35.06 (63.54) 0-281.15	18.99 (24.24) 0-117.17	26.65 (38.45) 0-142.75	24.82 (50.44) 0-281.15	30.73 (51.88) 0-281.15	17.30 (30.26) 0-142.75
Friday	28.05 (59.11) 0-413.60	43.32 (83.56) 0-413.60	17.27 (29.65) 0-140.01	22.26 (33.62) 0-140.01	32.75 (73.91) 0-413.60	36.22 (71.91) 0-413.60	14.67 (23.70) 0-101.55
Saturday	22.52 (35.86) 0-198.91	21.97 (25.98) 0-84.01	22.91 (41.83) 0-198.91	14.84 (18.33) 0-66.95	28.76 (44.76) 0-198.91	29.42 (42.99) 0-198.91	11.23 (13.96) 0-47.15
Sunday	15.39 (28.57) 0-140.17	22.04 (41.18) 0-140.17	10.69 (13.17) 0-59.71	9.85 (14.32) 0-59.71	19.88 (35.91) 0-140.17	20.12 (34.39) 0-140.17	7.64 (12.01) 0-34.60

*gender difference (2.04, p=.05)

Appendix P: Study Weather Conditions

June, 2007

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3	4	5	6	7 hmdx	8 hmdx	9
10	11	12 Fog	13	14	15	16
17 hmdx	18 hmdx	19 hmdx	20	21	22	23
24	25 hmdx	26 hmdx	27 hmdx	28	29	30

July, 2007

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5 Fog	6	7
8 hmdx	9 hmdx	10 hmdx	11	12	13	14
15	16	17	18	19 hmdx	20	21
22	23	24	25	26	27 hmdx	28 hmdx
29 hmdx	30	31 hmdx				

August, 2007

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1 hmdx	2	3	4
5	6	7	8 hmdx	9	10 hmdx	11
12	13	14	15	16 hmdx	17	18
19	20	21	22	23 hmdx	24 hmdx	25
26	27	28 hmdx	29 hmdx	30	31	

September, 2007

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1
2	3 hmdx	4	5 hmdx	6 hmdx	7 hmdx	8
9	10	11	12 Fog	13	14	15
16	17	18	19	20	21 hmdx	22
23	24	25 hmdx	26	27	28	29
30						

October, 2007

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5 hmdx	6 hmdx
7	8 hmdx	9	10	11	12	13
14	15	16	17	18 Fog	19	20
21	22	23	24	25	26	27
28	29	30	31			

<u>Legend:</u>

 = sunny

 = rain

 = heavy rain

= sunny with clouds

 = mostly cloudy

 = thundershowers

hmdx = humidex reading of 30 or above (30-39 = some discomfort; 40-45 = great discomfort)

Fog = noted by participants in their Trip logs (Environment Canada defines as a cloud based at the earth's surface consisting of tiny water droplets, resulting in visibility < 1 km)

Appendix Q: Reported Avoidance versus Actual Behaviour

Driving Situation	Self-Report	Actual behaviour		Kappa (p)
	Try to avoid	Did not drive	drove	
1. Night	No Yes	14 30	11 5	-.27 (.01)
2. Dawn or dusk	No Yes	36 15	8 1	.10 (.36)
3. Bad weather conditions (general)*	No Yes	11 25	5 19	.09 (.40)
4. Heavy rain	No Yes	17 41	1 1	-.02(.53)
5. Fog	No Yes	6 51	0 3	.01(.55)
6. Night bad weather (e.g., heavy rain)	No Yes	7 49	2 2	-.06 (.04)
9. Trips lasting more than 2 hours (one way)	No Yes	35 24	1 0	-.03 (.41)
10. Unfamiliar routes/detours	No Yes	26 29	3 2	-.04 (.59)
11. Heavy traffic/rush hour in town	No Yes	2 6	19 27	-.10 (.38)
12. Heavy traffic/rush hour on hwy/express	No Yes	10 28	7 9	-.13 (.21)
13. Left hand turns with traffic lights	No Yes	0 0	51 3	-
14. Left hand turns, <u>no</u> lights/stop signs	No Yes	1 0	40 13	.01 (.57)
16. Hwys with 3+ lanes, $\geq$ 100 km/h	No Yes	27 21	6 0	-.21 (.04)
18. Two-lane highways	No Yes	30 1	22 1	.01 (.83)
19. Rural areas, night	No Yes	24 27	1 2	.03 (.64)
20. With passengers, may distract	No Yes	13 8	29 8	-.14 (.18)

Appendix R: Perceptions and Self-reported Behaviour with Trip Purposes

Trip purpose	DCS-D	DCS-N	DCS-N #1	PDA	PDA Change	Frequency	Avoidance
Religious	-.06 (.66)	-.13 (.32)	.08 (.56)	-.08 (.57)	-.02 (.89)	-.01 (.96)	.07 (.60)
Work/school	.05 (.69)	.18 (.18)	.08 (.58)	-.02 (.89)	-.14 (.29)	-.01 (.93)	-.12 (.37)
Volunteer	.14 (.31)	.18 (.17)	**.30 (.03)**	**.29 (.03)**	.004 (.98)	**.34 (.01)**	-.21 (.13)
Active leisure	-.08 (.55)	.06 (.64)	.23 (.08)	.11 (.41)	-.13 (.34)	**.27 (.04)**	-.03 (.84)
Shopping/errands	-.04 (.76)	.03 (.80)	.14 (.30)	.24 (.07)	-.08 (.55)	**.35 (.01)**	-.05 (.70)
Social/entertainment	.24 (.08)	**.38 (.003)**	.22 (.09)	**.30 (.02)**	-.16 (.24)	**.40 (.002)**	**-.37 (.005)**
Medical	.07 (.59)	.05 (.73)	.11 (.40)	.16 (.24)	-.20 (.14)	-.02 (.91)	-.07 (.62)
Helping others	-.01 (.92)	.05 (.71)	.23 (.08)	.09 (.49)	-.02 (.88)	.25 (.06)	.02 (.90)
Other	-.20 (.14)	-.13 (.34)	.12 (.37)	.15 (.26)	-.03 (.84)	.05 (.72)	.04 (.79)
Mandatory	.03 (.83)	.17(.20)	**.30 (.02)**	**.34 (.01)**	-.05(.74)	**.34 (.01)**	-.14 (.31)
Discretionary	.05 (.70)	.19 (.15)	**.29 (.03)**	**.29 (.03)**	-.14 (.28)	**.43 (.001)**	-.20 (.14)
% Religious	-.05 (.71)	-.17 (.21)	.02 (.87)	-.19 (.15)	.01 (.93)	-.12 (.36)	.11 (.42)
% Work/school	.02 (.89)	.14 (.29)	.07 (.60)	-.01 (.94)	-.15 (.27)	-.03 (.85)	-.02 (.88)
% Volunteer	.12 (.38)	.13 (.32)	**.27 (.04)**	**.27 (.04)**	-.005 (.97)	**.27 (.04)**	-.17 (.21)
% Active leisure	-.08 (.57)	.04 (.75)	.20 (.14)	.03 (.83)	-.15 (.27)	.15 (.28)	.04 (.79)
% Shopping/errands	-.02 (.91)	-.10 (.29)	-.18 (.17)	-.18 (.17)	.08 (.57)	-.11 (.43)	.21 (.12)
% Social/entertainment	.13 (.33)	.18 (.17)	.07 (.58)	.15 (.26)	-.11 (.43)	.02 (.90)	**-.33 (.01)**
% Medical	.006 (.98)	-.07 (.63)	.10 (.47)	-.04 (.78)	-.17 (.20)	-.14 (.31)	.04 (.75)
% Helping	-.02 (.87)	.02 (.90)	.18 (.18)	-.12 (.39)	.06 (.63)	.11 (.41)	.10 (.47)
% Other	-.24 (.07)	-.21 (.11)	.10 (.54)	.11 (.41)	-.04 (.77)	-.08 (.56)	.12 (.36)
% Mandatory	-.05 (.69)	-.003(.98)	.14 (.31)	-.09 (.52)	-.01 (.94)	.05 (.71)	.05 (.71)
% Discretionary	.05 (.69)	.003(.99)	-.14 (.29)	.09 (.52)	.005(.97)	-.05 (.71)	-.05 (.71)

Note: Values are represented by Pearson r (p-value), with the exception of DCS-N #1 and PDA Change (Spearman Rho, p)

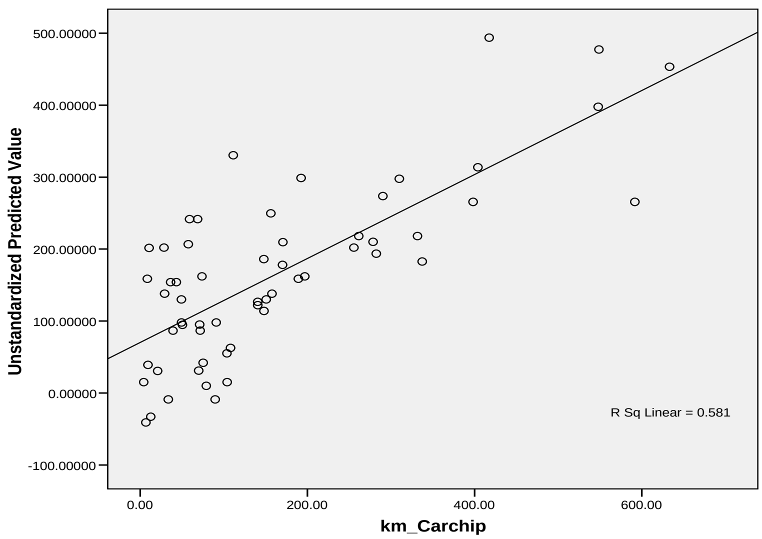
Appendix S: Associations with Distance and Average Radius Driven

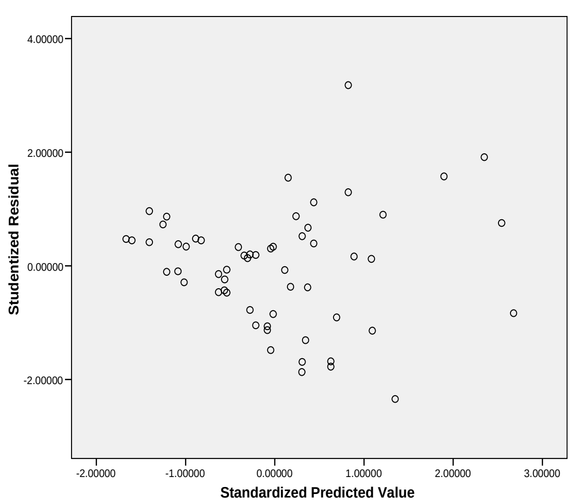
Characteristic	N	Km	Average Radius
Overall Health			
Good/Excellent	54	173.2 (160.4)	7.67 (7.65)
Poor/Fair	4	41.5 (22.3)	3.25 (.68)
t-value (p)		5.37 (<.001)	3.98 (<.001)
Able to ¼ Mile			
No	7	140.6 (39.3)	6.28(4.25)
Yes	51	167.3 (168.3)	7.60 (7.87)
t-value (p)		-.96 (.34)	-.02(.89)
Eyesight compared to others			
About the Same	30	122.6 (110.7)	5.97 (5.08)
Better than Most	25	222.2 (194.8)	9.38 (9.48)
t-value (p)		-2.27 (.03)	-1.63 (.11)
missing	5		
Last physician visit			
< 6months	45	156.2 (154.0)	7.49 (8.06)
< year	10	166.5 (160.3)	7.42(6.18)
> year	1	548.8 (0)	8.66 (0)
F-value (p)		3.14 (.05)	.01(.99)
Missing	2		
# Days/wk of Physical Activity			
Pearson r	58	.04 (.79)	-.01(.92)
Diagnosis Score			
Pearson r (p-value)	58	-.11 (.43)	.04(.77)
Physical difficulty index			
Pearson r (p-value)	57	-.21 (.11)	-.09 (.51)
Missing	1		
Lower body index			
Pearson r (p-value)	57	-.22 (.11)	-.06 (.66)
Missing	1		
Upper body index			
Pearson r (p-value)	57	-.06 (.65)	.007 (.96)
Missing	1		
Barrier Score			
Pearson r (p-value)	56	.31 (.02)	.20 (.15)

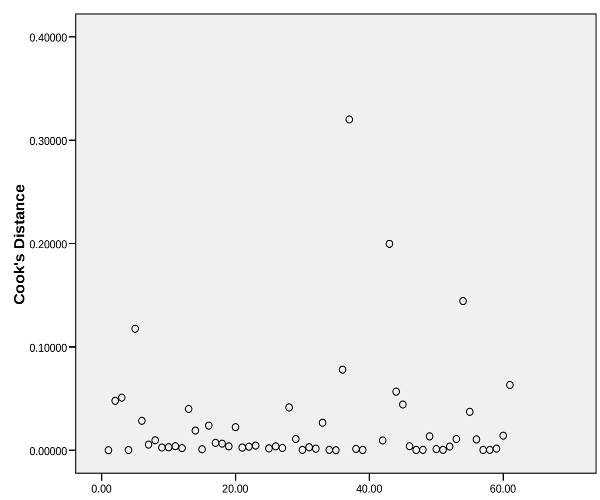
Appendix T: Regression Residual Plots

A. Distance (km)

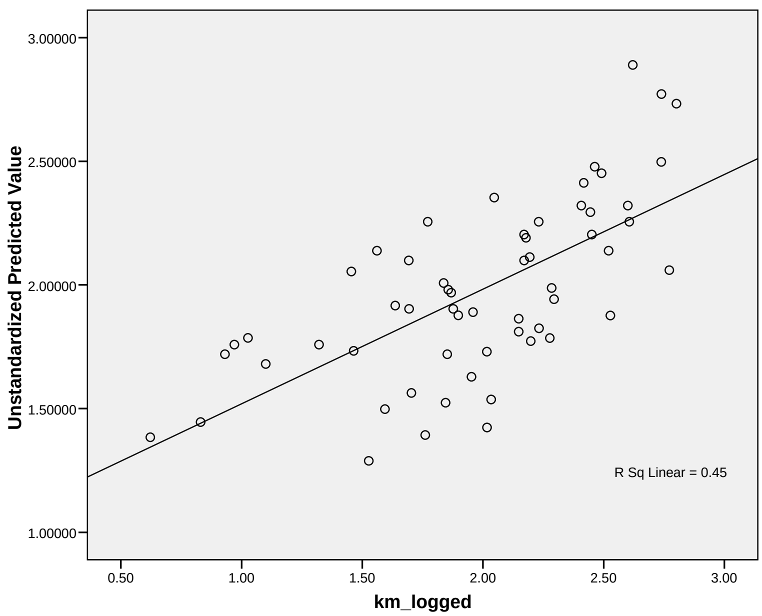
1) Untransformed

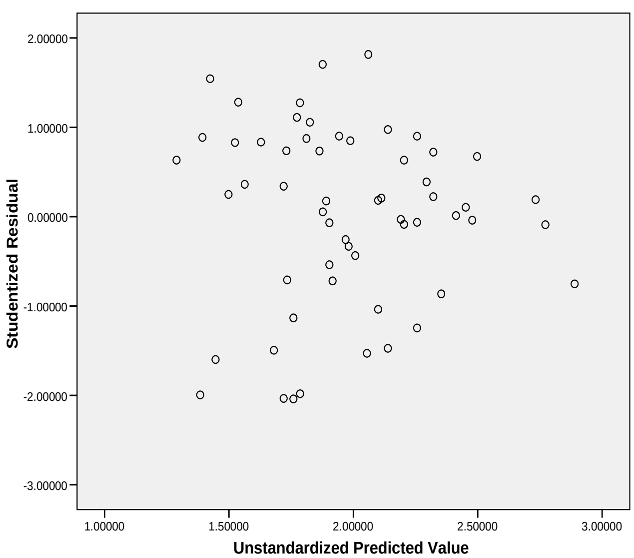


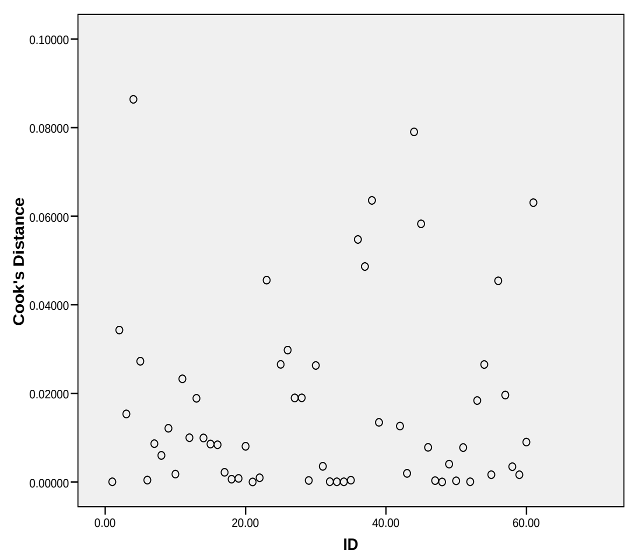




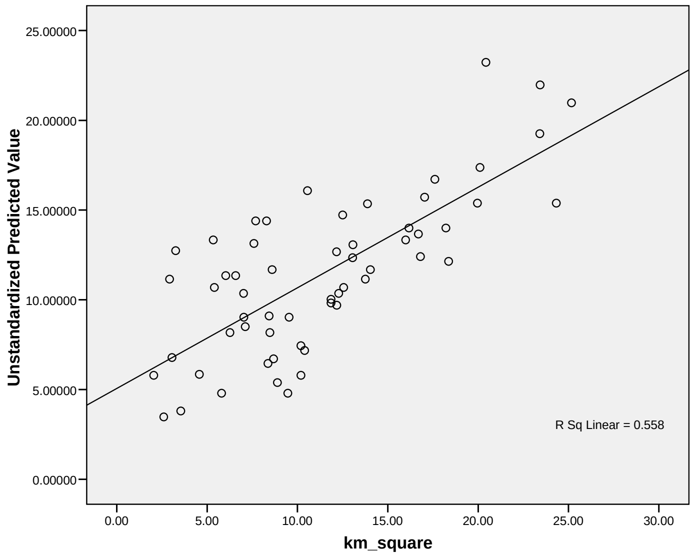
2) Log transformation

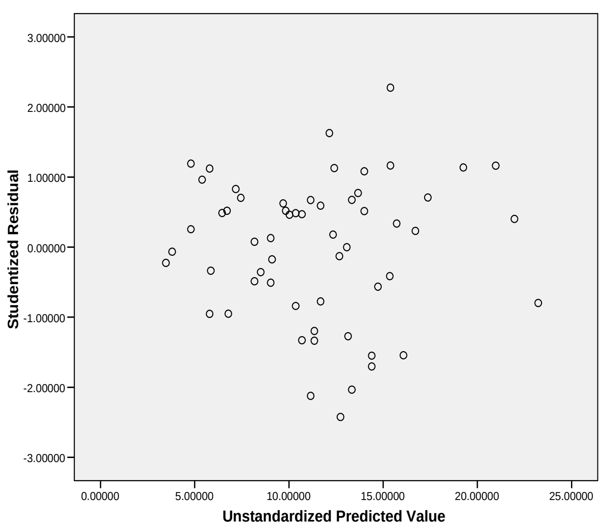


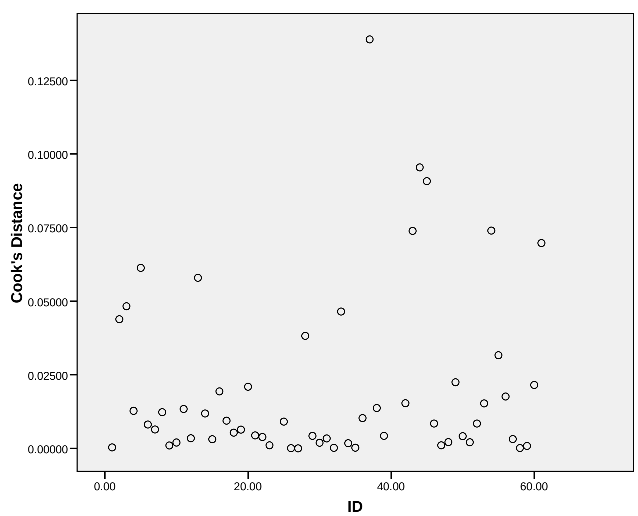




3) Square-root transformation

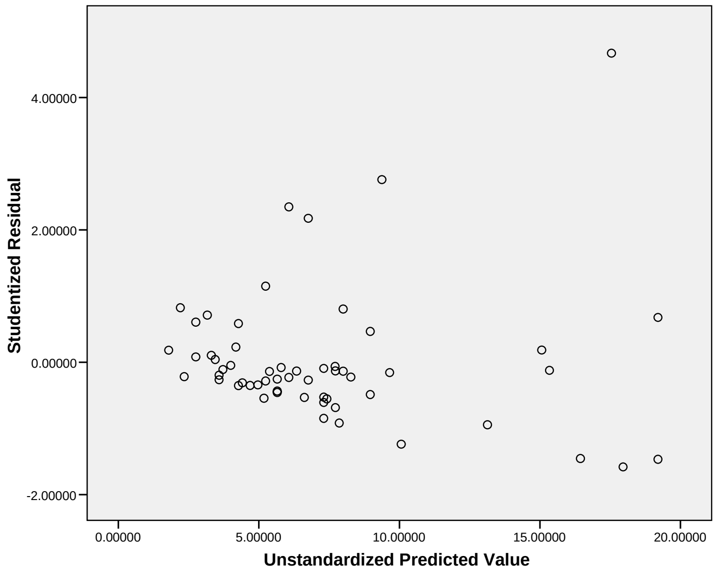


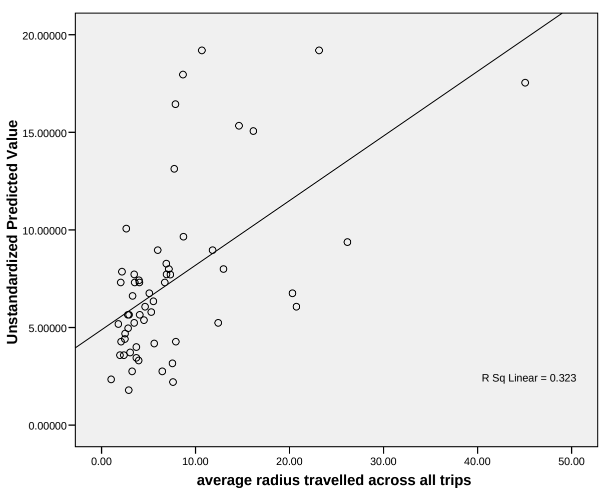


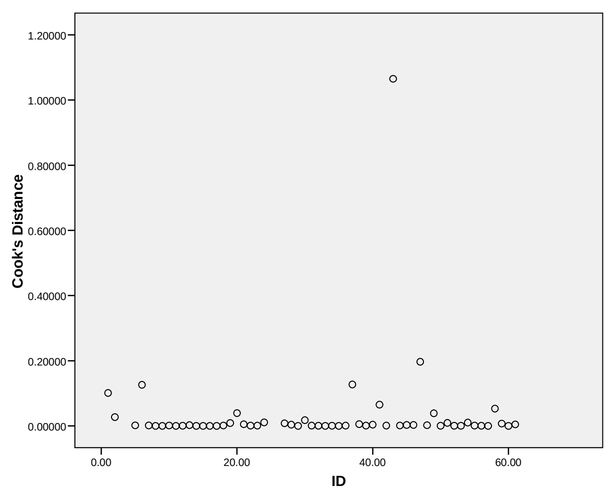


B. Average Radius per Trip

1) Untransformed







2) Log Transformation