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Self-Perceptions of Competence as Determiners of Driving Patterns

by

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Dedication

In memory of my father, H. Murray Lowe, for his love, his encouragement, and his unfailing support, and to my mother, Lola Marie Lowe, for her love and her laughter, and for instilling in me the value of education.

Abstract

There were three primary goals of the current research. The first goal was to examine if individual *perceptions* of competency, rather than the traditional measures of *functional* ability, were better predictors of restrictions in driving (Study 1). The second goal was to determine if physician referral for a driving evaluation biases ratings of self-perceptions of competency (Study 2). The primary goal of Study 3 was to examine the congruence between self-perceptions of driving competency and on-road behavior. Questionnaire data on driving behavior and self-perceptions of driving competency were obtained from older cognitively unimpaired individuals (n = 60) and from individuals with clinically significant cognitive impairment (n = 294). Corresponding driving information for each of the participants also was obtained from collateral sources. All participants received an on-road driving evaluation.

The results from Study 1 provide strong support for the perceived competency thesis in predicting restrictions in driving behavior. Overall, the findings reveal that measures of functional ability are not reliable predictors of driving restrictions. Global competency measures are, however, significant predictors of driving restrictions for cognitively unimpaired individuals and, to a much lesser extent, for cognitively impaired individuals. A result warranting special note is the evidence that restrictions in driving are multi-dimensional. Results from Study 2 revealed no significant differences between the non-referred and referred groups in perceptions of driving competency (global and facet). The findings from Study 3 reveal that the congruency between self-perceptions of driving competence and on-road driving behavior differs as a function of cognitive status. Compared to cognitively unimpaired drivers, individuals with a dementia (AD or MID) were found to overestimate their driving competencies, either by overestimating their global driving competence or by underestimating the degree of difficulty on selected driving manoeuvres. Estimations of competency did not differ as a function of type of pathology. The findings have important implications. First, it is unlikely that individuals with a dementia who overestimate their competence to drive will appropriately restrict their driving. Second, self-perceptions

of driving competency cannot be used as a basis for decisions about continued driving in cognitively impaired populations. Finally, determining the congruency between self-perceptions of driving competence in relation to on-road driving behavior is an important first step in understanding the way in which certain risk factors predispose sub-populations of older drivers toward over-involvement in vehicular crashes.

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CHAPTER 1

STATEMENT OF THE PROBLEM

Canada, like most other industrialized nations, is undergoing a demographic revolution (Statistics Canada, 1997). The dramatic aging of the North American population has led to older drivers being one of the fastest growing segments of the driving population, with the numbers projected to continue to increase into the middle of the next century (Transport Canada, 1997; U.S. Department of Transportation, 1995). Not only is the older driver population growing in terms of sheer numbers, but their driving exposure is increasing as well. Major travel surveys taken during the last 15 years indicate that older drivers are driving more and driving longer into old age, and this trend is expected to continue (Federal Highway Administration, 1985; Hu & Young, 1994).

The increased driving of the older driver population, unfortunately, is not without substantial cost. When amount of driving is taken into account, older drivers *as a group* have the highest crash rate of any adult age group (National Highway Traffic Safety Administration, 1989), and, once involved in a crash, they are more likely to be injured, to sustain more serious injuries, and to die from their injuries than are their younger counterparts (Barr, 1991; Evans, 1988; Graca, 1986; McCoy, Johnston, & Duthie, 1989; Retchin, Cox, Fox, & Irwin, 1988). This situation has emphasized the need for research targeted toward increasing the safety of older drivers (Transportation Research Board, 1988, 1992).

Although safety is a serious concern, there also has been a call for researchers and others to remain mindful that mobility is a key component in the maintenance and well-being of older adults (Carp, 1988), and of the important role that driving plays in the mobility of older people (Hu & Young, 1994). This has been especially important to communicate to policymakers and researchers whose focus has been on the safety problems associated with age-associated ability declines. Some solutions that could effectively increase safety could be unjustifiably detrimental to the mobility and independence of older drivers (e.g., unwarranted restrictions or even revocation of licensing privileges). In fact, the tension between older people's need for mobility and the need for personal and public safety has prompted government officials and traffic researchers to call for balanced solutions that maximize safety for older drivers *without* compromising mobility (Transportation Research Board, 1988).

Voluntary self-restriction of driving behavior has been advanced as one way older driver safety could be enhanced while preserving their mobility (Ball & Owlsey, in press; Jette & Branch, 1992; Marottoli, Ostfeld, Merrill, Perlman, Foley, & Cooney, 1993; Ontario Ministry of Transportation, 1994; Schieber, 1994; West, Haegerstrom-Portnoy, Oman, Gildengorin, & Reed, 1998). From a public policy perspective, the adoption and promotion of voluntary driving restrictions as a means of enhancing the safety and mobility of older drivers is appealing. With this strategy, older drivers would reduce their crash risk by voluntarily reducing their exposure to driving situations and conditions that put them at-risk for crashes by limiting their driving to safer times and routes; older drivers would remain mobile and the need for costly government restriction programs could be avoided. On the surface, voluntarily restricting driving to accommodate age-related declines in functional abilities seems like a responsible and reasonable means for older drivers to enhance their own safety without unduly restricting mobility. Unfortunately, the relevant research findings have been disappointing.

Voluntary restrictions based on functional ability declines presume a direct link between declines in those abilities and changes in driving patterns. Several researchers have investigated the possibility that declines in functional abilities are directly linked to voluntary changes in driving patterns (Ball & Owsley, in press; Forrest, Bunker, Songer, Cohen, & Cauley, 1997; Kington, Reuben, Rogowski, & Lillard, 1994; Marottoli et al., 1993; Retchin et al, 1988; Stewart, Moore, Marks, May, & Hale, 1993; Stutts, 1998). In general, researchers have found the relationship between declines in functional abilities and restrictions in driving to be disappointing. For example, results from Marottoli et al. (1993) and Kington et al. (1994) reveal insignificant associations between self-restrictions in driving behaviors and limitations in functional abilities, such as activities of daily living and instrumental activities of daily living. These same two studies also report a lack of association between declines in health status and driving self-restrictions. Impairments in vision also have been found to be unassociated with self-restrictions in driving in most studies (Forrest et al., 1997; Kington et al., 1994; Marottoli et al., 1993; but see Stutts, 1998). As a general summary, it can be said that there is a lack of support for the assumption that declines in functional abilities lead to driving self-restrictions. Thus, despite the apparent reasonableness of the self-restriction approach, it does not seem older drivers, *as a group*, voluntarily change driving patterns in accordance with functional ability declines. This suggests that either voluntary regulation of driving is not a strategy that should be pursued as a means of enhancing the safety and mobility of older drivers, or that the basic assumptions underlying that strategy need to be examined.

One of the fundamental assumptions of the self-restrictions approach is that there is, or can be, a direct link between functional ability declines and voluntary restrictions by the individual that appropriately limits driving to accommodate the ability declines (Janke, 1994; Planek, Condon, & Fowler, 1968; Schieber, 1994). The presumption that there is a direct link between age-associated declines in functional abilities and the imposition of voluntary driving restrictions was likely predicated on research suggesting that some older drivers do voluntarily reduce their exposure to driving situations and conditions that may put them at-risk for crashes. Results from a number of studies that have examined the travel patterns of older drivers provide evidence that some older drivers do impose restrictions on their driving behavior (Campbell, Bush, & Hale, 1993; Eisenhandler, 1990; Jette & Branch, 1992; Kington et al., 1994; Marottoli et al., 1993, Marottoli, de Leon, Glass, Williams, Cooney, Berkman, & Tinetti, 1997; Waller, 1992). For example, research reveals that many older drivers limit or eliminate night time driving (Eisenhandler, 1990; Forrest et al., 1997; Holland & Rabbitt, 1992; Kosnik, Sekuler, & Kline, 1990; Mortimer, 1988; Schlag, 1993). In addition, many restrict or avoid week-end driving (Stutts, Waller, & Martell, 1989), avoid driving during rush hours (Ball & Owsley, 1991), and during adverse weather conditions (Eisenhandler, 1990; Forrest et al., 1997; Kosnik et al., 1990; Moritmer, 1988, Schlag, 1993). However, because of the high crash rates of older drivers per miles driven, it must be the case that the restrictions are not sufficient or that only some drivers are appropriately restricting their driving while others are not. Indeed, the literature reviewed above cited studies investigating a variety of impairments for which drivers were not restricting their driving beyond that of drivers without the impairments. The inconsistency in findings suggests that presuming ability declines will uniformly result in compensatory driving restrictions may be one of the problems. In view of this, it may be instructive to consider when changes in functional abilities would be such that older drivers would impose self-restrictions on their driving, and when that outcome would not be realized. This, in turn, may lead to a different and more productive way of understanding and investigating the determinants of driving self-restrictions.

In attempting to understand the relationship between functional ability declines and self-restrictions in driving, it is important to note what underlies the possibility that there could be a link between declines in functional ability and compensatory changes in driving patterns. Clearly, the assumption of self-restrictions based on ability declines presumes that the individual will have *insight* into his or her ability declines. It seems reasonable to presume that healthy older drivers might have insight into declines in functional abilities relevant to driving and restrict their driving accordingly. However, it is equally reasonable to presume this same relationship would not hold if the individual's insight was impaired. When an individual's insight is impaired, as is often the case in those with a dementing illness (McGlynn & Schacter, 1989), he or she may not recognize functional ability declines.

Although little is known about the individual driving *patterns* of persons with a dementia, their crash rates far exceed those of non-dementing seniors (Cooper, Tallman, Tuokko, & Beattie, 1993; Drachman & Swearer, 1993; Dubinsky, Williamson, Gray, & Glatt, 1992; Friedland, Koss, Kumar et al., 1988; Gilley, Wilson, Bennett et al., 1991; Lucas-Blaustein, Filipp, Duncan, & Tune, 1988; O'Neill, Neubauer, Boyle, Gerrard, Surmon, & Wilcock, 1992; Tuokko, Tallman, Beattie, Cooper, & Weir, 1995). Clearly, persons with a dementia, as a group, do not adjust their driving in ways that are concordant with their abilities. Moreover, there is good reason to believe that individuals with a dementia do not appropriately recognize their declines. Several studies have shown that individuals with a dementia lack insight into their declines in driving competence (Dobbs & Dobbs, 1999; Dobbs, Dobbs, Heller, & Schopflocher, 1996; Friedland et al., 1988; Hunt, Morris, Edwards, & Wilson, 1993; Kapust & Weintraub, 1992). The suggestion that those with a dementia may lack insight about ability declines relevant to driving is consistent with empirical reports showing dementia patients overestimate their abilities in other performance domains (Ford, Bolmar, Salmon, Medalie, Roy, & Galazka, 1988; Kuriansky, Gurland, & Fleiss, 1976; Rubenstein, Schairer, Wieland, & Kane, 1984)

Older drivers who have cognitive impairments that can affect insight represent one of the clearest breakdowns in the assumption of a direct link between functional ability declines and voluntary driving restrictions. If ability declines are not recognized, there is little reason to believe that the individual would restrict his or her driving because of the decline in ability. Knowing there is a decline in ability is a prerequisite for voluntarily changing any behavior because of that decline. Failing to acknowledge the important (perhaps essential) role that awareness must play in voluntarily accommodating functional ability declines is a serious deficiency of assuming a direct link between declines in abilities and driving self-restriction. In view of the shortcomings of that assumption, at least for some subgroups of older drivers, perhaps a better assumption would be one that links self-restrictions in driving behavior to *self-perceptions* of driving competence, independent of the actual ability levels.

The research presented here provides an initial exploration of the efficacy of a shift to considering self-perceptions of driving competence to be more fundamental to self-restrictions in driving than is functional ability decline per se. One of the primary advantages is that a conceptualization based on self-perceptions provides a rationale (and testable hypothesis) for why declines in functional abilities per se are poor predictors of driving patterns. Comparing the utility of self-perceptions of driving competence relative to measures of functional ability for predicting self-restrictions in driving is central to the present research. The methodological approach is to compare the utility of the two approaches for predicting driving restrictions for a group of healthy older drivers and a group of cognitively impaired older drivers who are likely to have impaired insight.

CHAPTER 2

STUDY 1

PREDICTING SELF-RESTRICTIONS IN DRIVING: A COMPARISON BETWEEN FUNCTIONAL ABILITIES AND SELF-PERCEPTIONS OF COMPETENCE

Introduction

The central hypothesis under investigation in Study 1 is that an individual's *perceptions* of his or her own competence to drive will be the primary mechanism influencing self-restrictions in driving patterns (when, where, and how much an individual drives). The shift to an assumption that perceived competence is a major determiner of imposing voluntary driving restrictions may appear to be only a minor shift in orientation. However, it is much more than that. The magnitude of the shift is evident when the existing driving research is reviewed in an attempt to seek information relevant to the perceived competence -- driving restrictions hypothesis. That review indicated that only three studies have data directly applicable to the perceived competence hypothesis (Holland & Rabbitt, 1992; Marotttoli & Richardson, 1998; Ontario Ministry of Transportation, 1994).

Perceived Competence and Driving Self-Restrictions

Holland and Rabbitt (1992) examined the relationships between perceived changes in sensory abilities and changes in driving behavior in a sample of older community dwelling volunteers. Although declines in hearing were unrelated to changes in driving behavior, there were several significant correlations between perceived visual abilities and self-rated driving behavior. Individuals reporting difficulties with seeing in the dark or at dusk were more likely to report that they avoided driving in the dark. Individuals reporting difficulties with bright lights or glare also were likely to report avoiding driving in the dark, at dusk, and in very bright sunlight.

On the other hand, individuals who generally felt that their eyesight had become worse over the past decade tended not to avoid driving in any particular situation.

A second study investigating the relationship between perceptions of competence and driving self-restrictions was conducted by the Ontario Ministry of Transportation (1994). In that study, researchers investigated the awareness of driving ability and risk and self-restrictions in driving in a group of 50 to 79 year old Ontario drivers. Significant relationships were reported between perceptions of ability and risk and self-reports of self-restrictions in driving. In general, individuals with self-perceptions of reduced ability were more likely to report compensating by restricting when, where, and how much they drove. Specifically, self-perceptions of reductions in visual and cognitive skills were the most highly correlated with driving restrictions, suggesting that declines in specific, rather than gross skills, are associated with self-restriction decisions.

In the most recent study, Marottoli and Richardson (1998), investigated the relationship between self-ratings of driving ability and driving patterns in a sample of drivers 77 years of age and older. Results revealed that individuals who rated themselves as better drivers than their same-aged peers were more likely to drive more miles. Interestingly, self-ratings of driving ability were not related to age or to gender.

Although there are few studies within the driving literature that directly examine perceptions of competence relevant to driving self-restrictions, those that are available provide support for the hypothesis that perceptions of competency can underlie self-restrictions in driving. Moreover, results from literature in areas other than driving also support this relationship, and they provide conceptual analyses that are relevant to the driving domain. Primary in this regard is the literature related to self-efficacy theory (Banduara, 1977; 1986), and literature on competence and aging (Salthouse, 1997; Willis, 1991). The importance of that literature is especially compelling in the context of the failure of the research findings to provide support for the position that declines in functional abilities will be related to self-restrictions in driving behaviors. Because the presumption of this direct relationship represents the prevailing view in the driving domain, and the lack of support for that relationship is the impetus for the current study, the research concerned with evaluating the direct relationship between declines in functional abilities and driving self-restrictions will be reviewed before a more in-depth consideration of the self-perception hypothesis.

Functional Abilities and Driving Self-Restrictions

Although there is a general belief that many older drivers restrict when, where, or how much they drive due to declines in functional abilities, only a few studies have examined that relationship. In one of the earliest studies, Retchin et al. (1988) compared frequent drivers with drivers who drove infrequently, or not at all. Significant differences were obtained among the three groups in grip strength, reaction time, static visual acuity, dynamic visual acuity, and peripheral vision. However, most of the differences were due to differences between the non-driving and driving groups, and direct comparisons between frequent and infrequent drivers were not presented.

A number of researchers have investigated factors associated with reductions in mileage with age. Marottoli et al. (1993) studied the effects of demographic, physical, psychosocial, and activity-related features on driving cessation, number of miles driven, and changes in miles in a population of community living older drivers. The only significant predictors of reductions in mileage were increasing age and ability to perform higher level physical activities such as walking one-half mile, climbing a flight of stairs, and engaging in heavy housework. Importantly, the presence or absence of chronic medical conditions (e.g., cataracts, diabetes, glaucoma, myocardial infarction, Parkinson's Disease, and stroke), impairments in mental status, deficits in sensory functioning (vision and hearing), and deficits in activities of daily living (ADL's) failed to predict mileage restriction. Results from that investigations also revealed that high mileage drivers are likely to be men who are younger, who are still working, and who have few significant functional disabilities. Forrest et al. (1997) investigated the effects of demographics, lifestyle behavior, and medical conditions on the driving patterns of 1768 older women. Women with greater comorbidity, as measured by number of medical conditions, were more likely to report reductions in driving mileage in the last five years and to avoid driving after dark. Self-reports of poor vision and measures of physical activity, however, were not associated with restrictions in driving. The use of avoidance strategies such as restrictions in driving during inclement weather, after dark, and during rush hour traffic were, however, significantly associated with increasing age.

In a recent study, Stutts (1998) examined driving restrictions in a sample of older drivers with impairments in visual and cognitive functioning. Measures of restrictions in driving included mileage reduction, as well as avoidance of driving in high risk situations such as driving after dark, in heavy traffic, and during inclement weather. Although lower levels of cognitive and visual functioning were associated with reduced driving exposure, more than 60% of the drivers in the lowest two quartiles (Quartiles 3 and 4) of the visual function measures (contrast acuity, contrast sensitivity, and peripheral vision) failed to restrict their driving in three or more of the high risk driving situations. On tests of cognitive functioning (Trails A and B and Short Blessed Test), almost 70% of those performing on the lowest two quartiles reported no reductions in driving exposure for three or more of the high risk driving situations.

Restrictions in driving after dark also have been studied by Kington et al. (1988). In that investigation, the authors examined the influence of demographic, health, and functional status factors on driving after dark in a large group of drivers 50 years and older. Older individuals, women, and those with fewer years of education were more likely to restrict their driving after dark. With the exception of limitations in using the phone, functional limitations in ADL's and instrumental activities of daily living (IADL's) failed to predict driving restrictions after dark. In general, few of the self-reported functional and health status measures predicted driving patterns. Rather, as noted by the authors, a combination of sociodemographic variables, health status, and the presence of medical conditions provided better predictions of driving patterns.

Finally, in the most recent study, Ball and Owsley (in press) investigated restrictions in driving frequency in a sample of older drivers with and without cataracts. Results reveal that individuals with cataracts do restrict their driving. However, the absolute amount of restriction is small. Compared to older drivers without cataracts, those with cataracts reported driving only one day a week and one place a week less than was reported to be driven by the healthy participants. There were no reported reductions between the two groups in the number of trips or miles driven per week.

In summary, research suggests that at least some drivers voluntarily restrict their driving by driving fewer miles or altering when and where they drive. However, there is little evidence that declines in functional abilities are reliably related to self-restrictions in driving.

A fundamental assumption of the self-restriction approach is that there is a direct link between declines in functional abilities and self-restrictions in driving behavior. However, a critical examination of the literature makes it clear that declines in functional abilities have not been very successful in predicting driving patterns of older drivers. It appears that a major constraint in the prediction of self-restrictions is the conceptualization postulating a direct link between declines in functional abilities and self-restrictions in driving. A new conceptualization which can more effectively allow for predicting and accounting for when restrictions in driving patterns will occur could provide significant advancements for theory, methodology, and practice. A quite different approach, and the one advanced here, would be to suggest that it is not how *functionally* competent a person is that determines his or her driving patterns, but how competent they *think* they are that is the more effective determiner of imposing restrictions.

The shift to an assumption that perceived competence is a major determiner of imposing self-restrictions in driving represents a major shift in orientation, as evidence by the paucity of literature in this area. Self-perceived competence has, however, been an important theme of research in other areas (Bandura, 1977, 1986; Salthouse, 1997; Willis, 1991). That literature has important implications for conceptualizing how self-perceptions of competency can be related to driving self-restrictions, and for the methodology used to investigate that relationship.

Self-Efficacy and Behavior Change

Although Bandura's research does not directly investigate driving behavior, it is consistent with the basic premise that perceptions of one's competency to drive would be related to driving behaviors. According to self-efficacy theory (Bandura, 1977), people's efficacy expectations or beliefs about their own abilities are major determinants of their behavior. Self-efficacy theory was originally developed to advance our understanding of the mechanisms through which therapeutic procedures (e.g., desensitization, implosive therapy, participant modeling, symbolic modeling) alter behavioral functioning in individuals suffering phobic reactions. In Bandura's theoretical framework, self-efficacy is assigned a central role, with expectations of self-efficacy determining or regulating behavior. According to self-efficacy theory, people engage in or become involved in activities or situations they believe themselves competent to handle. In contrast, people avoid situations or restrict their activities in situations that they believe exceed their skills to cope.

Previous research provides support for the perceived self-efficacy – behavior relationship. Results from three correlational field studies indicate that measures of mathematical self-efficacy were significantly and positively related to choice of math-related majors in college students (Hackett & Betz, 1989), perceived career options in students in a High School Equivalence program (Bores-Rangel, Church, Szendre, & Reeves, 1990), and perceived career options in college students (Lent, Brown, & Larkin, 1984). Results of research by Sexton and Tuckman (1991) reveal that measures of self-efficacy for mathematics were significantly related to choice of task difficulty in a sample of college women. In general, high self-efficacy subjects chose more difficult problems than did low self-efficacy subjects. Self-efficacy also has been found to be related to task persistence and effort. In general, the results indicate that high levels of self-efficacy are related to greater task persistence and effort (cf. Schunk, 1989a).

Self-efficacy research among younger age groups has focussed on achievement abilities in academic contexts. In contrast, the research on self-efficacy in the older population has focussed almost exclusively on self-efficacy in the areas of memory and intelligence. Consistent with the definition provided earlier, memory self-efficacy consists of a set of beliefs about one's capability to use memory effectively in various situations (Berry, West, & Dennehey, 1989; Hertzog, Dixon, & Hultsch, 1990a). In general, studies from the adulthood and aging literature provide support for positive efficacy-performance relationships (Berry et al., 1989; Cavanaugh & Poon, 1989; Dixon & Hultsch, 1983a; Multon, Brown, & Lent, 1991; Rebok & Balcerak, 1989).

Finally, as noted earlier, although there has been little in the way of research investigating the role of perceptions of self-efficacy in determining driving behaviors, that which is available, although largely atheoretical, provides support for the hypothesis that self-perceptions of competence are related to driving behaviors (Holland & Rabbitt, 1992; Marottoli & Richardson, 1998; Ontario Ministry of Transportation, 1994).

Conceptualization of Perceptions of Self-Efficacy

Two issues related to the conceptualization of self-efficacy have relevance for the current research. Both issues are concerned with the specificity with which self-efficacy is measured.

The first issue pertains to whether self-efficacy operates at a global or generalized level or at a domain-specific level. The second issue is concerned with whether assessments at the domain-specific level should be made at a more general level or at a more task-specific level. In the sections that follow, an overview of the literature relevant to each of the issues is provided.

Domain-Specific vs. Generalized Self-Efficacy

Bandura (1986) defines self- efficacy as people's judgements of their capabilities to attain a given level of performance. In his original conceptualization, Bandura (1977) presented self-efficacy as a very domain-specific concept. Most of the research has examined the concept of self-efficacy from this perspective, with investigations of self-efficacy covering a wide variety of domains: parenting (Sirignanao & Lachman, 1985), mathematics ability in children (Schunk & Hanson, 1989a, b) and adolescents (Meece, Wigfield, & Eccles, 1990), career choice (Betz & Hackett, 1986), interpersonal relationships (Kanfer & Zeiss, 1983), athletic performance (Feltz, 1982), complex decision making (Bandura & Jourden, 1991), the treatment of various phobias (Bandura, Adams, & Beyer, 1977; Bandura, Adams, Hardy, & Howell, 1980; Bandura, Reese, & Adams, 1982), social support (Holhahan & Holhahan, 1987), and memory functioning in older adults (Berry et al., 1989).

Recently, researchers have examined the concept of self-efficacy from a more general or global perspective (Sherer, Maddux, Mercandante, Prentice-Dunn, Jacobs, & Rogers, 1982; Sherer & Adams, 1983). However, results have failed to support the conceptualization of self-efficacy as a general construct (Woodruff & Cashman, 1993). Moreover, a number of recent studies provide evidence that domain-specific measures of perceived self-efficacy are better predictors of performance than are global or general measures of self-efficacy. For example, results of research by Earley & Lituchy (1991) indicate that domain-specific measures of mathematical self-efficacy were better predictors of mathematics performance relative to a more generalized measure of self-efficacy. Wang and Ricarde (1988) present evidence that task-specific measures of self-efficacy were more highly related to their specific tasks than a generalized measure of self-efficacy. In general, research suggests that self-efficacy is *not* a global self-evaluation but is, instead, tied to specific tasks or situations.

It is interesting to note that a similar debate as to whether competence is a global or domain-specific construct has been made in the competence and aging literature (Salthouse, 1997). Although the concept of competence has numerous meanings, questions about competence in terms of aging frequently pertain to an individual's ability or abilities to engage in activities necessary to function in everyday life (Willis, 1991). However, a somewhat different usage of the term "competence" has been used in the medical and legal literature. Under these circumstances, competence represents a legal status concerning an individual's right to make life decisions and engage in a variety of transactions with others. Relevant to this discussion is the observation that, within the legal and medical systems, competence was once conceptualized as a global, all-or-none, construct. At present, however, competence is defined and is understood as more specific in nature. Thus, an individual could be incompetent in a specific domain (e.g., financial planning), but remain competent in other domains (self-care, shopping).

Recently, Salthouse (1997) has proposed a definition of competence that reflects the present movement away from the earlier conceptualization of competence as a *global* construct. According to Salthouse, "competence is a judgement about an individual's capability in a particular activity based on an assessment, which can be formal or informal and objective or subjective, of two or more aspects presumed to be relevant to the successful performance of that activity" (p. 51). In terms of *subjective* assessments or self-perceptions, the conceptualization of competence as advanced by Salthouse is synonymous, if not identical, to Bandura's (1977) definition of self-efficacy. Because the term 'self-perceptions of competence' will be more readily understood by those familiar with the driving literature and unfamiliar with the social psychological literature, the term 'self-perceptions of competency' rather than 'perceptions of self-efficacy' will be used throughout the remainder of this dissertation. That self-perceptions of competency may be a domain-specific construct has important implications for the current study. The implication is such that if competency is specific to a particular activity, and is not a general or universal construct, then assessments of competency should be based on assessments explicit to the domain or activity to which one is referring.

Domain Specific: Global or Specific Measures

The second issue relevant to the conceptualization of self-perceptions of competency is whether measures within a domain should be global or specific. Salthouse (1997) argues that assessments of competence should be relevant to the activity of domain under consideration based on "...*aspects* presumed to be relevant to the successful performance of activity" (p. 51, italics added). Thus, according to Salthouse, competence is best understood in terms of functioning in a particular activity or domain, *and* for relevant activities *within* that domain. A similar argument is made by Bandura (1986, 1990).

In general, Bandura (1977) suggests that perceptions of competence (self-efficacy) are not all encompassing for a performance domain. Instead, self-perceptions of competence relate to *aspects* of the overall task. Although not involved in research in the driving domain, Bandura used driving to illustrate differences in levels of task requirements, and the level of analysis he thought was relevant. In this regard, Bandura noted that self-perceptions of competence are

> usually measured in terms of variable use of the subskills that one possesses under different situational demands. For example, in measuring driving self-efficacy, people are not asked to judge whether they can turn the ignition key, shift the automatic transmission, steer, accelerate, and stop an automobile.... Rather, they judge whatever

their subskills may be, the strength of their perceived self-efficacy to navigate through busy arterial roads, congested city traffic, onrushing freeway traffic, and twisting mountain roads. The motor components of driving are trivial, but the generative capability of manoeuvring an automobile through congested city traffic and speedy freeways is not.

(Bandura, 1986, p.387)

The early focus of Bandura's research was on assessments of task-specific self-efficacy. As such, he utilized a 'microanalytic approach' that provided for an assessment of self-efficacy and performance on specific aspects of the task. Although few studies have results relevant to this approach, those that are available have provided support for the utility of measuring task performance in terms of specific aspects of the task (Berry et al., 1989). Recently, Berry and West (1993) suggest that, in order for advancements to occur, both measures of self-perceptions of competence be included in studies investigating the relationship between self-perceptions of competence and performance. In general, Berry and West suggest that "task specific measures should garner more precision regarding the accuracy of the efficacy-performance relationships whereas measures at the domain level should provide more general information regarding self-evaluations of abilities (p. 358).

The literature reviewed above has important implications for the current research. First, assessments of self-perceptions of driving should include both general domain-specific measures as well as task-specific measures. Secondly, as discussed below, the literature has relevance for the measurement of the 'self-restrictions in driving' construct.

Multidimensionality of Self-restrictions in driving.

Bandura argues that perceptions of self-efficacy are likely to vary as a function of task requirements (Bandura, 1977, 1986). Thus, tasks may vary in difficulty and the subskills that they require. Different tasks can make different demands on different abilities, and even the same task may tap different abilities under different circumstances. If perceptions of self-efficacy vary as a function of task requirements, and if those perceptions determine task restriction or avoidance, then there may be differential restriction or avoidance as a function of task requirements, even *within* a performance domain. This has important methodological implications for the current study.

If driving is a task with different levels of task difficulty, and if restriction or avoidance of task performance occurs as a function of task requirements, the implication is that 'restrictions in driving' may not be a unidimensional construct. Clearly, some aspects of the driving task require fewer and/or lesser abilities than do other aspects. Driving may be a relatively simple task on a highway during daylight, but increases in the demands it places on abilities when it is nighttime and during blizzard conditions. Because of this, individuals may believe their competency for these driving situations differ, and restrict their driving accordingly. The conceptual implication is that driving, like other performance domains, is multi-dimensional, and the methodology needs to address, explicitly, how the dimensions of driving restrictions will be measured.

Although there is evidence (e.g., Forrest et al., 1997; Persson, 1993; Planek & Fowler, 1971) that older drivers differentially restrict their driving in terms of situations (week-day vs. week-end) and conditions (good weather, inclement weather), no previous studies have applied a methodology appropriate for isolating relevant dimensions, nor have they investigated how self-perceptions about components of driving (e.g., merging) might be related to the way(s) in which driving patterns are altered. Investigating the structure of the 'driving self-restrictions' construct was pursued in the current study.

Testing the Self-Perception Hypothesis

The fundamental difference between the approach linking functional ability declines to driving self-restrictions and the perceived competency approach advocated here is the role of insight into abilities. The former approach implicates restrictions in driving patterns based on declines in functional abilities. The latter approach argues that ability declines per se may or may not be related to restrictions in driving patterns, depending on whether the individual perceives those declines. One of the most straight-forward ways to test the utility of the two approaches, then, would be to examine self-restrictions in driving for a healthy population and a population that has definite declines in those abilities, but lacks insight into those declines. This was the approach taken in the current study. The clear prediction is that those with ability declines, but no insight into those declines, will have driving pattens commensurate with their self-perceptions of competence, but incompatible with their declined functional ability. The match between self-perceptions of competence and amount of restrictions in driving should be equally strong for older, cognitively unimpaired drivers, again because it is self-perceptions that serve as the basis for behavior change. However, in the case of the cognitively unimpaired, driving patterns are predicted to be compatible with age-related declines in functional ability.

Drivers with a dementia provide a good sample for which insight into declines in functional abilities is most often lacking. For example, results from numerous studies suggest that individuals with a dementia tend to overestimate their functioning relative to either objective ratings (Kuriansky, Gurland, & Fleiss, 1976), ratings from nursing staff (Rubenstein et al., 1984), or ratings from significant others (Magaziner, Simonsick, Kashner, & Hebel, 1988; McCusker & Stoddard, 1984; Rothman, Hedrick, Bulcroft, et al., 1991; Rubenstein et al., 1984). To test the prediction that individuals with a dementia lack insight into ability declines relevant to driving, measures of functional abilities, self-perceptions of abilities, and driving restrictions of a sample from a dementia population were compared with those same measures for a healthy (e.g., cognitively unimpaired) group of otherwise comparable older drivers.

Although individuals with a dementia can provide valid self-evaluations, it is unreasonable to expect that they can provide valid recall of actual events such as their own driving patterns. The recall of where one drives, how much one drives, and under what conditions one does and does not drive requires mental abilities that may be compromised by dementing illnesses. Because of this, that information must be obtained from some other source. In most cases, information is obtained from collateral sources (Hing, Sekscenski, & Strahan, 1989; Zimmerman & Magaziner, 1994). In the present study, information about the driving patterns of the cognitively impaired and cognitively unimpaired older drivers was obtained form collateral sources. Although imperfect, the use of collateral or proxy reports is one way of obtaining information (e.g., functional status, health status, driving habits) on individuals who may not be able to provide accurate or reliable information about themselves. A number of recent studies, which have evaluated the accuracy of collateral reports to objective measures or have assessed collateral-subject response agreements reveal that, in general, the accuracy or agreement of collateral reports with other measures is best when questions concern behaviors or functions with observable manifestations (Magaziner, 1997; Magaziner, Hebel, Warren, 1987; Magaziner et al., 1988; Zimmerman & Magaziner, 1994). In addition, research suggests that asking about discrete or specific aspects of a task rather than asking about general aspects of a task is another method of reducing bias (Magaziner, 1992). Finally, research indicates that the closer the association (as indicated by shared residence, providing assistance, first-order relationship) between the study participant and the collateral source of information in cognitively impaired populations, the greater the agreement between ratings (Magaziner et al., 1988). All of these techniques were used in the current study as a means of increasing the validity of the self-restriction measures.

In summary, the primary goal of Study 1 was to provide information about the relative utility of self-perceptions of competence for predicting self-restrictions in driving. Of special interest was comparing this outcome to the level of predictability that could be achieved using measures of functional ability. This overall goal required several steps. The first step was to investigate the structure of the three most relevant sets of data (Perceived Competence measures, Functional Ability measures, and data on Driving Self-Restrictions) for the cognitively unimpaired participants. Principal Components analysis was used for this goal (Dillon & Goldstein, 1984). Once the structure was determined, the resulting dimensions were used in the assessments of the predictive utility of: a) functional abilities for predicting driving restrictions, and b) perceived competence for predicting driving restrictions for the older, cognitively unimpaired drivers. The next step was to compare the utility of the functional ability and perceived competence measures for predicting self-restrictions in driving. Finally, the same sequence of steps was repeated for the cognitively impaired group.

Research Questions

The subgoals of Study 1 can be expressed in terms of several research questions:

(1) Is ‘self-restrictions in driving’ a multidimensional construct?

(2) Do measures of functional abilities (e.g., vision, physical mobility) predict driving restrictions in a sample of older cognitively unimpaired drivers?

(3) Do measures of self-perceptions of driving competency predict driving restrictions in a sample of older cognitively unimpaired drivers?

(4) Is there a difference in the utility of self-perceptions of competence and measures of functional abilities for predicting driving self-restrictions in a sample of older cognitively unimpaired drivers?

(5) Do measures of functional abilities (e.g., vision, physical mobility) predict driving self-restrictions in a sample of cognitively impaired drivers?

(6) Do measures of self-perceptions of driving competency predict driving self-restrictions in a sample of cognitively impaired drivers?

(7) Is there a difference in the utility of self-perceptions of competence and measures of functional abilities for predicting driving self-restrictions in a sample of older cognitively impaired drivers?

Method

Data Collection

The participants were drawn from the Driving and Dementia Study (DDS), a research program conducted by Dr. Allen Dobbs and his team from the Neurocognitive Research Unit of the Northern Alberta Regional Geriatric (NARG) Program at the Glenrose Rehabilitation Hospital in Edmonton (see Appendix A). The DDS was designed to evaluate the driving abilities of individuals with a dementia. This was done by comparing the driving abilities of individuals with a dementia with the driving abilities of cognitively unimpaired younger and older drivers. The younger and older cognitively unimpaired participants were recruited from the community by means of advertising in local newspapers and at senior community centres. The community volunteers underwent six hours of neuropsychological testing and all but six were found to be within the normal range on all tests. For one of the six community participants, results from the neuropsychological examination were consistent with a diagnosis of early Alzheimer's Disease. Results from neuropsychological testing for the remaining five subjects indicated the presence of a cognitive impairment. All six subjects were eliminated from further study. Those participants retained in the study also underwent two additional hours of testing by an Occupational Therapist. Those results indicated that the community volunteers showed no abnormalities on conventional tests of basic motor abilities, strength, vision and peripheral vision, or perceptual skills. Self-report of medical conditions indicated that none of the community participants had an illness that would adversely affect driving.

All members of the cognitively impaired group were referred by physicians to the research program because of concerns about driving. For those cognitively impaired individuals referred by the hospital physicians, the diagnosis of dementia was made by the Memory Clinic physician or a geriatrician in consultation with a neuropsychologist using Diagnostic and

Statistical Manual of Mental Disorders (4th Ed.) (DSM-IV) criteria (American Psychiatric Association, 1994). In the case of referrals from community physicians, the basis for diagnosis is presumed to have been DSM-IV, but this cannot be confirmed.

All DDS participants were licensed, active drivers at the time they entered the research protocol. In addition to a standardized on-road driving assessment, demographic and driving related data were collected from all study participants. Individuals providing collateral information for each of the research participants were, by self-affirmation either the primary caregiver and/or the person most knowledgeable about the participant's driving behaviors. The collateral informants provided demographic data about themselves and for their study participant. Each of the collateral sources also provided driving related data for their study participant, based on questions that were identical to those asked of their study participant but with the wording of the collateral question phrased so as to refer to the participant's ability.

The original database (i.e., the DDS database) from which the data for the current study were drawn consisted of 68 older cognitively unimpaired drivers and 489 older cognitively impaired drivers. It was decided a priori to eliminate subjects with missing data greater than 10% (Tabachnick & Fidell, 1996). In the majority of cases, subjects were eliminated because of complete or partial missing data from the collateral source, and in the vast majority of cases, the missing data were due to the collateral source giving a "don't know' response. Statistical comparisons between those retained in the study and those eliminated from the study are provided in Appendix B.

Sample

Participants

In total, the sample used in the present study consisted of 60 cognitively unimpaired older community volunteers and 294 individuals with clinically significant cognitive impairment.

The diagnostic categories for the cognitively impaired group, as designated by the referring physicians, were as follows: Alzheimer Disease (28%), Vascular Dementia (28.3%), Mixed Dementia (1.4%), Cognitive Impairment No Dementia (23.9%), and Other (18.4%: Cognitive Impairment due to Chronic Obstructive Pulmonary Disease, Renal failure, Post-Myocardial Infarct, Parkinson, etc.).

Collateral Sources of Information.

All of the participants in the current study had a collateral informant. For the cognitively unimpaired older participants, 65% of those providing information were spouses, 15% were sons or daughters, 13% were friends, and the remainder (7%) were classified as other (e.g., neighbour). For the cognitively impaired sample, 57% of the individuals providing collateral information were spouses, 30% were sons/daughters, 2% were sons-/daughters-in-law, 7% were friends, and 5% were classified as other.

Instrumentation

Operationalization of Variables

Data used in the present study were collected by questionnaire, administered by means of a face-to-face interview by a trained research assistant. Each of the research assistants, who held an undergraduate degree in Psychology, was trained in the research protocol by a qualified research psychometrist. The questionnaire, a modified version of a driving questionnaire developed by researchers for the Older Drivers Study at the Gerontological Research Centre, Simon Fraser University, Vancouver, BC. (Rothe, 1990), is a comprehensive 86 item questionnaire. The questionnaire contains ten major areas or domains that are presumed or have been found to be relevant to driving (e.g., demographics, sensory and health, driving history, driving patterns, driving difficulties, etc.). A full description of the questionnaire is provided in Appendix C, and a copy of the Driving Questionnaire is provided in Appendix D. The Collateral

Sources Questionnaire is identical to the Driving Questionnaire, except that the wording of the collateral question is phrased so as the refer to the participant's ability. The questionnaires were reviewed to determine which variables had relevance for the current study. Items that were hypothesized to measure concepts or constructs to be tested in the current study were chosen from the Driving Questionnaires and are described below.

Measures of Functional Abilities

In previous research, a number of measures of functional ability have been investigated as possible determiners of driving self-restrictions. These variables can be grouped into four main categories: Sensory Performance, Mobility Measures, Health Status, and Mental Status (Forrest et al., 1997; Holland & Rabbitt, 1992; Kington et al., 1994; Marottoli et al., 1993; Stutts, 1998). Four variables, one for each of the four functional ability categories, were selected from the Driving Questionnaire and used as measures of functional ability in the current study. For three of the measures of functional ability (vision, mobility, and health), the data from collateral sources rather than self-reports were used. Although the use of self-reports for measuring functional abilities is common in aging research (Bernard, Kincade, Konrad et al., 1997; Kiyak, Teri, & Borson, 1994; Kuriansky & Gurland, 1976; Weinberger, Samsa, Schmader, Greenberg, Carr, & Wildman, 1992), and have been used in previous studies assessing the link between functional ability and driving restrictions (Forrest et al., 1997; Kington et al., 1994; Marottoli et al., 1993), the decision to use collateral source data was made based on the characteristics of the present sample. The current study was composed of cognitively impaired participants, as well as cognitively unimpaired participants. Because the presence of a cognitive impairment may limit the accuracy of self-reports (Kiyak et al., 1994), ratings provided by the collateral sources, rather than self-report measures, were used for these four functional ability measures. Previous research has indicated that collateral source ratings of study participant abilities correlate significantly with actual performance. For example, results from Feher, Mahurin, Inbody, Crook, & Priozzolo (1991) indicate that family ratings of study participant abilities on three memory tests were significantly correlated with actual performance on those tests. For consistency purposes, ratings from collateral sources for the visual ability, mobility, and health status measures also were used for the cognitively unimpaired sample. The final measure of functional ability (mental status) was assessed using the Mini Mental Status Exam (MMSE), developed by Folstein, Folstein, & McHugh (1975).

The measures of functional ability are described below and summarized in Table 1-1.

Sensory (Vision) Measure.

Responses to the following question were used as a measure of visual functioning: How would you rate (the participants) vision?. Responses are coded on a four point scale with 1 = poor, 2 = fair, 3 = good, and 4 = excellent.

Mobility Measure.

Responses to the question: To what extent does (the participant's) physical health interfere with (his/her) ability to carry out everyday activities? were used as a measure of mobility. Responses are coded on a five point scale with 1 = never, 2 = rarely, 3 = sometimes, 4 = frequently, and 5 = all the time. In order for there to be consistency in the directionality of the scales among the functional measures, the scale for the mobility measure was reversed so that 1 = all the time, 2 = frequently, 3 = sometimes, 4 = rarely, and 5 = never.

Health Status Measure.

Responses to the following question 'How would you rate (participant's) physical health now?' were used as a measure of health status, with responses coded 1 = poor, 2 = fair, 3 = good, and 4 = excellent. This question is typical of that used in the literature to assess health status (Earles, Connor, Smith, Park, 1997; Idler, 1993).

Mental Status Measure.

The MMSE is one of the most commonly used measures of mental status (Morris, Heyman, Mohs, et al., 1989), and it was used as an indicator of mental status in this investigation. The MMSE is a short screening instrument of cognitive status consisting of questions and tasks designed to assess orientation to time and place, registration of verbal information, attention and calculation, recall, language and visual construction (see Appendix E). Scores can range from 0-30, with scores 24 or below considered to be indicative of cognitive impairment (Lezak, 1995).

Table 1-1. Functional Ability Measures.

Measure	Item
Sensory (Vision)	How would you rate (the participant's) vision? Responses are coded on a 4 point scale with 1 = poor, 2 = fair, 3 = good, and 4 = excellent.
Mobility	To what extent does (the participant's) physical health interfere with (his/her) ability to carry out everyday activities? Responses re-coded on a 5 point scale with 1 = all the time, 2 = frequently, 3 = sometimes, 4 = rarely, 5 = never
Health Status	How would you rate (the participant's) physical health now? Responses are coded 1 = poor, 2 = fair, 3 = good, and 4 = excellent:
Mental Status	Scores on the MMSE†

† Mini Mental Status Exam (Folstein, Folstein, & McHugh, 1975)

Measures of Perceived Competency

All of the perceived competency data used in this study are self-report data because: a) it has been suggested that for perceived competence, external ratings and self-evaluations may tap different psychological constructs (Hillman, 1987) and b) the research hypotheses require self-reports on this construct. The perceived competency measures in the current study were divided into two types: a) a global measure intended to provide an overall or global self-rating of an individual's perception of driving competency, and (b) self-perception measures of competency for specific aspects or individual facets of driving.

Global Measure of Perceived Competence.

The global measure of perceived competence used in the current study is the same measure as that used in the Older Driver Questionnaire (Rothe, 1990). Participant responses to the following question provided a global assessment of perceived competency: Compared to drivers of your own age, do you think you are: [1] more able [2] about as good [3] less able [99] Don't Know"?.

Self-Perceptions on Competence on Facet Measures of Driving.

Twenty four items were selected from the Driving Questionnaire to provide ratings of driving competence for facet measures of driving. The items from the Driving Questionnaire are identical to those in the Older Drivers Study (Rothe, 1990), and provide information on self-perceptions of driving difficulties on manoeuvrers basic to driving (e.g., turning left at intersections, merging, passing, judging distances, shoulder checking). The items include manoeuvres commonly implicated as those leading to increased crashes of older drivers, including unsafe left turns (Keltner & Johnson, 1987; Kline, Kline, Fozard, Kosnik, Schieber, & Sekuler, 1992; Staplin, Breton, Haimo, Farber, & Byrnes, 1987), inappropriate turns (Keltner & Johnson, 1987; Kline et al. 1992), unsafe passing (Graca, 1986), and failure to yield (Cerelli, 1989; Graca, 1986; Kline et al, 1992; Moore, Sedgely, & Sabey, 1982).

The 24 items, shown in Table 1-2, are formatted on a five-point scale, consistent with their prior use (Rothe, 1990). The format is such that: 1 = never, 2 = rarely, 3 = sometimes, 4 = frequently, and 5 = all the time.

Table 1-2. The Twenty Four Items Used as Facet Measures of Driving Competency.

How often do you have difficulty with:			
Item #		Item #	
1	Seeing at night while driving	13	Entering stream of city traffic
2	Oncoming headlight glare at night	14	Parking your car
3	Rear or side mirror glare at night	15	Passing other cars
4	Daytime glare (sun, reflections)	16	Backing your car
5	Shoulder checking	17	Entering controlled intersection
6	Changing lanes	18	Entering uncontrolled intersection
7	Staying alert	19	Entering freeway
8	Steering your car	20	Keeping the car in its lane
9	Making right turns	21	Judging distances
10	Making left turn at controlled intersection	22	Keeping an appropriate distance behind other cars
11	Making left turn at uncontrolled intersection	23	Left/right confusion
12	Keeping up with the flow of traffic	24	Losing your way on familiar routes

Restrictions in Driving Measures

Restrictions in driving have been conceptualized, at least implicitly, in terms of: a) amount of driving, and b) timing and location of driving. Research, in general, indicates that older drivers travel significantly fewer miles than younger drivers (Cooper & Rothe, 1989; Graca, 1986; Holland & Rabbitt, 1992; Hu & Young, 1994; Retchin et al., 1988; Stutts, 1998). In addition, results from research reveal that many older drivers place restrictions on when (e.g, rush hour) and where (e.g., freeways) they drive. The self-restriction items selected from the Driving Questionnaire provide a measure of those restrictions.

Measures of driving speed also were included as measures of driving restriction. Although measures of speed restrictions typically have not been included in investigations specifically examining self-restrictions in driving, research suggests that many older drivers compensate for age-related declines in sensory and motor abilities by driving at slower speeds (Rothe, 1990; Shope & Eby, 1998). Therefore, measures of speed under different conditions (e.g., in the city, on single-lane highways, double-lane highways, and in rural areas) were included in the current study. The items, and the scales used to measure each of the items, are listed in Table 1-3.

Table 1-3. Self-Restrictions in Driving Measures.

Items	Scale
Days driven weekday morning rush hour	Average number of days per week
Days driven weekday afternoon rush hour	
Weekdays driven evening after dark	
Days driven on weekends	
Kilometers driven per week	kilometers

(continued)

Items	Scale
Drive less frequently in winter months compared to summer months	Re-coded such that 1 = yes and 2 = no
Drive less frequently when raining compared to when it is nice	
Drive less frequently when snowing compared to when it is clear	
Preferred speed in the city	1 = Less than the posted speed limit 2 = Posted speed limit 3 = Greater than the posted speed limit
Preferred speed on double lane highways	
Preferred speed on single lane highways	
Preferred speed in rural areas	

Data Analyses

The research questions addressed in the present study were presented at the conclusion of the Introductory Section of this study. They are based on a conceptualization which proposes that self-perceptions of driving competency are major determiners of self-restrictions in driving. The first research question is concerned with the dimensionality of the driving self-restriction measures. Four of the research questions are concerned with examining the utility of measures of self-perceptions of competence and measures of functional ability for predicting driving self-restrictions. The utility of each of the measures is examined; first, in a sample of cognitively unimpaired older drivers and then in a sample of cognitively impaired older drivers. Two of the research questions (one for each of the samples) are concerned with comparing the utility of the perceived competence and functional ability measures in predicting driving restrictions.

All statistical analyses were carried out using the Statistical Package for the Social

Sciences (SPSS Release 6.1; SPSS Inc., 1994). The major statistical analyses were: (1) Standard descriptive statistics - used to assess sample characteristics, (2) Multivariate analyses of variance (MANOVA's) - used to examine demographic differences between the cognitively unimpaired older group and the cognitively impaired group (participants and collateral sources) for continuous variables; differences for categorical variables were tested using the chi-square test, (3) Principal Components analyses - used: a) to determine the dimensionality of the self-restriction measures, and b) as a data reduction technique for the self-restriction, functional ability, and perceived competence data sets, and 4) Simple regression and standard multiple regression - used to assess the utility of the measures of functional abilities and perceived competence for predicting driving self-restrictions.

Analyses began with an exploratory analysis of the data using Principal Components analyses. Principal Components analysis was used in the current study for two reasons. First, it was used to determine the dimensionality (Stevens, 1986) of the self-restrictions in driving measures. Second, it was used as a data reduction procedure. Principal Components analysis is often used to reduce an original set of variables in a data set to a smaller set, while continuing to account for most of the variance in the data (Dillon & Goldstein, 1984; Stevens, 1986). Reducing the original set of variables to a smaller set is particularly valuable in a multiple regression context. The reduction is valuable because with a smaller set of predictor variables, there is an increase in the number of subjects-per-variable ratio, which increases the possibility of the regression equation holding up under cross-validation (cf. Herzberg, 1969). In the current study, Principal Components analysis was used to reduce the number of variables in the self-restrictions, functional ability, and perceived competence-facet measures data sets. Although the number of predictor variables in the functional ability data set were small (4) compared to those in the self-restrictions and perceived competence-facet measures data sets (12 and 24, respectively), Principal Components analysis was used to reduce the data in all three data sets in order to maintain consistency in analytic technique across data sets.

The results of the Principal Components analysis for each of the data sets (self-restrictions, functional ability, and perceived competence-facet measures) provided the basis for the construction of composite scores (Kim & Mueller, 1978). Using the results of the Principal Components as a template, composite scores for each of the data sets were constructed by summing the items which loaded on each of the factors. To determine which loadings were significant, and to avoid capitalizing on chance, each loading was tested at a two-tailed alpha level of 0.01 (see Stevens, 1986, p. 344). Only those items with loadings ≥ 0.647 were retained for constructing the composite scores for each of the data sets. The composite scores were then used as variables in the regression analyses (Kim & Mueller, 1978). The composite scores for a) functional ability and b) perceived competence-facet measures served as predictor variables, and the composite scores for driving self-restrictions served as criterion variables. Because only one item was used as a measure of global competence, scores for that item served as the predictor variable for global competence.

Next, simple and standard multiple regression analyses were used to assess the predictability of the measures of functional ability and of the self-perceived competence measures (Global and Facet) for each of the driving restriction measures. Standard multiple regression is a commonly used technique, and compared to other regression techniques, is the method recommended for assessing relationships among variables (Tabachnick & Fidell, 1996).

Results

Demographic Information

Participants

Cognitively Unimpaired Older Participants.

Demographic information is shown in Table 1-4. As shown, the mean age of the cognitively unimpaired participants was 68.48 years (SD = 5.94). The mean level of education was 14.53 years (SD = 2.82). Fifty two percent of the sample were male. The average mental status score of the cognitively unimpaired sample, as measured by MMSE, was 28.93 (SD = 1.13), with a range of 25-30. Seventy one percent of the sample were married, 12% widowed, 5% divorced, 2% were separated, and 10% of the participants were single.

Cognitively Impaired Participants.

The cognitively impaired group had a mean age of 72.64 years (SD = 9.36)(see Table 1-4). Mean level of education was 10.75 (SD = 3.64). Seventy two percent of the sample were male. The cognitively impaired group had a mean MMSE score of 23.87 (SD = 3.84). Seventy percent of the sample were married, 20% widowed, 5% divorced, 1% separated, and 3% were single.

Table 1-4. Demographic Measures of Cognitively Unimpaired and Cognitively Impaired Participants and Collateral Sources.

	Age	Education	Gender	MMSE
Cognitively Unimpaired (CU) (n = 60)	68.48 (SD = 5.94) (Range 47-83)	14.53 (SD = 2.82) (Range 8-20)	31 (M) 29 (F)	28.93 (SD = 1.13) (Range 25-30)
Cognitively Impaired (CI) (n = 294)	72.64 (SD = 9.36) (Range = 41-91)	10.75 (SD = 3.64) (Range = 0-24)	212 (M) 82 (F)	23.87 (SD = 3.84) (Range 12-30)
Collateral Source for CU (n = 60)	61.92 (SD = 13.44) (Range 29-78)	13.98 (SD = 2.43) (Range 8-19)	16 (M) 44 (F)	–
Collateral Source for CI (n = 294)	60.27 (SD = 14.43) (Range 25-86)	12.28 (SD = 3.19) (Range 0-21)	68 (M) 226 (F)	–

Multivariate analysis of variance (MANOVA) revealed significant differences between the cognitively unimpaired and impaired groups for age, $F(1,352) = 10.90$, $p \leq .001$, education, $F(1,352) = 57.66$, $p \leq =.001$, and, not surprisingly, for mental status, $F(1,352) = 102.19$, $p \leq = .001$. The cognitively unimpaired group was significantly younger, more highly educated, and had higher mental status scores than the cognitively impaired group. The distribution of males and females was significantly different between the two groups, $\chi^2 = 9.67$, $p. < .002$. Males and females were equally represented in the cognitively unimpaired group compared to a predominance of males in the cognitively impaired group (approximately 7:3; Male:Female ratio). Group differences in demographic characteristics would be an important consideration if group comparison was a primary objective of the study. However, in the current study, all statistical analyses were conducted within data sets and not across data sets. Comparisons between functional ability and competence measures for predicting driving restrictions also occurred within data sets rather than across data sets. Therefore, group differences are not of consequence.

Collateral Sources of Information.

Collaterals for the Cognitively Unimpaired Older Participants.

As shown in Table 1-4, the mean age of individuals providing collateral sources of information for the cognitively unimpaired participants was 61.92 (SD = 13.44). Seventy three percent of the individuals were female. As noted previously, the majority of those providing collateral sources of information for the cognitively unimpaired participants were spouses (65%).

Collaterals for the Cognitively Impaired Participants.

The average age of collateral sources for the cognitively impaired sample was 60.27 (SD = 14.43). Similar to those providing collateral sources of information for the cognitively unimpaired group, the majority of those providing collateral sources of information for the cognitively impaired sample were female (77%) and spouses (57%).

There were no significant differences between the two groups providing collateral sources of information for age, F, (1,323) = 0.37, p > .53, for gender (χ^2 = 0.34, p > .55), or for relationship to research participant (χ^2 = 8.50, p > .07).

Cognitively Unimpaired Participant Results

Principal Components Analysis

Restrictions in Driving Measures

The following results address the research question: *(1) Is the 'self-restriction in driving' construct a multidimensional construct?*

Factor Solution.

Principal Components analysis with varimax rotation was performed on the inter-correlation matrix of the 12 measures of driving restriction for the cognitively unimpaired participant sample. The analysis yielded a four-factor solution, using Kaiser's (1960) criterion of retention of factors with eigenvalues > 1, accounting for 74% of the variance. The items, the factors, and the rotated loadings are presented in Table 1-5.

Four items (preferred speed in the city, on double lane highways, single lane highways, and in rural areas) loaded highly (> 0.81) on the first component, and accounted for 33% of the variance. This first rotated component can be interpreted as representing a 'speed' factor. The three items (driving less frequently when raining, in winter, and when snowing) that loaded on the second rotated factor also loaded highly (the smallest loading = 0.83). This factor, which can be interpreted as representing an 'inclement weather' factor, accounted for 18% of the variance. The variables with significant loadings on the third rotated factor were number of days driven during the weekend, number of days driven after dark, and number of kilometers driven per week. Accounting for 14% of the variance, this component has been interpreted as an 'exposure' factor. Factor four, which accounted for 9% of the variance, consists of the two rush hour items (morning and afternoon), with morning rush hour attaining the highest loading (0.85). This component can be interpreted as measuring 'rush hour' driving.

Table 1-5. Rotated Factor Matrix and Factor Loadings for Driving Self-Restriction Measures (Cognitively Unimpaired Group).

Item	Factor 1	Factor 2	Factor 3	Factor 4
Preferred speed in the city	**0.86**	-0.05	-0.02	0.21
Preferred speed (double lane highway)	**0.83**	-0.02	0.11	0.02
Preferred speed (single lane highway)	**0.82**	0.17	0.15	-0.18
Preferred speed in rural areas	**0.81**	0.16	0.18	0.25
Drive less frequently when raining	-0.04	**0.86**	-0.03	0.12
Drive less frequently in winter months	0.13	**0.85**	0.17	0.11
Drive less frequently when snowing	0.10	**0.83**	0.18	0.05
Days driven/week after dark	0.16	0.18	**0.83**	0.20
Days driven/week on weekends	0.07	-0.09	**0.72**	0.31
Kilometers driven/week	0.16	0.25	**0.72**	-0.14
Days driven/week morning rush hours	0.20	0.18	0.07	**0.85**
Days driven/week afternoon rush hours	-0.03	0.12	0.50	**0.67**

Composite Scores.

The results of the Principal Components analysis were used to construct the driving restriction composite measures. Four composite scores were constructed based on this analysis. The first composite score SR1 (Self-Restriction 1) is based on the sum of the four variables loading on factor one. As can be seen from Table 1-5, all four variables, representing collateral reports of the participants' preferred speed while driving, have loadings greater than 0.647. This composite score was labelled as SPEED to reflect those items. The second composite score, SR2 (Self-Restriction 2), is composed of summing responses from the collateral sources to three items (driving less frequently when raining. during winter, and when snowing). This composite has been labelled as INCLW (Inclement Weather) to reflect the nature of the items making up that composite. The third composite measure, SR3 (Self-Restriction 3) is the sum of responses to three items (amount of driving on weekdays after dark, on weekends, and number of kilometers driven per week). This factor has been labelled as EXPOSURE to reflect the nature of those items. The final composite variable, SR4 (Self-Restriction 4) consists of the sum of two collateral source responses (amount of driving per week during morning rush hour and during afternoon rush hour), and has been labelled as RUSH. The composite measures and items used for constructing the composite measures are shown in Tables 1-6.

Table 1-6. Composite Measures for Self-Restrictions in Driving Measures.

Composite Measure	Items
SR1 (SPEED)	Preferred speed in the city
	Preferred speed on double lane highways
	Preferred speed in rural areas
	Preferred speed on single lane highways
SR2 (INCLW)	Drive less frequently in rain
	Drive less frequently in winter
	Drive less frequently in snow
SR3 (EXPOSURE)	Days driven weekdays after dark
	Days driven on week-ends
	Number of km driven per week
SR4 (RUSH)	Days driven morning rush
	Days driven afternoon rush

Functional Ability Measures

Factor Solution.

The four measures of functional ability (physical health, physical mobility, vision, and

MMSE) were subjected to a Principal Components analysis with varimax rotation. Two factors were extracted. However, this factor solution was not easily interpretable. In order to more closely examine the factor structure, and to aid interpretation, the variables were forced into a three-factor solution. The rotated factor structures, with factor loadings for each of the solutions, are shown in Tables 1-7a and b, respectively. As can be seen, the three-factor solution, which is the most easily interpretable solution, accounts for a substantially greater proportion of the variance (88%) than the two-factor solution (66%). Based on these considerations, the decision was made to proceed with the three-factor solution.

Tables 1-7a and b. Factor Matrix and Factor Loadings for Functional Ability Measures (Cognitively Unimpaired Group).

Table 1-7a. Rotated Two Factor Solution*

Item	Factor 1	Factor 2
Physical Health	**0.87**	-0.04
Physical Health Interfere with ADL's	**0.79**	0.06
Vision	-0.17	**0.61**
MMSE	-0.41	**0.85**

* Variance accounted for = 66%

Table 1-7b. Rotated Three Factor Solution*

Item	Factor 1	Factor 2	Factor 3
Physical Health	**0.89**	-0.05	-0.12
Physical Health Interfere with ADL's	**0.81**	0.24	-0.18
Vision	0.09	**0.98**	0.07
MMSE	-0.02	0.07	**0.99**

* Variance accounted for = 88%

As can be seen in Table 1-7b, two items (physical health, and the degree to which physical health interferes with ADL) loaded highly on the first factor (≥0.81), accounting for 39% of the variance. The first rotated component can be interpreted as representing a '<u>physical health/mobility</u>' factor. Only one item (vision) loaded on the second factor (0.98), accounting for 27% of the variance. This factor was interpreted as representing a '<u>vision</u>' factor. The final item (MMSE) loaded highly on factor three (0.99), and accounted for 22% of the variance. This factor was interpreted as representing a '<u>mental status</u>' factor.

<u>Composite Scores</u>.

The results of the Principal Components analysis were used to construct composite scores for the functional ability measures. The first composite score FUNC1 (Functional Ability 1) is based on the sum of the two variables loading on factor one. As can be seen from Table 1-7b, the two variables, representing collateral reports of the participants' physical health and the degree to which the participants' physical health interferes with ability to carry out everyday activities have loadings greater than 0.80. The final two functional ability 'composite' scores represent collateral reports of the participants' vision (FUNC2) and the participants' score on the MMSE (FUNC3). The items and composite measures are shown in Tables 1-8.

<u>Table 1-8. Composite Measures for Functional Ability Items</u>.

Composite Measure	Items
FUNC1 (PHYSICAL)	How would you rate (participant's) physical health now? To what extent does (participant's) physical health interfere with his/her ability to carry out everyday activities?

(continued)

Composite Measure	Items
FUNC2 (VISUAL)	How would you rate (participant's) vision?
FUNC3 (MENTAL)	MMSE scores

Perceived Competence Facet Measures

Factor Solution.

Principal Components analysis, with varimax rotation, was performed on the inter-correlation matrix of the 24 facet measures of perceived competence for the cognitively unimpaired participant sample. The analysis yielded a six-factor solution, using a criterion of retention of items with eigenvalues > than 1 (Kaiser, 1960). This solution accounted for 74% of the total variance. The rotated factors, the items, and the loadings are presented in Table 1-9.

The first rotated factor has significant loadings on seven variables, with loadings ranging from 0.60 to 0.92. This first factor accounted for 39% of the variance and appears to represent a 'manoeuvrers with decision' factor. Factor two consists of six items, with loading ranging from 0.63 (backing car and staying alert) to 0.75 (changing lanes). This factor, accounting for 10% of the variance, can be interpreted as a 'spatial' factor. Two of the 3 items on the third factor loaded highly (0.88 for difficulty with seeing at night, and 0.82 for difficulty with headlight glare), This third component accounted for 9% of the variance and appears to represent a 'nightvision' factor. Factor four, accounting for 6% of the variance, is dominated by the 'shoulder checking" variable, and has been labelled as such. Four items loaded on factor five, with the item 'losing your way in familiar areas' attaining the highest loading (0.80). The item 'difficulty with left/right confusion' also loads highly on this factor (0.60). Factor five accounts for 6% of the variance and has been interpreted as representing a 'losing way' factor. Two items loaded on the final factor. The item, 'difficulty with daytime glare' had the highest loading (0.75), followed by difficulty with rear or side mirror glare (0.58). Factor six, accounting for 4% of the variance, has been interpreted as a 'dayvision' factor.

Table 1-9.Rotated Factor Matrix and Factor Loadings for Perceived Competence-Facet Measures (Cognitively Unimpaired Group).

Item	F1	F2	F3	F4	F5	F6
Left turn at uncontrolled intersection	**0.92**	0.14	0.00	0.10	0.00	0.10
Left turn at controlled intersection	**0.88**	0.23	0.00	0.27	0.00	0.12
Making right turns	**0.85**	0.10	-0.10	0.00	0.20	0.24
Entering uncontrolled intersection	**0.84**	0.37	0.00	0.18	0.00	0.16
Entering freeway	**0.80**	0.21	0.26	0.13	0.00	0.00
Entering stream of city traffic	**0.66**	0.12	0.30	0.13	0.40	0.00
Entering controlled intersection	**0.60**	0.41	0.00	0.54	0.00	0.18
Changing lanes	0.37	**0.75**	0.10	0.31	0.00	0.10
Keeping appropriate distance behind cars	0.00	**0.72**	-0.20	0.13	0.30	0.33
Keeping car in its lane	0.14	**0.71**	0.10	-0.20	0.20	0.00
Parking car	0.45	**0.66**	0.34	0.16	0.00	-0.20
Staying alert	0.31	**0.63**	0.00	0.27	0.00	0.10
Backing up	0.44	**0.63**	0.00	0.10	0.00	0.00
Seeing at night	-0.10	0.10	**0.88**	0.00	0.00	0.00
Headlight glare at night	0.12	0.00	**0.82**	0.10	0.00	0.28
Keeping up with flow of traffic	0.13	0.28	**0.39**	-0.40	0.20	0.16
Shoulder checking	0.21	0.14	0.22	**0.78**	0.30	0.00
Steering car	0.38	0.26	0.00	**0.54**	0.00	0.27
Losing way on familiar routes	0.00	0.16	0.00	0.29	**0.80**	0.00
Left/right confusion	0.53	0.10	0.00	-0.20	**0.60**	0.23
Judging distance	0.00	0.45	0.11	0.00	**0.50**	0.10
Passing other cars	0.42	0.39	0.31	0.40	**0.40**	0.00
Daytime glare	0.15	0.22	0.22	-0.30	0.00	**0.75**
Rear or side mirror glare	0.22	0.00	0.45	0.10	0.20	**0.58**

Composite Scores.

As can be seen from Table 1-9, six of the facet measures of perceived competence had loadings of 0.647 or higher on factor one. The sum of the individual scores for those facet measures was used to construct the variable FM1 (Facet Measure 1). This variable was labelled as MANEUV/DECISION (manoeuvrers with decision making) based on the items making up this composite measure. The same criterion was used to construct composite measures for factors two and three (e.g., summing of individual scores for those items with loadings ≥ 0.647). The variable FM2 (Facet Measure 2) was labelled as SPATIAL to reflect those items used to construct the measure. The third composite measure, FM3 (Facet Measure 3) consists of summing individual scores for two items: 'degree of difficulty with seeing at night while driving' and with 'degree of difficulty with oncoming headlight glare at night'. This variable was labelled as NIGHTVISION. Because only one item loaded on each of the remaining three factors (factors 4, 5, and 6), the 'composite variable' for each of these factors represents the individual response scores for 'degree of difficulty with shoulder checking' (FM4: SCHECKING), for 'difficulty with losing your way in familiar areas' (FM5: LOSINGWAY), and 'degree of difficulty with daytime glare' (FM6: DAYGLARE). The composite measures and the items used for constructing the composite measures are shown in Tables 1-10.

Table 1-10. Composite Measures for Perceived Competence-Global and Facet Items.

Composite Measure	Items
Global Measures	
GLOBAL	Compared to other drivers your own age, do you think you are: more able, about the same, or less able?
Facet Measures [+]	

(continued)

Composite Measure	Items
FM1 (MANEUV/DECISION)	How often do you have difficulty with: Left turns at uncontrolled intersections? Left turns at controlled intersections? Right turns? Entering controlled intersection? Entering freeway? Entering stream of city traffic?
FM2 (SPATIAL)	How often do you have difficulty with: Changing lanes? Keeping appropriate distance behind cars? Keeping car in lane? Parking car?
FM3 (NIGHTVISION)	How often do you have difficulty with: Seeing at night while driving? Oncoming headlight glare at night?
FM4 (SCHECKING)	How often do you have difficulty with: Shoulder checking?
FM5 (LOSINGWAY)	How often do you have difficulty with: Getting lost in familiar areas?
FM6 (DAYGLARE)	How often do you have difficulty with: Daytime glare?

† Responses based on the following scale:

_____1____/_____2_____/_____3_____/_____4_____/_____5_____

never rarely sometimes frequently all the time

Perceived Competence-Global Measure

A global measure of perceived competence also was used as a predictor variable in the current study (See Table 1-10). However, because this measure was based on participant responses to one question, the data reduction techniques and construction of composite scores used for the other predictor variables were not needed for this measure. The measure, labelled as GLOBAL, reflects participant responses to the following question: Compared to drivers your own age, do you think you are [1] more able, [2] about the same, or [3] less able?.

Multiple Regression Analyses

Functional Ability Regression Models

Regression analyses were performed using the measures of functional ability as predictor variables to address the research question: *(2) Do measures of functional abilities (e.g., vision, physical mobility, mental status) predict driving restrictions in a sample of older cognitively unimpaired drivers?*

Recall that results from the Principal Components analysis for driving self-restrictions was found to be a multidimensional construct. This means that a single regression analysis to predict driving restrictions was not justifiable. Because of this, four standard multiple regression models were developed to predict the four driving restriction dimensions of speed (SPEED), inclement weather (INCLW), exposure (EXPOSURE), and rush hour driving (RUSH). The three measures of functional ability (one composite measure - PHYSICAL, and two single measures - VISION, and MENTAL) served as predictor variables. The correlation coefficients between each of the three functional ability measures and each of the four restriction dimensions are shown in Table 1-11. As shown, significant correlations were not obtained for any of the functional measures and dimensions of restrictions in driving (SPEED, INCLW, EXPOSURE, or RUSH).

Table 1-11. Correlation Matrix of the Functional Ability Measures and Driving Self-Restriction Measures (Cognitively Unimpaired Group).

	FUNC1	FUNC2	FUNC3	SR1	SR2	SR3	SR4
FUNC1 (PHYSICAL)	1.00						
FUNC2 (VISUAL)	0.20	1.00					
FUNC3 (MENTAL)	0.00	0.10	1.00				
SR1 (SPEED)	-0.25	-0.19	0.02	1.00			
SR2 (INCLW)	0.00	-0.10	0.00	0.18	1.00		
SR3 (EXPOSURE)	0.04	0.00	0.05	**0.30***	**0.31***	1.00	
SR4 (RUSH)	0.00	-0.10	-0.20	0.24	**0.29***	**0.46****	1.00

* $p \leq .05$
** $p \leq .01$

Table 1-12 presents the variables in the regression equation, their standardized (β) and unstandardized (B) coefficients, t-test scores, and multiple R's for each of the models. As can be seen, none of the functional ability measures was a significant predictor of the four driving restriction dimensions.

Table 1-12. Multiple Regression of Functional Ability Measures to Predict Self-Restrictions in Driving (Cognitively Unimpaired Group).

	SR1 (SPEED)			SR2 (INCLW)			SR3 (EXPOSURE)			SR4 (RUSH)		
	ß	B	t	ß	B	t	ß	B	t	ß	B	t
FUNC1 (PHYSICAL)	-0.22	-0.35	-1.70	0.01	0.01	0.08	0.05	0.12	0.38	-0.04	-0.09	-0.28
FUNC2 (VISION)	-0.14	-0.47	-1.09	-0.07	-0.15	-0.54	-0.05	-0.27	-0.40	-0.04	-0.20	-0.30
FUNC3 (MENTAL)	0.02	0.04	0.18	-0.03	-0.03	-0.24	0.06	0.14	0.43	-0.19	-0.45	-1.50
Multiple R	$.29^{NS}$			$.08^{NS}$			$.08^{NS}$			$.21^{NS}$		

^{NS} = Not Significant

Perceived Competence Regression Models

Regression analyses were performed on the perceived competence measures to address the research question: *(3) Do measures of self-perceptions of driving competency predict driving restrictions in a sample of older cognitively unimpaired drivers?*

Global Competence.

Four standard regression models were developed to predict the four driving restriction dimensions of speed (SPEED), inclement weather (INCLW), exposure (EXPOSURE), and rush hour driving (RUSH), using the measure of global competence (GLOBAL) as the predictor variable. The correlation coefficients between the global competence measure and four restriction dimensions are shown in Table 1-13. As can be seen from Table 1-13, the measure of global competence was significantly correlated with SPEED, $r = -0.29$, $p = .05$, EXPOSURE, $r = -0.34$, $p = .01$, and with RUSH, $r = -0.34$, $p = .01$. The correlation between GLOBAL and the driving restriction dimension, INCLW, was non-significant.

Table 1-13. Correlation Coefficients Between Global Competence and Measures of Driving Self-Restrictions (Cognitively Unimpaired Group).

	SR1 (SPEED)	SR2 (INCLW)	SR3 (EXPOSURE)	SR4 (RUSH)
GLOBAL (PHYSICAL)	**- 0.29***	0.04	**- 0.34****	**-0 .34****

* $p \leq .05$
** $p \leq .01$

Using standard regression, global competence was a significant predictor of three driving restriction dimensions; SPEED, $R^2 = 0.08$, $F(1,58) = 5.32$, $p < .03$, EXPOSURE, $R^2 = 0.12$, $F(1,58) = 7.78$, $p < .008$, and RUSH, $R^2 = 0.12$, $F(1,58) = 7.43$, $p < .009$. The relationships are such that individuals who rated themselves as 'more able than drivers their own age' are reported to drive at greater speeds than those individuals who rated themselves 'about as good as drivers their own age'. Drivers rating themselves as 'more able...' also are reported to drive more kilometers per week, and to restrict their driving less on week-ends and after dark. Individuals who rated themselves as 'more able...' are reported to restrict their driving less during morning and afternoon rush hour. Global competence was not a predictor of driving during inclement weather.

Table 1-14 presents the variables in the regression equations for each of the models, and their standardized (β) and unstandardized (B) coefficients. The t values, and r's of the standardized coefficients for each of the models also are presented.

Table 1-14. Results of Standard Regression for Global Competence (Cognitively Unimpaired Group).

	SR1 (SPEED)			SR2 (INCLW)			SR3 (EXPOSURE)			SR4 (RUSH)		
	ß	B	t	ß	B	t	ß	B	t	ß	B	t
GLOBAL	-0.29	-1.15	-2.31*	0.04	0.11	0.33	-0.34	-2.10	-2.79*	-0.34	-2.01	-2.72*
r	.29*			$.04^{NS}$			.34**			.34**		

* $p \leq .05$
** $p \leq .01$
^{NS} = Not Significant

Perceived Competence - Facet Measures.

The six measures of *perceived* competence served as the predictor variables for the same four dimensions of restrictions in driving. Those predictor variables were MANEUV/DECISION, SPATIAL, NIGHTVISION, SCHECKING, LOSINGWAY, and DAYGLARE. As seen in Table 1-15, significant correlations were obtained between the independent variable SPATIAL (FM2) and the dependent variable SPEED (SR1), $r = -0.30$, $p = .05$. The independent variable NIGHTVISION (FM3) was significantly correlated with three of the restriction dimensions, INCLW (SR2), $r = -0.38$, $p = .01$, EXPOSURE (SR3), $r = -0.26$, $p = .05$, AND RUSH (SR4), $r = -0.28$, $p = .05$. LOSINGWAY (FM5) was significantly correlated with the dependent variable SPEED (SR1), $r = -0.33$, $p = .01$. The correlations between MANEUV/DECISION (FM1), SCHECKING (FM4), DAYGLARE (FM6) and the four restrictions in driving dimensions were non-significant.

Using standard multiple regression, and with all of the facet measures in the regression equation, the multivariate F's for SPEED, INCLW, EXPOSURE, and RUSH were non-significant (largest F (6,53) = 1.87, $p > .10$). The standardized (ß) and unstandardized (B) coefficients, t values, and multiple R's for each of the models are presented in Table 1-16.

Table 1-15. Correlation Matrix of the Facet Measures and Measures of Driving Self-Restrictions (Cognitively Unimpaired Group).

	FM1	FM2	FM3	FM4	FM5	FM6	SR1	SR2	SR3	SR4
FM1	1.00									
FM2	**0.56****	1.00								
FM3	0.13	0.19	1.00							
FM4	**0.40****	**0.40****	0.20	1.00						
FM5	0.16	**0.28***	0.13	**0.39****	1.00					
FM6	**0.28***	**0.31***	**0.28****	0.09	0.00	1.00				
SR1	-0.20	**-0.30***	-0.23	-0.11	**-0.33****	0.00	1.00			
SR2	-0.10	0.00	**-0.38****	0.07	0.00	0.00	0.18	1.00		
SR3	0.00	-0.10	**-0.26***	-0.11	-0.16	0.00	**0.30***	**0.31***	1.00	
SR4	-0.10	-0.10	**- 0.28***	-0.17	0.00	0.00	0.24	**0.29***	**0.46****	1.00

* $p \leq .05$
** $p \leq .01$

Table 1-16. Results of Multiple Regression for Facet Measures (Cognitively Unimpaired Group).

	SPEED			INCLW			EXPOSURE			RUSH		
	β	B	t	β	B	t	β	B	t	β	B	t
MAN/DM	-0.01	0.00	-0.04	-0.10	-0.04	-0.65	-0.01	-0.01	-0.06	-0.02	-0.02	-0.15
SPATIAL	-0.24	-0.25	-1.50	0.05	0.03	0.29	0.00	0.01	0.02	0.01	0.01	..4
NIGHTVIS	-0.18	-0.18	-0.14	-0.42	-0.26	**-3.2****	-0.27	-0.41	**-1.9***	-0.29	-0.43	**-2.1***
SCHECKING	0.13	0.34	0.92	0.18	0.28	1.20	-0.02	-0.07	-0.11	-0.14	-0.53	-0.91
LOSINGWAY	-0.29	-1.03	**-2.1***	-0.01	-0.02	-0.05	-0.12	-0.64	-0.82	0.07	0.39	0.51
DAYGLARE	0.03	0.07	0.24	0.05	0.06	0.37	0.11	0.33	0.75	0.12	0.37	0.85
Mult R	$.44^{NS}$			$.42^{NS}$			$.31^{NS}$			$.33^{NS}$		

* $p \leq .05$
** $p \leq .01$
^{NS} = Not Significant

Comparison of Functional and Perceived Competence

Comparing the utility of self-perceptions of driving competence relative to measures of functional ability for predicting self-restrictions in driving was a central goal of the current study. The section below provides a summary of the regression results relevant to the research question: *(4) Is there a difference in the utility of measures of self-perceptions of competence and measures of functional abilities for predicting driving self-restrictions in a sample of older cognitively unimpaired drivers?*

The results of the multiple regression analyses have been summarized and are presented in Table 1-17. The multiple R's for each of the driving restriction dimensions are shown for the Functional Ability models in the second column. None of these R's was statistically reliable. The r's for the global competence measure are shown in the next column. All of the r's, except INCLW, were statistically reliable. The multiple R's for the Perceived Competence (facet measures) models are shown in the fourth column. As can be seen, none of the R's was statistically reliable. Putting the findings in juxtaposition provides a stark contrast between the effectiveness of the three models. Global competence was a significantly better predictor of driving self-restrictions than were any of the functional ability measures. It also was a significantly better predictor than the perceived competence-facet measures. Clearly, the superiority lies with the global competence model.

Table 1-17. Comparison of Functional Ability and Competence Models in Predicting Self-Restrictions in Driving With Multiple R's and r's as the Comparators (Cognitively Unimpaired Group).

	Functional	Global	Facet Measures
	Multiple R	Univariate r †	Multiple R
SPEED	.29 NS	**.29***	.44 NS
INCLW	.08 NS	.04 NS	.42 NS
EXPOSURE	.08 NS	**.34****	.31 NS
RUSH	.21 NS	**.34****	.33 NS

* $p \leq .05$
** $p \leq .01$
NS Not Significant
† Note: Multiple R is the equivalent of Univariate r for Global because there is only a single measure

Discussion

The above findings address several questions of importance to understanding self-restrictions in driving. The primary goal was to assess whether the rather disappointing findings from previous research concerning the role of functional abilities in accounting for self-restrictions could be offset using a new approach. This new approach hypothesized that it is the perceptions of one's abilities, rather than functional abilities per se, that serve as the basis for driving self-restrictions. Several steps were necessary to lead up to testing the hypothesis that self-perceptions of competency were related to driving self-restrictions, and that self-perceptions of competency were stronger predictors of driving self-restrictions than were measures of functional ability.

The first step was to examine the concept of self-restrictions. It was proposed that self-restrictions might not be a unidimensional variable. Instead, it was proposed that there might be several dimensions of self-restriction. If so, this finding would be important in its own right in improving our understanding of how one might restrict their driving. But perhaps more importantly, this knowledge would serve as the basis for improving the methodological approach to studying the factor or factors that underlie if and how much an individual will place restrictions on his or her own driving. This improvement would come about because of the precision that would be anticipated for investigating relationships between dimensions of ability or self-perceptions about those abilities and more specific, uniform attributes of self-restriction.

The second and third steps were to assess the relationship between (a) measures of functional abilities and driving self-restrictions, and (b) the relationship between measures of self-perceptions of driving competence and driving self-restrictions. The predictive utility of the two types of measures was then compared. This comparison was fundamental to examining the relative contribution of the functional ability and the self-perceptions of competency measures for predicting the various components of self-restrictions in driving. Moreover, as revealed in the Results section and as discussed below, the findings indicating the considerable superiority of the global self-perceptions of driving competency measure for accounting for self-restrictions provides a compelling basis for the major premise of the current research. The premise is that a shift to a framework based on self-perception of competence may enable significant advancements in understanding when and how a voluntary self-restriction strategy could provide the safety advancements necessary to counter the current and projected increases in older driver crashes.

The discussion that follows considers the findings and implications relevant to each of the following research questions:

(1) *Is the 'restrictions in driving' construct a multidimensional construct?*

Previous studies have set as the goal the identification of predictors of restrictions in driving (Forrest et al., 1997; Kington et al., 1994; Marottoli et al., 1993; Stutts, 1998). Implicit in those studies is the contention that driving restriction is not a unitary concept. This is apparent when the investigators talk about restrictions in when, where, and how much a person drives. When a person drives and where a person drives could be different dimensions of restrictions, and each could be differentially determined by the (changed and/or perceived changed) attributes of the driver. However, despite this at least implicit assumption of multi-dimensionality, no previous study has included an explicit attempt to empirically examine the possible dimensions of driving restriction and to isolate the determiners of each of these dimensions.

The present findings provide substantial evidence showing that there are several dimensions underlying the way in which driving can be restricted. The Principal Components analysis of the driving restriction measures yielded a four-factor solution, with the items loading highly and uniquely on the respective factors. These factors can be taken to represent dimensions of restriction in driving. These dimensions are restrictions in speed, reduced driving in inclement weather, reduced exposure overall, and reduced driving during rush hour.

That driving restrictions may be multidimensional is not surprising or even a new concept. In fact, this has most often been the case for other domains underlying human performance (e.g., memory, intelligence). What is new is the articulation and explicit investigation of the multi-dimensionality of driving restrictions. Making the multi-dimensionality of restrictions explicit, and providing a first step toward identifying the dimensions, represents an important shift in thinking about driving restrictions. This shift may provide the basis for important advancements for research into understanding driving patterns and the ways in which they are restricted. This is because the search now is for the predictors of the different dimensions rather than for predictors that would be relevant for all aspects of restrictions.

(2) Do measures of functional abilities (e.g., vision, physical mobility) predict driving restrictions in a sample of older cognitively unimpaired drivers?

In the present investigation, none of the measures of functional ability was a significant predictor of restrictions in driving for cognitively unimpaired older drivers. These results are consistent with those of previous studies that have examined the relationship between measures of functional ability and driving restrictions (Forrest et al., 1997; Kington et al., 1994; Marottoli et al., 1993; Owsley, Ball, Sloane, Roenker, & Bruni, 1991). Thus, findings from this study support the hypothesis that measures of functional ability are unlikely to be useful in accounting for changes in driving patterns.

(3) Do measures of self-perceptions of driving competency predict driving restrictions in a sample of older cognitively unimpaired drivers?

Global Perceived Competence.

In contrast to the lack of reliable relationships between the functional measures and dimensions of restrictions in driving, global competence was reliably related to restrictions in driving. Self-perception of global competence was a significant predictor for three of the four dimensions of restrictions in driving. Individuals who rated themselves 'more able as compared to other drivers their own age' were rated to drive faster, to drive more overall, and to drive more during rush hours. This was reflected by reliable relationships between the global competence ratings and ratings on the speed, exposure, and rush hour dimensions, respectively.

Although the ratings of global competence were generally related to the driving restriction dimensions, there was one exception. The exception was the inclement weather measure, for which the self-ratings of global competence were not reliably related to measures of driving restriction. This finding may have come about because the questions relevant to inclement weather were too general to discriminate between driving during harsh weather conditions (e.g., blizzard) and to simply driving during the normative winter conditions of northern climates (e.g., winter, snow). It may be that the same questions would be more discriminating in milder climates. To obtain a relationship between weather conditions and driving restrictions for harsher climates, the questions may need to be more specifically worded to reflect unusually bad weather.

The finding of a relationship between self-ratings of global competence and driving restrictions, in general, is consistent with findings reported by Marottoli & Richardson (1998). For example, the relationship between lower self-ratings of global competence and reductions in overall miles driven reported here are consistent with those reported by Marottoli and Richardson. The present research, however, extends the findings of previous research by examining the relationship of self-perceptions of competence to different dimensions of self-restrictions (e.g., speed, rush hour).

The present findings also are consistent with findings from previous research investigating the relationship between self-perceptions of competence and performance in other domains. For example, previous research has demonstrated a positive relationship between measures of self-efficacy and academic performance (Multon et al., 1991), mathematics (Meece et al., 1990; Cooper & Robinson, 1991), and writing abilities (Meier, McCarthy, & Schmeck, 1984; Shell, Murphy, & Bruning, 1989), to name but a few. The present findings extend the findings from other domains to the domain of driving.

Facet Measures.

Results of multiple regression indicated that none of the facet measures was a significant predictor of driving self-restrictions. Significant correlations were, however, obtained between three of the facet measures and the self-restriction dimensions. Specifically, the facet measures 'spatial' and 'losing way' were correlated with speed, and the facet measure 'nightvision' was correlated with three of the self-restrictions dimensions (inclement weather, exposure, and rush). Thus, of all the facet measures, 'competence for driving at night' was the facet measure most associated with the restrictions in driving dimensions. The significant relationship between nightvision and driving self-restrictions reported here are consistent with results from Holland and Rabbitt (1992). In that investigation, difficulties with seeing at night also were related to restrictions in driving at night. The present results also are consistent with those reported by the Ontario Ministry of Transportation (1994). Results from that investigation revealed a significant relationship between self-perceptions of visual difficulties (e.g., night vision, glare) and restrictions in driving.

The lack of a significant relationship between most of the facet measures of driving and the self-restriction dimensions is most likely due to the constricted range of ratings for many of the facet measures (see Appendix G for a summary of the descriptive data). With the exception of the nightvision measure, the ratings on the facet measures showed a floor effect. That is, the majority of the cognitively unimpaired participants did not perceive themselves as having difficulties on these facet measures of driving. The nightvision measure was the aspect of driving for which the drivers rated themselves as having the greatest difficulties: Between 44% and 63% of older cognitively unimpaired participants rated themselves as having difficulty 'sometimes' to 'all the time' with the three nightvision items.

The most straightforward explanation for the discrepancy between the nightvision ratings and the other facet measures in terms of their relationship to the self-restriction dimensions is in terms of differences in the 'salience of difficulty' for the various facet measures. It may be simply that difficulties in driving at night are obvious and produce more extreme ratings. Difficulties with the other facet measures (e.g., left turns) may be less easily recognized. The possibility that 'salience of difficulty' with specific aspects of driving may be a factor in the perceptions of competence -- driving self-restriction relationship deserves consideration in future studies.

It has been suggested that specific measures of task performance should provide a more precise measure of the efficacy-performance relationship than more global measures (Berry & West, 1993). In the present research, however, global measures of self-perceptions of competency were better predictors of driving self-restrictions than were the facet measures. As noted above, many of the facet measures used here tapped aspects of driving for which the cognitively unimpaired did not perceive themselves to have difficulty. As a result, those facets were inconsequential predictors of self-restrictions. This does not necessarily mean that these drivers do not have difficulty with those facets of driving. It means only that either there were no difficulties or few difficulties on these facets, and that lack of difficulty was rightly perceived, or that difficulties on these aspects are not ones that even cognitively unimpaired drivers easily perceive. A more broadly based study of facets, perhaps including both a greater range of facets and a more detailed examination of self-perceived competence on each facet may be necessary to identify just why the specific measures were poorer predictors compared to the global measure in the present study.

In summary, there are three findings that warrant special note. The first has to do with the multi-dimensionality of restrictions in driving (*Research Question # 1*). Recognizing the multi-dimensionality of restrictions may be central to advancements in understanding driving patterns because a shift to a consideration of individual dimensions can have the dual advantage of (a) providing a more refined understanding of restrictions in driving and (b) enabling an increase in predictive precision through the explicit consideration of predictors of individual dimensions. The present study provides a first step in identifying relevant dimensions and predictors.

The second finding warranting special consideration has to do with the lack of a reliable association among measures of functional ability and dimensions of driving restriction (*Research*

Question # 2). Although it is frequently assumed that measures of functional ability are directly related to restrictions in driving, the present investigation and previous investigations have found the relationships to be weak or non-existent. Overall, the findings show that changes in functional status do not necessarily lead to restrictions in driving, and thus, cannot be used as reliable predictors of driving restrictions. The third finding warranting special note is the effectiveness of the global competency measure in predicting restrictions in driving (*Research Question # 3*). The results from this study support the thesis that it is not how *functionally* competent a person is that determines the pattern of driving restrictions, but rather, how competent they *think* they are that is the more effective determiner.

Cognitively Impaired Data Set

The results that follow are the results for the cognitively impaired participants. The format is such that results from the construction of composite scores are first presented. Next, results of standard multiple regression techniques are presented. These results are used to assess the predictability of the perceived competence and functional ability measures for each of the driving restriction criterion measures for the cognitively impaired sample. Finally, the regression results from the functional ability analysis and the self-perceptions of competence analysis are summarized to enable a comparison of the predictability of the measures.

(5) Do measures of functional abilities predict driving self-restrictions in a sample of older cognitively impaired drivers?

(6) Do measures of self-perceptions of competence for driving predict driving self-restrictions in a sample of older cognitively impaired drivers?

(7) Is there a difference in the utility of self-perceptions of competence and measures of functional abilities for predicting driving self-restrictions in a sample of older cognitively impaired drivers?

Composite Scores (Cognitively Impaired Group)

Composite scores for each of the competence measures (functional and perceived) and for the driving restriction dimensions for the cognitively impaired sample were constructed using the Principal Components analyses from the cognitively unimpaired participants as templates. As a point of interest, Principal Components analysis also was carried out on the self-restriction and perceived competence-facet measures data sets for the cognitively impaired group. The results of those analyses are presented in Appendix G (Tables G-4 and G-5, respectively). As can be seen, results from the self-restriction data set for the cognitively impaired group are remarkably similar to those from the cognitively unimpaired group. Specifically, in the cognitively impaired data set, the four speed items load together on factor one, the three exposure items load together on factor two, and the three inclement weather items load together on factor three, a loading pattern very similar to that found in the cognitively unimpaired group. The two remaining items, which represent rush hour driving (AM and PM), however, load with the three exposure items for the cognitively impaired group, rather than representing a separate factor, as was found in the cognitively unimpaired data set.

The results of the Principal Components analysis for the perceived competence-facet measures for the cognitively impaired group again are similar, but not identical to those obtained in the cognitively unimpaired group. As can be seen from Table G-5, the items loading on factors one and two are similar to those obtained in the cognitively unimpaired data set and can be interpreted as representing, respectively, a decision making/manoeuvrers factor and a spatial factor. Interestingly, the four vision variables (e.g., headlight glare at night, seeing at night, rear or side mirror glare, and daytime glare) load together on factor four in the cognitively impaired data. Recall these four items loaded on two separate factors in the cognitively unimpaired data set (e.g., a night vision factor and a dayglare factor). The loadings for the remaining items in the cognitively impaired data set are less easily interpreted. For example, items loading on factor four in the cognitively impaired data set include staying alert, keeping up with the flow of traffic, shoulder checking, changing lanes, and losing way on familiar routes.

As a result of the different factor structures (particularly for the perceived competence-facet measures) between the two samples, the structures of the self-restriction and perceived competence-facet measures for both samples were defined by the factor structures of the cognitively unimpaired group. The underlying rationale is that results of the Principal Components analyses from the cognitively unimpaired sample represent the 'true state of the world' in terms of identifying the underlying factor structures for the competence and self-restriction measures. Any deviations from those factor structures (e.g, as was obtained in the cognitively impaired data set) are seen as reflecting perturbations from those factor structures.

Thus, for the cognitively impaired sample, three functional ability variables, one global competence variable, six perceived competence (facet measures) variables, and four driving restriction variables were constructed employing the same methodology as that used for the sample of cognitively unimpaired participants. Standard regression techniques were used to assess the predictability of each of the competency measures (Functional, Global, and Facet Measures) for each of the driving restriction dimensions. Finally, a comparison of the competency measures was done, using multiple R's (or r's in the case of single predictors) as the criteria, to determine which competency measures better predicted restrictions in driving.

Multiple Regression Analyses (Cognitively Impaired Sample)

Functional ability Regression Models (Cognitively Impaired Group).

The section below provides a summary of the regression results relevant to the research question: *(5) Do measures of functional abilities predict driving self-restrictions in a sample of* *older cognitively impaired drivers?*

Four standard multiple regression models were developed, using the three measures of functional ability (PHYSICAL, VISION, and MENTAL) as predictor variables to predict the four restriction dimensions of speed (SPEED), inclement weather (INCLW), exposure (EXPOSURE) and rush hour driving (RUSH). The correlation coefficients between each of the three functional ability measures and four driving restriction dimensions are shown in Table 1-18. As can be seen, there were no significant correlations between each of the three functional measures and SPEED, INCLW, EXPOSURE, or RUSH.

Table 1-18. Correlations Between the Functional Ability Measures and Driving Self-Restriction Measures (Cognitively Impaired Group).

	SR1 (SPEED)	SR2 (INCLW)	SR3 (EXPOSURE)	SR4 (RUSH)
FUNC 1	0.11	0.09	-0.07	0.04
FUNC2	0.00	0.04	0.00	-0.01
FUNC 3	0.01	0.09	0.08	0.03

The variables in the regression equation, their standardized (β) and unstandardized (B) coefficients, t-test scores, and multiple R's of the standardized coefficients for each of the models are presented in Table 1-19. Based on multiple R's, none of the functional ability measures was an effective predictor of the four restriction in driving dimensions in the multivariate analysis.

Table 1-19. Multiple Regression of Functional Ability Measures to Predict Self-Restrictions in Driving (Cognitively Impaired Group).

	SR1 (SPEED)			SR2 (INCLW)			SR3 (EXPOSURE)			SR4 (RUSH)		
	ß	B	t	ß	B	t	ß	B	t	ß	B	t
FUNC1	0.12	0.12	**2.03***	0.11	0.07	1.87	0.13	0.09	1.54	0.06	0.04	0.80
FUNC2	0.03	0.00	0.42	0.08	0.01	1.28	0.00	0.02	0.41	0.00	0.00	0.00
FUNC3	0.03	0.01	0.46	0.11	0.03	1.81	0.07	0.09	1.64	0.03	0.04	0.77
Mult R	.12 NS			.16 NS			.12 NS			.06 NS		

* $p \leq .05$
NS = Not Significant

Perceived Competence Regression Models (Cognitively Impaired Group).

Provided below is a summary of the regression results relevant to the research question: *(6) Do self-perceptions of competence for driving predict driving self-restrictions in a sample of older cognitively impaired drivers?*

Global Competence (Cognitively Impaired Group).

Four standard regression models were developed for global competence, using the measure of global competence as the predictor variable and the four driving restriction dimensions as criterion variables. The correlation coefficients between global competence and each of the driving restriction measures are shown in Table 1-20. Global competence was significantly correlated with SPEED ($r = -0.13$, $p = .05$). The three remaining correlations were non-significant.

Table 1-20. Correlation Coefficients Between Global Competence and Measures of Driving Self-Restrictions (Cognitively Impaired Group).

	SR1 (SPEED)	SR2 (INCLW)	SR3 (EXPOSURE)	SR4 (RUSH)
GLOBAL (PHYSICAL)	**-0.13***	-0.08	-0.06	0.05

* $p \leq .05$

Using standard regression, global competence was a significant predictor for only one of the four restriction dimensions. Self-ratings on global competence significantly predicted SPEED, $R^2 = 0.02$, $F(1,292) = 4.73$, $p < .03$, with higher ratings of competency (i.e., more able) associated with greater reported speeds. Global competence was not a significant predictor of driving for the remaining restriction dimensions (INCLW, EXPOSURE, or RUSH).

Table 1-21 presents the variables in the regression equations for each of the models, and their standardized (ß) and unstandardized (B) coefficients. The t values and r's of the standardized coefficients for each of the models also are presented.

Table 1-21. Results of Standard Regression for Global Competence (Cognitively Impaired Group).

	SR1 (SPEED)			SR2 INCLW			SR3 (EXPOSURE)			SR4 (RUSH)		
	ß	B	t	ß	B	t	ß	B	t	ß	B	t
GLOBAL	-0.03	-0.52	**-2.17***	-0.08	-0.23	-1.45	-0.06	-0.35	-1.03	0.05	0.31	0.89
r	.13*			.08 NS			.06 NS			.05 NS		

* $p \leq .05$
NS Not Significant

Facet Measures of Perceived Competence (Cognitively Impaired Group).

The six measures of *perceived* competence (MANEUV/DECISION, SPATIAL, NIGHTVISION, SCHECKING, LOSINGWAY, and DAYGLARE) served as the predictor variables for the same four measures of restrictions in driving. The correlations are shown in Table 1-22. Significant correlations were obtained between two of the independent variables and INCLW (SR2). Those variables were SPATIAL (FM2), $r = -0.19$, $p = .01$, and LOSINGWAY (FM5), $r = -0.12$, $p = .05$. The independent variable NIGHTVISION (FM3) was significantly correlated with EXPOSURE (SR3), $r = -0.13$, $p = .05$. The remaining relationships were non-significant.

Table 1-22. Correlation Matrix of the Facet Measures and Measures of Driving Self-Restrictions (Cognitively Impaired Group).

	FM1	FM2	FM3	FM4	FM5	FM6	SR1	SR2	SR3	SR4
FM1	1.00									
FM2	**0.64****	1.00								
FM3	**0.25****	**0.23****	1.00							
FM4	**0.31****	**0.39****	0.11	1.00						
FM5	**0.35****	**0.38****	**0.12***	**0.20****	1.00					
FM6	**0.23***	**0.20****	**0.72****	**0.14***	0.10	1.00				
SR1	0.00	0.00	0.01	0.11	0.02	0.00	1.00			
SR2	-0.11	**-0.19****	0.00	-0.10	**-0.12***	0.00	**0.20****	1.00		
SR3	-0.10	-0.10	**-0.13***	**0.12***	0.00	0.00	**0.15***	**0.35****	1.00	
SR4	0.00	-0.10	-0.10	0.04	0.00	0.00	**0.14***	**0.32****	**0.54****	1.00

* $p \leq .05$
** $p \leq .01$

Using standard multiple regression, and with all of the facet measures in the regression equation, the multivariate F was significant for INCLW, $F(5,288) = 2.57$, $p < .03$. The predictor variable SPATIAL was significant for INCLW, (t = -2.35, p < =.02). Increases in self-reported difficulty with spatial manoeuvres (changing lanes, keeping an appropriate distance behind other cars, keeping the car in its lane, and parking the car) are associated with a reported decreased frequency of driving during inclement weather. The remaining multivariate F's (for SPEED, EXPOSURE, and RUSH) were non-significant (largest F (5,288) = 1.32, p. > .25).

Table 1-23 presents the variables in the regression equations for each of the models, their standardized (ß) and unstandardized (B) coefficients, t-values, and multiple R's.

Table 1-23. Results of Multiple Regression for Facet Measures (Cognitively Impaired Group)

	SPEED			INCLW			EXPOSURE			RUSH		
	ß	B	t	ß	B	t	ß	B	t	ß	B	t
MAN/DM	0.01	0.01	0.01	0.03	0.02	0.40	-0.02	-0.02	-0.27	0.08	0.08	1.01
SPATIAL	-0.10	-0.12	-1.19	0.19	-0.15	**-2.35***	-0.07	0.11	-0.82	-0.18	-0.11	-0.31
VISUAL	0.00	0.00	0.04	0.04	0.03	0.51	-0.16	0.21	-0.85	-0.17	-0.13	-1.49
SCHECKING	0.14	0.39	**2.11***	-0.03	-0.06	-0.46	0.22	0.05	0.84	0.26	0.06	0.99
LOSINGWAY	0.03	0.09	0.43	-0.06	-0.12	-0.93	0.12	0.03	0.42	-0.14	0.03	-0.50
DAYGLARE	0.01	0.03	0.17	-0.01	-0.02	-0.17	0.15	0.06	0.66	-0.22	0.08	0.95
Multiple R		.13 NS			**.21***			.15 NS			.14 NS	

* p ≤ .05
NS Not Significant

The section below provides a summary of the regression results relevant to the research question: *(7) Is there a difference in the utility of self-perceptions of competence and measures of functional abilities for predicting driving self-restrictions in a sample of older cognitively impaired drivers?*

The results of standard multiple regressions were used to determine which of the sets of measures (functional ability or perceived competency) best predicts driving restrictions for the cognitively impaired group. A summary of the data is presented in Table 1-24. The multiple R's for each of the criterion measures of driving restriction for the functional model are shown in the second column. Consistent with the results from the sample of cognitively unimpaired participants, none of these R's was statistically reliable. The r 's for the global competence measure are shown in the third column of Table 1-24. Global competence was a significant predictor of speed, but insignificant for the remaining self-restriction dimensions. The multiple R's for the perceived competence-facet measures are shown in the last column of the table. The multiple R for inclement weather was significant, the remaining R's were non-significant.

Compared to the functional ability measures, the perceived competence measures were better predictors of restrictions in driving.

Table 1-24. Comparison of Functional Ability and Competence Models in Predicting Driving Self-Restrictions with Multiple R and r as the Comparators (Cognitively Impaired Group).

	Functional Ability Multiple R	Global r †	Facet Measures Multiple R
SPEED	.12 NS	.13*	.13 NS
INCLW	.16 NS	.08 NS	.21 *
EXPOSURE	.12 NS	.06 NS	.15 NS
RUSH	.06 NS	.05 NS	.14 NS

* $p \leq .05$
NS Not Significant
† Note: Multiple R is the equivalent of Univariate r for Global because there is only a single measure

Discussion

The format of the Discussion section is consistent with that of the Results section. Thus, the sections below provide a discussion of the regression results relevant to each of the research questions.

Functional Ability Regression Models

(5) Do measures of functional ability predict driving self-restrictions in a sample of older cognitively impaired drivers?

As with the sample of cognitively unimpaired participants, the measures of functional ability for the cognitively impaired sample were, in general, not useful in predicting restrictions in driving.

Perceived Competence Regression Models

(6) Are self-perceptions of competence for driving effective predictors of driving self-restrictions in a sample of older cognitively impaired drivers?

The perceptions of competence measures have the appearance of being somewhat more useful than measures of functional ability in predicting self-restrictions in driving for the cognitively impaired sample. Noteworthy, however, is the small amount of variance accounted for by each of the competence measures. The measure of global competence accounted for less than 2% of the variance for restrictions in speed, and the facet measures accounted for approximately 5% of the variance for the inclement weather restriction dimension. Thus, although statistically significant, the predictors in the cognitively impaired sample are probably of little practical significance in explaining restrictions in driving. This is in contrast to the results obtained in the sample of cognitively unimpaired participants. In that sample, measures of global self-perception accounted for 8% to 12% of the variance in the self-restriction measures.

In addition to accounting for considerably smaller amounts of variance, the pattern of prediction was substantially different for the cognitively impaired sample compared to the sample of cognitively unimpaired participants. Global competence was a significant predictor for 3 of the 4 restriction dimensions in the sample of cognitively unimpaired participants, but for the cognitively impaired sample it was reliable in the analysis for only one dimension. In the regression analyses of the cognitively unimpaired data set, none of the facet measures predicted driving restriction. However, in the cognitively impaired sample, the results of multiple regression were significant for one of the driving restriction dimensions (inclement weather). The results of the regression analyses suggest that, in general, neither measures of functional abilities, nor measures of self-perceptions of competence from cognitively impaired drivers can be relied upon to serve as effective predictors of restrictions in driving.

Similar to results in the cognitively unimpaired data set, results of the correlational analyses in the cognitively impaired data set revealed significant relationships between a few of the facet measures and the self-restriction dimensions. The strongest relationship was between self-ratings of difficulty with 'spatial' manoeuvres and driving restrictions during inclement weather. Increased difficulties with spatial manoeuvres are associated with greater restrictions in driving. The remaining three correlations were weak but reliable. Ratings of 'difficulties with nightvision' are associated with reported speed in the cognitively impaired sample, and that relationship is such that greater nightvision difficulties are related to lower speeds. Difficulties with losing way are associated with inclement weather driving restriction. Again, increased difficulties are associated with reduced driving in inclement weather.

Compared to the cognitively unimpaired participant sample, the cognitively impaired participants were judged, by their collateral sources, as being far more restrictive in their driving (see Appendix G, Table G-3 for a summary of the descriptive data). However, with the exception of the visual facet measures, the self-reported degree of difficulty experienced by the cognitively impaired participants was not significantly different from that of the cognitively unimpaired participants. For the visual facet measures of driving, the cognitively unimpaired group reported significantly greater difficulties than did the cognitively impaired group. Results from interviews with the cognitively impaired individuals may provide insight for this pattern of findings. When asked regarding difficulties with facet measures of driving (e.g., left turns, merges), many of the cognitively impaired individuals reported 'never' having difficulty. However, the majority of respondents qualified their ratings with responses such as "I just sit and wait until the intersection is clear" or "I wait until there are no cars coming". Thus, it may be that there are difficulties with many of the facet measures of driving, but that the individual compensates for these difficulties, leaving them with the perception that the manoeuvres are accomplished without difficulty. It is important to note, however, that although the individual is compensating for difficulties in driving, those compensations may not always be appropriate; waiting for very large gaps in traffic may be inappropriate and even dangerous.

Of interest to this discussion is the disparate pattern of findings between the two groups for the competence measures and the restriction in driving dimensions. In considering the differences in the pattern of findings between the cognitively unimpaired and the cognitively impaired sample discussed above, it should be recalled that there were differences in the demographic attributes of the two groups. Although it seems unlikely that the somewhat older age, greater proportion of males, and/or lower education of the cognitively impaired group would be responsible for eliminating or minimizing the effects of the variables predicting driving restrictions that were found for the cognitively unimpaired group, this possibility can not be unequivocally rejected in the present study.

The demographic differences between the two groups notwithstanding, the differences in the pattern of findings are consistent with the notion that the cognitively impaired group also may lack insight. Lack of awareness of deficits is a common feature of cognitive impairment. Because of this, it should not be surprising that the self-perceptions of competence of the cognitively impaired participants were substantially unrelated to their collateral source ratings of restrictions in driving. In fact, it is the presumed disparity between the cognitively impaired individual's competence and their perceived competence that is the cause for concern about relying on self-regulation with these drivers. The relationship between self-perceptions of competency and measures of actual performance was pursued in Study 3.

CHAPTER 3

STUDY 2

TESTING THE BIAS HYPOTHESIS

Introduction

Self-perceptions of driving competence play a central role in this dissertation. The fundamental hypothesis under investigation in Study 1 was that, relative to measures of functional ability, an individual's *perceptions* of their own competence would be better predictors of driving self-restrictions. Results of that investigation revealed that for cognitively unimpaired individuals, global self-perceptions of driving competence were significant predictors of driving self-restrictions while measures of functional ability failed to predict driving self-restrictions. However, for cognitively impaired individuals, neither measures of functional ability nor of self-perceptions of competence, in general, predicted self-restrictions in driving.

The possibility exists that the measures of perceived competence for the cognitively impaired sample used in Study 1 were biassed. The bias may have occurred because all of the individuals in the cognitively impaired sample had been *referred* for a driving evaluation because of physician concerns about driving abilities. For example, anecdotal evidence suggests that some cognitively impaired individuals become defensive about their driving competence when their driving abilities are questioned and/or the individual is informed that an evaluation of their driving abilities is warranted based on clinical observations. The assumption is that a referral for a driving evaluation may lead to an *overestimation* of driving competency. Establishing whether a referral for a driving evaluation biases ratings of self-perceptions of competence is important for the current research. Thus, the goal of Study 2 was to determine if a referral for a driving evaluation could bias ratings of self-perceptions of competency. To achieve that goal, independent data on self-perceptions of driving competence were collected from a sample of cognitively impaired seniors who had *not* been referred for a driving evaluation. Those ratings of self-perceptions were then compared to ratings of self-perceptions of competence from individuals referred for a driving evaluation.

In summary, there was one research question for Study 2 and that question was: Does a referral for a driving evaluation bias ratings of self-perceptions of competence?

Method

Participants

Non-referred Sample.

Because all of the participants in Study 1 referred for a driving evaluation were diagnosed as cognitively impaired, the same criterion was used in recruiting the participants for the current study. Twenty six individuals, diagnosed with a cognitive impairment, were recruited from either the Geriatric Clinic or Memory Clinic at the Glenrose Rehabilitation Hospital in Edmonton. Importantly, the participants recruited for the current study had *not* been referred for a driving evaluation.

Referred Sample.

Participants in the referred sample were drawn from the sample described in Study 1. The referred participants were matched to the non-referred participants for age, sex, and diagnosis.

Instruments

Abbreviated Driving Study Questionnaire.

An abbreviated version of the Driving Study Questionnaire used in Study 1 was administered to the study participants described above. A copy of that questionnaire in provided in Appendix F (Non-Referred Sample Driving Questionnaire). Specifically, questions relevant to demographic, health and sensory information, and driving history were reduced from the original questionnaire. In addition, a number of sections in the original questionnaire were eliminated in the abbreviated questionnaire as the questions were irrelevant for the current study. Those sections are: Section VII (Changes Over Time), Section VIII (Licensure), Section IX (Concerns About Driving), and Section X (Characteristics of Vehicle Driven). Items used in the analyses for the current study (e.g., those relevant to Driving Patterns (Section IV), Driving Difficulties (Section V), and Feelings About Driving (Section VI)) are unchanged from the original questionnaire.

Procedures

The data used in the current study for the referred sample were drawn from the Driving Study Questionnaire as described in Study 1. The data for the non-referred sample were collected by means of a face to face interview by the author. The Non-Referred Sample Driving Questionnaire was administered to the Geriatric/Memory Clinic sample *prior* to the participant's or their caregiver's discussion with medical staff about the need for further consultations or testing (e.g., referral for a driving evaluation). The data from the non-referred sample were then compared to the data from the referred sample matched for age, sex, and diagnosis. To determine if referrals for a driving evaluation could bias ratings of self-perceptions of competence, the measures of self-perceptions of driving competence for the non-referred sample were compared to those for the referred sample.

The self-perceptions of driving competence measures are identical to those described in Study 1 and consisted of global measures of perceived competence and perceived competence-facet measures. The measures are summarized below.

A. Global measure of perceived competence.

Participant responses to the following question provided a global assessment of perceived competency: Compared to drivers of your own age, do you think you are: [1] more able, [2] about as good, [3] less able, or [99] Don't Know"?

B. Perceived Competence- Facet Measures

The composite scores for the facet measures for the current study were constructed based on the structure identified in Study 1. To do this, the same items used to construct Facet Measures 1 through 6 in Study 1 also were used to construct Facet Measures 1 through 6 in the current study. For example, there were six items used to construct the first Facet Measure in Study 1 and the scores for those same items for the referred and non-referred samples in the current study were used to construct Facet Measure 1 here. The composite scores and items are shown in Table 2-1

Table 2-1. Composite Measures for Perceived Competence-Global and Facet Items.

Composite Measure	Items
Global Measures	
GLOBAL	Compared to other drivers your own age, do you think you are: more able, about the same, or less able?
Facet Measures [+]	
FM1 (MANEUV/DECISION)	How often do you have difficulty with: Left turns at uncontrolled intersections? Left turns at controlled intersections? Right turns? Entering controlled intersection? Entering freeway? Entering stream of city traffic?

(continued)

Composite Measure	Items
FM2 (SPATIAL)	How often do you have difficulty with: Changing lanes? Keeping an appropriate distance behind cars? Keeping car in lane? Parking car?
FM3 (NIGHTVISION)	How often do you have difficulty with: Seeing at night while driving? Oncoming headlight glare at night?
FM4 (SCHECKING)	How often do you have difficulty with: Shoulder checking?
FM5 (LOSINGWAY)	How often do you have difficulty with: Getting lost in familiar areas?
FM6 (DAYGLARE)	How often do you have difficulty with: Daytime glare?

† Responses based on the following scale:

_____1_____/_____2_____/_____3_____/_____4_____/_____5_____

never rarely sometimes frequently all the time

Data Analyses

SPSS Release 6.1 (SPSS Inc., 1994) was used for all statistical analyses in the present research. Multivariate analyses of variance (MANOVA's) were used to test for differences between the referred and non-referred cognitively impaired sample on demographic variables (e.g., age, education, years of driving), on global perceived competency, and on perceptions of competency-facet measures. The samples were compared on the demographic measures of age, education, and years of driving because these measures have been shown to influence several aspects of driving. It was, therefore, deemed important to ensure that the two groups were comparable on these dimensions.

Results

As can be seen from Table 2-2, the samples were well-matched for age, sex, and diagnosis. The mean age for the non-referred sample was 72.92 (SD = 8.81), compared to 73.54 (SD = 8.54) for the referred sample, a difference that was non-significant (F (1, 50) = 0.07, p >.79). The samples were identical in terms of sex (10 females and 16 males) and diagnosis (14 Alzheimer's Disease [AD], 7 Multi-Infarct Dementia [MID], and 5 Cognitive Impairment No Dementia [CIND]). There were no significant differences between the two groups for education (F (1,50) = 0.23, p >.63), with mean number of years of education 11.57 years (SD = 2.89) for the non-referred sample compared to 12 years (SD = 3.42) for the referred sample. The groups did not differ significantly in number of years driven (F (1,50) = 0.48, p >.49). The majority of individuals in both samples had been driving more than 50 years. Sixty-five percent of the non-referred sample had been driving for 50 years or more whereas 69% of the referred sample had driven for 50 years or greater.

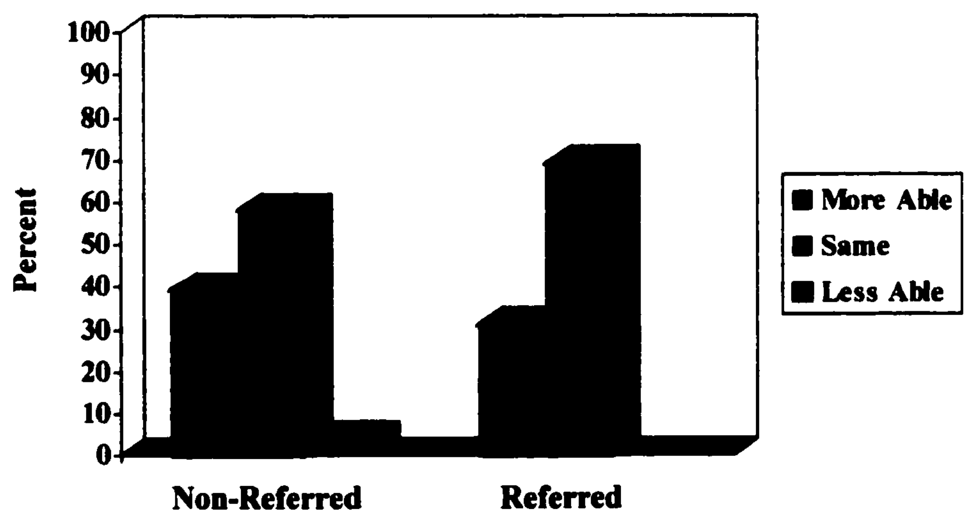
Table 2-2. Demographic Measures for Non-Referred and Referred Samples.

	Age	Sex	Diagnosis	Education	Yrs. Driving (50 or more)
Non-referred	72.92 (SD = 8.81)	10 (F) 16 (M)	14 (AD)† 7 (MID)†† 5 (CIND)†††	11.57 (SD = 2.89)	65%
Referred	73.54 (SD = 8.54)	10 (F) 16 (M)	14 (AD) 7 (MID) 5 (CIND)	12.00 (SD = 3.42)	69%

† Possible or Probable Alzheimer's Disease
†† Multi-Infarct Dementia
††† Cognitive Impairment No Dementia

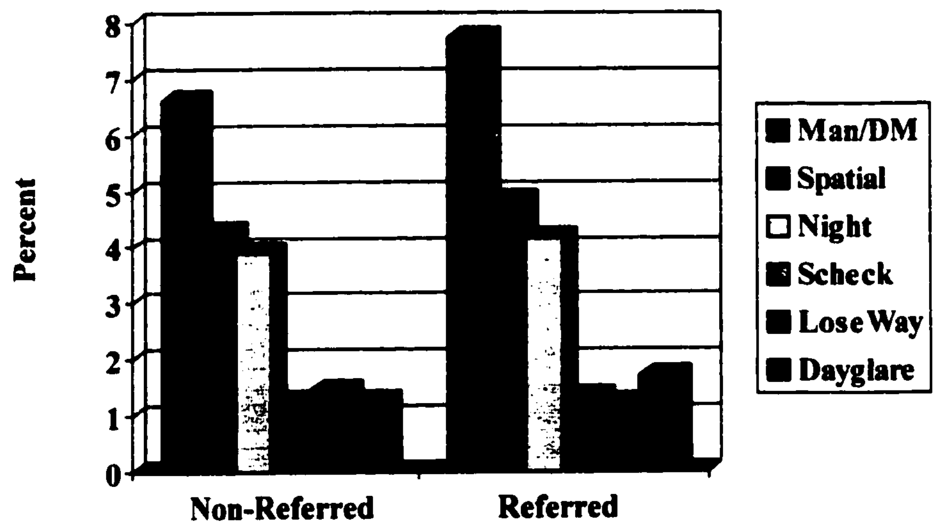
The two groups did not differ significantly in their self-perceptions of global competency (F (1,50) = 0.07, p >.78). As shown in Figure 2-1, compared to drivers their own age, 39% of the non-referred sample perceived themselves as 'more able', 58% considered themselves 'the same', while only 4% perceived themselves as 'less able'. Similarly, 31% of the referred sample rated themselves as 'more able' and 69% perceived themselves 'about the same as drivers their own age'. Post hoc comparisons for the 'more able' responses for the non-referred sample (39%) and the referred sample (31%) revealed that this difference was not significant (F 1, 50 = 0.35, p > .25).

Figure 2-1. Self-perceptions of driving competence (global) as a function of referral status.



There were no significant differences between the referred and non-referred groups in their self-perceptions of driving competency using the composite facet measures as dependent variables (MANOVA Wilks λ, F (6, 45) = 0.99, p > .45). As can be seen from Figure 2-2, individuals in both samples, by and large, reported few, if any difficulties, with any of the facet measures of driving. (See Appendix H for the full descriptive data).

Figure 2-2. Self-perceptions of driving competence (facet measures) as a function of referral status.



Discussion

Clinical impressions suggest that individuals may become defensive when their driving competence is questioned. The assumption is that this defensiveness may contribute to an overestimation of driving abilities once a referral for a driving evaluation has been made. Although it is reasonable to assume that a referral for a driving evaluation could bias an individual's ratings of self-perceptions of driving competency, the results from the current study do not support this assumption. Compared to a non-referred control group matched for age, sex, and diagnosis, individuals referred for a driving evaluation questioned in an interview setting did not differ in ratings of self-perceptions of driving competence. Responses to questions regarding global competence revealed that 39% of the non-referred sample perceived themselves as more able than drivers their own age compared to 31% for the referred sample, a difference that was not significant (see Appendix H for a summary of the descriptive data). In addition, there were no significant differences in ratings on facet measures of driving competence between the two groups.

In the present sample, 98% of the individuals, all with clinically significant cognitive impairment, considered themselves to be 'about the same as' or 'more able' than drivers their own age. It is interesting to note that this pattern of results is consistent with those obtained from samples of *cognitively unimpaired* individuals (B. Dobbs, unpublished data). In that study, the same Driving Study Questionnaire was administered to two independent samples of older individuals: a) the first was a sample (n = 92) of community dwelling seniors who are part of the SHARE (Seniors Helping Achieve Research Excellence) volunteer pool, affiliated with the Department of Psychology at the University of Alberta, and b) to 68 older cognitively unimpaired community-dwelling controls who participated in an ongoing research program for driving evaluations for medically at-risk older drivers (Driving and Dementia Study). When asked if they were 'more able', 'about the same', or 'less able compared to drivers their own age', 96% of the SHARE respondents considered themselves to be 'as good as' or 'better than drivers their own age'. Thirty percent of this group considered themselves 'more able', while 66% perceived themselves as 'about the same as drivers their own age'. Similarly, 96% of individuals in the second sample rated themselves 'as good as' or 'better than drivers their own age', with 28% rating themselves as 'more able' and 68% judging themselves 'about the same'. The responses from the remaining participants were "don't know".

The results reported here are very similar to those from two recent surveys. Rothe (1990) interviewed 904 community-dwelling drivers fifty-five years of age and older regarding their driving practices and attitudes. When asked about driving competency, 99% of the participants judged themselves to be 'as good or better than' drivers their own age. Forty one percent of the total sample judged themselves to be 'better than average' and 58% rated themselves 'as good as average'. Similar results were reported by Marottoli and Richardson (1998). Of the 125 older drivers interviewed, 68% of the participants rated themselves as being 'a little bit better than' or 'much better than' drivers their own age, with the remaining 32% rating themselves 'the same as' other drivers their age.

When questioned regarding difficulties with facet measures of driving (e.g., left turns, merges, entering controlled intersections, passing other cars, etc.), 91% of individuals in the present cognitively impaired sample reported 'never' or 'rarely' having a problem with these manoeuvres. Similar results (87%) were obtained from the cognitively unimpaired controls who participated in the Driving and Dementia Study, and from those obtained from the SHARE respondents (80%). Interestingly, when difficulties were reported, the majority of reports were for difficulties on 4 of the 24 facet measure items. Specifically, respondents were more likely to respond to difficulties with; seeing at night while driving, headlight glare at night, rear or side mirror glare, and daylight glare. Almost half (46.5%) of the individuals in the cognitively unimpaired samples (Driving and Dementia Study sample and SHARE sample) reported some degree of difficulty ('sometimes' to 'always') with the four visual measures. However, less than 25% (24.5%) of the cognitively impaired sample in the current study reported the same degree of difficulty on the visual measures. The reasons for the discrepancies are unclear. It may be that individuals with a cognitive impairment are reluctant to report a loss of abilities. A more plausible suggestion is that cognitive impairment is associated with a loss of insight into one's abilities or changes in abilities, a point that was pursued in Study 3 of the present research.

Important to this discussion is the finding that referrals for a driving evaluation do not bias ratings of self-perceptions of driving competence. Although cognitively impaired individuals may become defensive in discussions with their physicians regarding driving competence, this study found no evidence that this is the case in a non-clinical interview context. Equally important is the similar pattern of findings in global self-ratings of driving competency between cognitively impaired individuals and their cognitively unimpaired counterparts. Despite the presence of *clinically significant* cognitive impairment, 51 of the 52 individuals rated themselves as 'about as good as' or 'more able than' drivers their own age. When questioned regarding specific aspects of the driving task, *fewer* of the cognitively impaired drivers reported having any difficulties compared to older cognitively unimpaired drivers.

The results of the present study provide evidence that referrals for a driving evaluation fail to bias ratings of self-perceptions of driving competence. In addition, results from Study 1 indicate that self-perceptions of driving competency are unrelated to driving self-restrictions in a sample of cognitively impaired older drivers. Given this lack of a relationship, the most straightforward next step would be to determine the relationship between self-perceptions of driving competence and actual driving performance. That relationship was explored in Study 3.

CHAPTER 4

STUDY 3

CONGRUENCE BETWEEN SELF-PERCEPTIONS OF DRIVING COMPETENCY AND EXPERT RATINGS OF DRIVING COMPETENCY

Introduction

Determining the relationship between self-perceptions of driving competency and restrictions in driving is an important step in understanding driving restrictions of older drivers. However, knowledge of that relationship tells us little, if anything, about the appropriateness of the self-perceptions of driving competency and/or the appropriateness of the restrictions imposed. Appropriateness of self-perceptions of driving competence could be defined in a number of ways. In the current context, appropriateness of self-perceptions of driving competence is conceptualized in terms of the congruence between self-perceptions of driving competence and *actual driving performance*. Understanding how self-perceptions of driving competence relate to actual driving performance is an important step in helping to determine if voluntary driving restrictions could be used as a viable means of enhancing the safety and mobility of older drivers.

In Study 1, the hypothesized relationship between self-perceptions of competency and driving self-restrictions was predicated on the assumption that changes in driving patterns would be related to *perceptions* of driving competence, rather than to functional abilities. That is, in order for there to be changes in driving behavior patterns (e.g., restrictions) to accommodate ability declines, there needs to be more than just changes in abilities. The individual must first *recognize* that competence has changed and that this could affect his or her driving. For this reason, the suggested shift in emphasis for examining self-restrictions in driving was from assessments of functional abilities to assessments of self-perceptions of driving competence. The underlying rationale was that if an individual does not perceive there to be a change in competence which will affect driving, it is unreasonable to presume that driving patterns will change, regardless of whether or not performance has changed. The focus on self-perceptions of competence also implies that if the person perceives his or her performance to have changed, then the assumption is that driving patterns will change, regardless of whether or not there really was a change in performance. Results from Study 1 provide support for the role of self-perceptions of competency as a determiner of self-restrictions in driving for older cognitively unimpaired drivers. Results from that study also revealed that self-perceptions of competence were unrelated to driving self-restrictions in a sample of cognitively impaired older drivers.

As noted above, in cognitively unimpaired older drivers, an individual's perceived level of competence tells us whether an individual *will* modify or restrict his or her driving. On the other hand, an individual's actual driving performance tells us whether that individual *should or should not* modify or restrict his or her their driving. Combining self-perceptions of driving competence with on-road driving performance can provide a marker of whether the driving restrictions are appropriate (see Dobbs and Dobbs, in press, for a full discussion). For example, if an individual perceives his or her self competent to drive, and that perception is congruent with performance, then the most likely and appropriate outcome would be non-restriction of driving activity. However, if an individual perceives his or her self competent to drive, and that perception is *incongruent* with performance, driving restrictions are unlikely to occur, an outcome that is incongruent with actual ability level.

It seems reasonable to assume that, in cognitively unimpaired populations, perceptions of competency for an activity would be congruent with actual performance, and research supports that assumption (Cavanaugh & Poon, 1989; Dixon & Hultsch, 1983a; Zelinski, Gilwiski, & Anthony-Bergstone, 1990, but see Sunderland, Watts, Baddeley, & Harris, 1986). It also is reasonable to assume that cognitive impairment could affect an individual's perceptions of competency, such that perceptions of competency for an activity may be incongruent with actual performance. Inaccurate self-perceptions of abilities or impaired awareness of deficits are believed to be a common feature of many neuropathological disorders (McGlynn & Schacter, 1989). Recently, a number of researchers have empirically investigated impaired awareness of deficits, or anosognosia, in individuals with a dementing disorder (Auchus, Goldstein, Green, Green, 1994; Danielczyk, 1983; Feher et al., 1991; Green, Goldstein, Sirockman, & Green, 1993: McDaniel, Edland, Heyman, & the CERAD Clinical Investigators Group, 1995; McGlynn & Kaszniak, 1991; Neary, Snowdon, Bowen, et al., 1986; Neary, Snowdon, Mann, et al., 1990; Ott, Lafleche, Whelilihan, Buongiorno, Albert, & Fogel, 1996; Reed, Jagust, & Coulter, 1993; Reisberg, Gordon, McCarthy, & Ferris, 1985; Sevush & Leve, 1993). The majority of the research has investigated awareness for cognitive deficits (Auchus et al., 1994; Lopez, Becker, Somsak, Dew, & DeKosky, 1994; Reisberg et al., 1985), and for memory deficits (Feher et al., 1991; McDaniel et al., 1995; Ott et al., 1996; Schacter, McLachlan, Moscovitch, & Tulving, 1986; Sevush & Leve, 1993) in individuals with a dementia, with fewer studies investigating awareness of deficits for independent living skills (DeBettingnies, Mahurin, & Pirozzolo, 1990; Mangone, Hier, Gorelick, et al., 1991; Ott et al., 1996). In general, results reveal that individuals with a dementia lack awareness of their deficits by overestimating their abilities.

Importantly, however, different patient populations can vary widely in their awareness of deficits. Generally, research suggests that individuals with AD (and Pick's Disease) show a lack of awareness of their own deficits, with insight relatively well-preserved in individuals with vascular dementia (Mahendra, 1984). Danielczyk (1983) investigated awareness of deficits in four groups of individuals with mental deterioration: Parkinson's Disease (PD), AD, atypical Parkinson's Disease (AP), and multi-infarct dementia (MID). Individuals with PD showed relatively good insight into their illness. However, the other three groups exhibited impaired awareness of deficits. The individuals with AD showed the least amount of awareness for their illness, followed by the AP group. Those in the MID group showed the least amount of impaired awareness within the impaired awareness group.

Impaired frontal lobe functioning has been related to impaired awareness of deficits (Nauta, 1971; Stuss, 1991; Stuss & Benson, 1986). Both AD and Pick's Disease are typically associated with frontal-lobe pathology. However, degeneration of the frontal lobes is typically more severe in the early stages of Pick's Disease than in AD (Kaszniak, 1986; Mahendra, 1984), and research suggests that individuals with Pick's Disease generally exhibit earlier losses of insight than individuals with AD (Gustafson & Nillson, 1982; Neary et al., 1990).

The commonly reported overestimation of abilities associated with impaired awareness of deficits in individuals with a dementing illness can have significant implications. For example, individuals with a loss of insight into ability declines may be more likely to attempt activities beyond their current abilities (e.g., driving, using the stove). The potential consequences of such attempts for activities such as driving can have significant implications for personal and public safety. Despite its relevance, few studies have systematically evaluated awareness of deficits for driving in a cognitively impaired population.

The goals of the current study were twofold. The first goal was to determine if appropriateness of self-perceptions of driving competency was significantly different between a sample of older drivers with a dementia and a sample of cognitively unimpaired older drivers. It was hypothesized that there would be a greater degree of congruence between self-ratings of driving competence and measures of actual driving performance for the older cognitively unimpaired sample than for the dementia sample. It was further hypothesized that those with a dementia would overestimate their driving competency. The second goal of the present study was to determine if appropriateness of self-perceptions of driving competency differed significantly between two dementia groups. Because deficits in awareness have been found to be greater in individuals with AD compared to those with MID, it was hypothesized that overestimations in driving competency would be significantly greater (i.e., the differences between self-reports and measures of on-road driving performance would be larger) for individuals with AD compared to those with MID.

Thus, the research questions for Study 3 were twofold:

(1) Does the accuracy of self-perceptions of driving competence differ as a function of cognitive status (e.g., cognitively impaired vs. cognitively unimpaired)?

(2) Does the accuracy of self-perceptions of driving competence differ as a function of type of dementia pathology (e.g., AD vs. MID)?

Method

Participants

All cognitively unimpaired older participants and those individuals with a clinical diagnosis of AD and MID were selected from the original Driving and Dementia Study database (described in Study 1) for inclusion in the current study. Nine of the subjects in the cognitively impaired sample were subsequently deleted because of missing data for the on-road evaluations. Three of the participants were not given an on-road evaluation because of safety concerns by the driver examiner, for 5 of the 9 participants the on-road evaluation was aborted because of safety concerns by the driver examiner, and one individual did not hold a valid driver's license. There were no significant differences between those individuals excluded from the study and those included in the study in terms of age (F (1, 289) = 0.15, $p > .69$), education (F (1,289) = 0.04, $p > .84$), sex ($\chi^2 = 0.42$, $p > .51$), or MMSE score (F (1,289) = 2.28, $p > .13$).

The final sample consisted of 64 cognitively unimpaired older participants, 105 individuals with a clinical diagnosis of AD, and 113 individuals with a clinical diagnosis of MID. As noted in Study 1, for those cognitively impaired individuals referred by the hospital physicians, the diagnosis of dementia was made using Diagnostic and Statistical Manual of Mental Disorders (4th Ed.) (DSM-IV) criteria (American Psychiatric Association, 1994). In the case of referrals from community physicians, the basis for diagnosis is presumed to have been DSM-IV, but this cannot be confirmed.

Procedures

Operationalization of Variables.

Accuracy of Self-Perceptions of Driving.

Appropriateness of self-perceptions can be defined in a number of ways. A frequently used method of defining appropriateness of self-perceptions of some aspect of performance (e.g., memory, activities of daily living) involves comparisons of participant self-perceptions on some aspect or aspects of performance with ratings of the same aspect(s) of performance by collateral sources (DeBettignies et al., 1990; Feher et al., 1991; Green et al., 1993; McGlynn & Kaszniak, 1991). Another commonly used method involves comparisons of participant self-perceptions to some objective measure of performance (e.g., results from neuropsychological tests) or to expert ratings of performance (Anderson & Tranel, 1989; Lopez et al., 1994; McDaniel et al., 1995; McGlynn & Kaszniak, 1991; Reed et al., 1993; Seltzer, Vasterling, & Burswell, 1995). In the current study, appropriateness of self-perceptions was determined by comparing self-perceptions of driving competence to expert ratings of on-road driving performance. The rationale for this approach is provided below (see Expert Ratings of Driving Competency section).

Self-perceptions of Competency.

Two sets of measures of self-perceptions of competency (Global and Facet) were used in the current study, and are subsets of the measures used in Study 1.

A. Global measure of perceived competence

Participant responses to the following question provided a global assessment of perceived competency: Compared to drivers of your own age, do you think you are: [1] more able, [2] about as good, [3] less able, [99] Don't Know"?

B. Composite ratings of perceived competence - Facet Measures

Four items from the Driving Questionnaire (Appendix D), providing information on self-perceptions of driving specific to manoeuvres basic to driving, were congruent with the expert ratings of driving performance (e.g., left turns, right turns). Those items were selected as facet ratings of driving competence for the current study. Participant responses were coded using a five-point Likert format, such that 1= never, 2 = rarely, 3 = sometimes, 4 = frequently, and 5 = all the time. The four participant facet items, along with the global item, are shown in the first column of Table 3-1.

Table 3-1. Items to be used in Calculating Difference Scores Between Participant and Driving Evaluator Ratings.

PARTICIPANT	DRIVING EVALUATOR
Global Ratings:	**Global Ratings:**
Compared to drivers your own age, do you think you are: [1] more able, [2] about as good, [3] less able	Based on the Driving Evaluator's professional judgement, driver skill was rated as: 1 = very poor driver, 2 = poor driver, 3 = satisfactory driver, 4 = excellent driver
Facet Ratings: (using the following scale): 1 = never, 2 = rarely, 3 = sometimes, 4 = frequently, 5 = all the time	**Facet Ratings:** (using the following scale): 1 = no problem to 5 = very severe problems
Left turn at controlled intersection Left turn at uncontrolled intersections	Left hand turns across traffic
Making right turns	Right hand turns across traffic
Keeping up with flow of traffic	Speed appropriate to traffic and road conditions
Changing lanes	Lane changes

Expert Ratings of Driving Competency.

A number of different measures have been used for assessing driving competency in the research literature; crash outcomes, moving violations, driving simulators, collateral source reports, and on-road performance (Dobbs, Heller, & Schopflocher, 1998; Fitten, Perryman, Wilkinson, et al., 1995; Friedland et al., 1998; Hunt et al., 1993; Lucas-Blaustein et al., 1988; Odenheimer, 1993; Rebok, Keyl, Bylsma, et al., 1994). Not surprisingly, each methodology has strengths and limitations. Of all the methodologies, on-road performance is, however, the only measure that provides a direct evaluation of driving performance and, as such, has become the "gold standard" with regard to assessments of driving performance in the older driving population (Lundberg, Johansson, Ball et al., 1998). Thus, in the present study, on-road driving performance was used as the standard in determining driving competency and the research participants' self-perceptions of competency were compared to that standard. In the majority of cases (~98%), participant ratings of self-perceptions of driving competency and expert ratings of competency were collected within a one week time frame. For the remaining two percent of cases, expert and participant ratings were collected within a two-week time frame.

The measures of on-road driving performance were provided by professional driving evaluators, blind to diagnosis, during and after a standardized on-road evaluation of the research participants. Two professional driving evaluators provided the evaluations of on-road performance. Both evaluators (JC and JH) were professional driving instructors with the Alberta Motor Association (AMA), with more than 30 years of combined driving instructor experience. More than 80% of the evaluations were conducted by one driving instructor (JH), who, at the time of the assessments, was the Chief Provincial Examiner for the AMA. The standardized on-road evaluation consisted of approximately 40 minutes of driving time on commercial and residential streets in a large urban centre (Edmonton, Alberta). The on-road assessment consisted of 34 manoeuvres (e.g., turns, stops, yields) selected to maximize those implicated in the crashes of older drivers (e.g., left turns, merges, etc.).

The driver evaluators' measures assessing specific aspects of driving performance (e.g., left turns, merges) were collected during the on-road testing procedure. At the conclusion of the on-road assessment, the driving evaluators provided overall ratings for the specific aspects of the research participant's driving performance, based on a scale ranging from 1 = no problem to 5 = very severe problem. The driving evaluators also provided a global rating of driver skill at the conclusion of the on-road assessment, based on their professional judgement. The global ratings ranged from 1 = very poor driver to 5 = excellent driver. As noted previously, four of the measures were selected because of their congruence with the participant self-ratings. Those measures are outlined in the second column of Table 3-1.

Difference Scores.

An appropriateness of perceived competency score was derived by calculating the difference between each individual's self-perceived competency score and the respective driving evaluator's score for the global as well as the facet measures of perceived competency. Before difference scores were calculated, however, the scales were transformed because the scales used by the participants and the driving evaluators were not identical. The global ratings of competence by the research participants and the driving evaluators were measured using scales with opposite anchors. The participant rating scale was, therefore, reversed to be consistent with the scale used by the driving evaluator. Next, the driving examiner (JH), who was blind to the research hypothesis, transformed the driver examiner rating scales for the global measure to be consistent with the participant rating scales. The original and transformed scales for the global measure of competency are shown in Table 3-2.

Table 3-2. Transformation of Driving Evaluator Ratings (Global Measures).

DRIVER EVALUATOR RATINGS		PARTICIPANT RATINGS
Original	Re-coded as:	
1 = very poor 2 = poor 2.5	1 = less able	1 = less able
3 = average 3.5	2 = about as good	2 = about as good
4 = above average 4.5 5 = excellent	3 = more able	3 = more able

In the case of the facet measures rating scale, the driver evaluator ratings of 'severity of problem' do not translate directly to the participant rating scale of 'frequency of difficulty' with manoeuvre. Moreover, a frequency judgement for a facet driving problem is not appropriate for a short driving evaluation (e.g., 40 minutes). However, in the opinion of the driving evaluator, a person with a severe degree of difficulty on a facet of driving would be likely to demonstrate that problem all the time. Conversely, a person rated as having no problem on a facet of driving most likely would be rated as never demonstrating that problem. Based on this rationale, the driver examiner converted the driving evaluator scale to conform to the participant rating scale on the facet measures of driving. The original and transformed driver rating scales and the participant rating scales are shown in Table 3-3.

Table 3-3. Transformation of Driving Evaluator Ratings (Perceived Competence - Facet Measures).

DRIVER EVALUATOR RATINGS		PARTICIPANT RATINGS
Original Scale	Re-Coded Variable	Original Scale
1 = no problem	1 = never	1 = never
2 = minor	2 = rarely	2 = rarely
3 = moderate	3 = sometimes	3 = sometimes
4 = severe	4 = frequently	4 = frequently
5 = very severe	5 = all the time	5 = all the time

Difference scores were then calculated by subtracting the driving evaluators' ratings of competence from the equivalent self-ratings of driving competence. A difference score greater or lesser than zero is indicative of a mismatch between self- and driving evaluator ratings.

A global difference score was calculated for each research participant. Positive difference scores indicate that participants have overestimated their abilities compared to the expert ratings. Negative difference scores indicate an underestimation of abilities by the research participants in comparison to expert ratings. Difference scores also were calculated for the perceived competence-facet measures. For each participant, an overall self-rating facet score and an overall driver evaluator facet score were constructed by summing the individual facet ratings for left turns, right turns, speed, and lane changes. An overall facet difference score was derived by subtracting the overall driving evaluator *facet* score from the overall self-rating *facet* score. Positive scores are indicative of an overestimation by the participant of the *degree of difficulty* on facet ratings compared to expert ratings. A negative score represents an underestimation of the *degree of difficulty* on the facet ratings of perceived competence by the research participant, compared to expert ratings.

Data Analyses

Multivariate analysis of variance (MANOVA) was used to examine the differences among the three groups (cognitively unimpaired, AD, and MID) on age, sex, and education. The hypothesis that drivers with a dementia would show greater discrepancy than cognitively unimpaired drivers in self-ratings versus expert ratings of driving competence was tested using MANOVA with three subject groups (cognitively unimpaired, AD, MID) and two dependent variables (difference scores for global ratings and for overall facet ratings). Planned pairwise comparisons between groups were conducted to investigate differences between the cognitively unimpaired (CU) group and each of the dementia groups (CU vs. AD; CU vs. MID).

Planned pairwise comparisons also were done to test the hypothesis that differences between self-perceptions of driving competency and expert ratings would be significantly greater in the AD group than in the MID group, with the AD group predicted to overestimate their driving competency to a greater degree than the MID group. Pairwise comparisons were made between the AD group and the MID group for each of the global and overall facet measures. A modified Bonferroni was used to test each of the planned comparisons. Finally, one-sample t-tests were used to test whether the difference scores for each of the groups (CU, AD, and MID) were significantly different that zero.

Results

Demographics

For those participants retained in the study, there were significant differences among the three groups for age, education, and MMSE scores (MANOVA: Wilks λ $F = 25.78$, $p < .001$). As shown in Table 3-4, the mean age of the AD group was 73.49 ($SD = 7.72$), compared to 71.26 ($SD = 10.13$) for the MID group, and 69.23 ($SD = 6.47$ for the cognitively unimpaired group, F $(2, 279) = 5.11$, $p < .01$. The three groups differed significantly in terms of education, F (2, 279)

= 27.73, p < .001. The cognitively unimpaired participants had attained a higher level of education (M = 14.36 years, SD = 2.81), compared to those diagnosed with AD (M = 11.82, SD = 3.36), and for those diagnosed with MID (M = 10.46, SD = 3.59). There also were significant differences in MMSE scores among the three groups, F (2, 279) = 56.01, p < .001. Not unexpectedly, the cognitively unimpaired participants had higher MMSE scores (M = 28.83, SD = 1.36), with the AD group having the lowest scores (M = 23.25, SD = 4.12). The mean MMSE score for the MID group was 24.52 (SD = 3.43). The three groups differed in terms of gender ($\chi^2_{(2)}$ =17.92, p < .001). As can be seen in Table 3-4, the percentage of males in the MID group was higher (81%) compared to 57% for the AD group, and 55% for the cognitively unimpaired group.

Table 3-4. Demographic Measures for the Cognitively Unimpaired , AD, and MID Groups.

	Age**	Education**	MMSE score**	Gender**
Cognitively Unimpaired	69.23 (SD = 6.47)	14.36 (SD = 2.81)	28.83 (SD = 1.36)	35 (M) 29 (F)
AD group	73.49 (SD = 7.72)	11.82 (SD = 3.36)	23.25 (SD = 4.12)	63 (M) 48 (F)
MID group	71.26 (SD = 10.13)	10.46 (SD = 3.59)	24.52 (SD = 3.43)	98 (M) 23 (F)

** p <.001

Appropriateness of Competency Measures

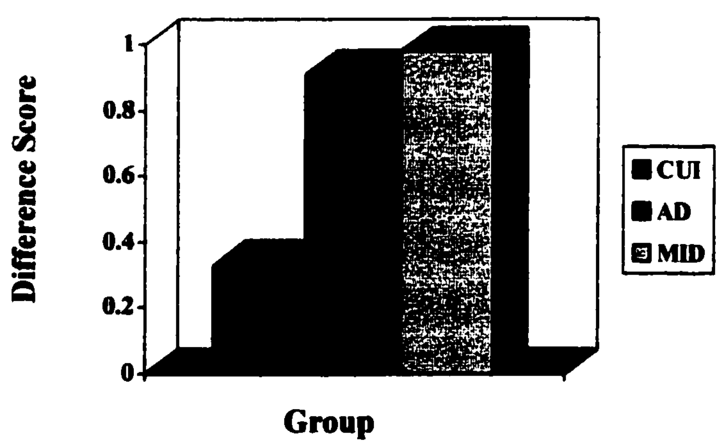
Results from the MANOVA revealed significant differences among the three groups (Wilks λ F = 20.99, p < .001). Univariate F's revealed significant differences between driver examiner and self-ratings for global competence (F (2, 279) = 23.22, p < .001) and for the facet measures (F (2, 279) = 31.01, $p < .001$).(For a full description of the data, see Appendix I).

Global Competence.

Planned pairwise comparisons revealed significant differences in the difference scores between the cognitively unimpaired group and the AD group (F (1,278) = 112.93, $p < .001$), and between the cognitively unimpaired group and the MID group (F (1, 278) = 141.00, $p < .001$) on the global competence measure. The mean difference scores for each of the three groups are shown in Figure 3-1. All three groups tended to overestimate their global competence, with the older cognitively unimpaired group overestimating their global competence to a lesser degree (M_{diff} = 0.33) than either of the dementia groups (M_{diff} = 0.91 for the AD group and 0.98 for the MID group).

Planned pairwise comparisons between individuals with AD and those with MID revealed no significant differences (F 1,278 = 1.64, $p > 0.25$). That is, both of the dementia groups tended to overestimate their driving competence on the global rating to a comparable degree.

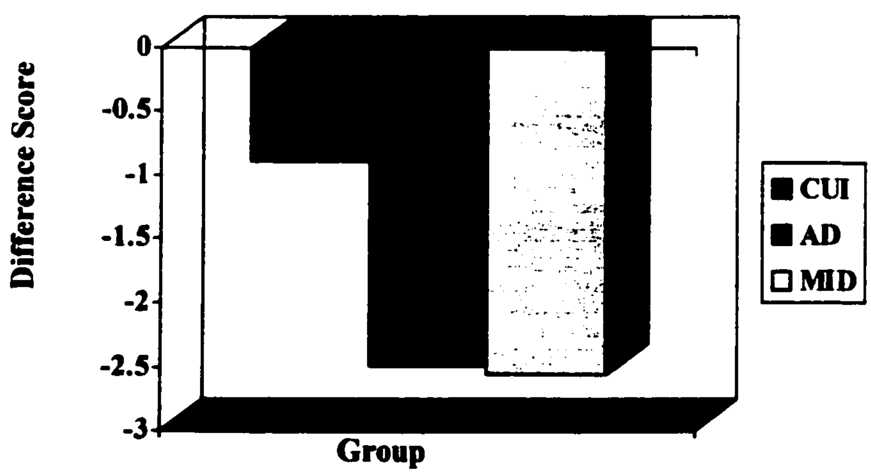
Figure 3-1. Mean difference score (global driving competence) as a function of group status.



Facet Measures.

Planned pairwise comparisons of the difference scores for the facet measures also revealed significant differences between the cognitively unimpaired group and the AD group (F (1, 278) =170.26, $p < .001$) and between the cognitively unimpaired group and the MID group (F (1, 278) =185.49, $p < .001$). The mean difference scores for each of the three groups are shown in Figure 3-2. Again, the differences between the difference scores for the cognitively unimpaired group and each of the dementia groups were substantial. Compared to the cognitively unimpaired group (CUI: M_{diff} = -0.89), there was close to a threefold increase in underestimation of degree of difficulty on the facet measures by both of the dementia groups (M_{diff} = - 2.49 AD; - 2.56 MID). A comparison of the difference scores on the facet measures for the AD group versus the MID group showed they did not differ significantly (F (1, 278) = 0.32, $p > .25$). That is, both dementia groups underestimated their degree of difficulty on the facet measures to a similar degree.

Figure 3-2. Mean difference score (degree of difficulty with facet measures of driving) as a function of group status.



A one-sample t-test revealed a significant difference between the mean difference score for the cognitively unimpaired group and the hypothesized population value of zero, $t(63) = 4.08$, $p < .001$. The mean difference scores for the AD group ($t(104) = 14.37$, $p < .001$) and the MID group ($t(112) = 16.30$, $P < .001$) also were significantly different from the hypothesized population values of zero.

Discussion

The present findings confirm the hypothesis that, compared to cognitively unimpaired participants, individuals with AD or MID overestimate their driving competencies to a greater degree, both by overestimating their overall driving competence or by underestimating the degree of difficulty they have with selected driving manoeuvres. Although individuals in the cognitively unimpaired data set also overestimated their global competence, that difference was slight. In fact, the pattern of the results is such that 62.5% of the ratings by the cognitively unimpaired sample on the global competency measure were congruent with the driver examiner ratings. Five percent of the cognitively unimpaired sample rated themselves as less competent than ratings provided by the driver examiner, and 33% rated themselves as more competent than ratings provided by the driver examiner. In comparison, only 20% of the global ratings between the participants and the driver examiners were congruent in the dementia group. More than 78% of the dementia participants rated themselves as more competent than ratings from the driver examiner. Less than 2% of the dementia sample rated themselves as less competent compared to driver examiner ratings. Importantly, when there were discrepancies between the participant ratings and driver examiner ratings, 86% of the cognitively impaired sample rated themselves 'as able or more able than drivers their own age' whereas the driver examiner rated them as 'less able than drivers their own age'. In contrast, less than 30% of the cognitively unimpaired sample rated themselves 'as able or more able than drivers their own age' when the driver examiner rated them as 'less able than drivers their own age'. A similar pattern of results was found for the facet ratings. Thus, in the case of the cognitively unimpaired sample, the overestimation of driving competence represents an overestimation of abilities that are judged to be adequate by an expert driving evaluator. On the otherhand, the overestimation of abilities by the cognitively unimpaired group represents an overestimation of abilities that are judged to be inadequate by an expert driving evaluator.

There are, of course, strong implications of these findings. First, because individuals with a dementia such as AD or MID overestimate their competence to drive, it is unlikely that they will *appropriately* restrict their driving as their competence continues to decline. Second, the overestimation and apparent lack of awareness of competence declines mean that physicians, family, and others cannot rely on the self-reports of individuals with dementia to serve as an appropriate basis for decisions about driving. This holds regardless of whether the individual with dementia is making a global judgement about their performance on the driving task or a judgement about specific aspects (facets) of the task.

The deficit in judgements about competence for the driving task is consistent with literature from other domains. A sizeable number of individuals with AD fail to recognize significant impairments in their cognitive functioning (Auchus et al., 1994; Feher et al., 1991; Lopez et al., 1994; McDaniel et al., 1995; Ott et al., 1996; Reisberg et al., 1985; Schacter et al., 1986; Sevush & Leve, 1993), and in activities of daily living (DeBettingnies et al., 1990; Mangone et al., 1990; Ott et al., 1996). Failure to recognize ability declines can have significant and hazardous consequences for an activity such as driving. Results from research examining the crash rates of cognitively impaired older drivers speak to those consequences. Results from one of the earliest studies examining the crash risks associated with dementia were published by Waller (1967), who compared the driving records of 82 normal older drivers with the records of

82 older drivers described as 'senile' and 199 drivers diagnosed with dementia and cardiovascular disease. The comparisons revealed crash rates of 12.1, 19.3, and 36.2 crashes per million miles driven for the three groups, respectively. More than twenty years later, Friedland et al. (1988) compared the driving histories of individuals with dementia of the Alzheimer's type (DAT) and healthy age-matched controls. Results from this investigation revealed that the DAT patients were nearly five times more likely to have had a crash than healthy, elderly controls. Recent research (Cooper et al., 1993; Drachman & Swearer, 1993; Dubinsky et al., 1992; Gilley, Wilson, Bennett, et al., 1991; Lucas-Blaustein et al., 1988; O'Neill et al., 1992; Tuokko et al., 1995) corroborates these early findings, with the majority of evidence providing a clear indication that individuals with a dementia, as a group, have crash rates that far exceed those of non-dementing seniors.

The results of the on-road assessments in the current study also are consistent with previous research. A number of investigators have examined the driving ability of individuals with dementia using on-road assessments (Cushman, 1992; Dobbs, 1997; Dobbs et al., 1998; Fitten et al., 1995; Hunt et al., 1993; Kapust & Weintraub, 1992; Odenheimer, Beaudet, Jette, Albert, Grande, & Minaker, 1994; Shemon & Christensen, 1991). Results reveal that the majority of the individuals with a dementia in those investigations failed the on-road assessment (Cushman, 1992; Dobbs, 1997; Dobbs et al., 1998; Fitten et al., 1995; Odenheimer et al., 1994; Shemon & Christensen, 1991).

The present findings are inconsistent with the results of greater unawareness in AD individuals compared to those with MID reported by DeBettignies et al. (1990). In that investigation, level of insight for independent living skills was assessed in a sample of 12 individuals with AD, 12 individuals with MID, and 12 normal elderly controls. Level of insight was measured by subtracting the self-report scores on measures of independent living from informant report scores on those same measures. Results revealed a significantly greater loss of insight in individuals with AD compared to those with MID and to controls for impairments in independent living skills (ADL's and IADL's). There was no significant difference between controls and individuals with MID. The reason for the lack of significant differences between the two groups in this investigation is not clear. It may be that there is more uniformity in level of dementia severity between individuals with AD and MID in the current investigation compared to those in the DeBettignies et al. (1990) study. Unfortunately, level of dementia severity for each of the groups in the DeBettignies investigation was not reported, precluding an examination of this possibility. However, individuals with mild *and* moderate cognitive decline were included in DeBettignies study sample, whereas the majority of individuals in the current study were mildly impaired (Mean mental status score was 23.8). Another possibility that may account for the difference in findings is the small sample size in the DeBettingnies investigation. Nevertheless, the present findings indicate that just because there seems to be greater insight by individuals with MID for some functional skills, this does not necessarily mean that this greater insight can be generalized to all functional tasks. This is particularly significant in the case of driving where there are clear issues of personal and public safety.

Finally, the results from the present study examining the relationship between self-perceptions of driving competence and driving evaluator ratings of on-road performance in the cognitively unimpaired sample are, for the most part, remarkably consistent. For example, the mean difference score between participants and the driving evaluators for global ratings of competence was less than point three four (0.34), and less than minus one (-1) for the overall facet ratings. The data from the cognitively unimpaired sample indicate the self-perceptions of driving competence are congruent with ratings from on-road performance, at least for the global and facets ratings that were measured. These data suggest that, to the extent that self-perceptions are the direct determinants of self-restrictions, those restrictions are likely appropriate in this group. However, using the same reasoning, it is likely the case that self-restrictions in the cognitively impaired group are inappropriate. This is because of the discrepancy between the self-ratings of driving competence and ratings made by the driving evaluator. Thus, the imposition of voluntary restrictions in driving is likely to be an appropriate strategy for enhancing safety while preserving mobility for the majority of cognitively unimpaired older drivers, but an inappropriate strategy for cognitively impaired drivers.

CHAPTER 5

SUMMARY

Voluntary self-restriction of driving behavior has been advanced as one way older driver safety could be enhanced while preserving their mobility. The basic assumption underlying that approach has been that drivers will voluntarily restrict their driving as a direct (safety enhancing) response to declines in functional abilities. However, as reviewed earlier, the results of investigations attempting to find evidence of a direct association between functional ability levels and driving self-restrictions have been disappointing. Despite the disappointing findings, the importance of the traffic safety problem remained. In addition, the voluntary restriction solution continued to be an attractive means of accomplishing the safety goals while minimizing the negative consequences for mobility, and for bypassing the need for costly new regulations and enforcement. At the same time, it seemed clear that if self-restriction was to be an effective strategy, then research must move beyond thinking about voluntary restrictions in driving as being the direct result of declines in functional abilities. The purpose of the current dissertation was to redirect thinking by proposing a different conceptualization of driving restrictions and providing relevant empirical support.

It was postulated that presuming a direct association between declines in abilities and the imposition of self-restrictions was misleading in two ways: First, it misidentified the factor determining driving self-restrictions. The basic premise of the current research was that it is not how *functionally* competent an individual is that determines when and how the individual will restrict their driving, but how competent the individual *thinks* he or she is (whether appropriately or inappropriately) that is the more effective determiner of the extent of the self-restrictions in driving. Second, it was proposed that the presumed relationship between functional abilities and imposition of driving restrictions mistakenly treated self-restrictions as though they were unidimensional. Consistent with work in other domains of functional skills, the present work postulated that driving restrictions would be multidimensional. Thus, combining these two shortcomings, the proposed framework was that *self-perceptions of competence* would be the most important factor determining the *extent and type* of driving restrictions.

Support for the perceived competency thesis provides a new direction for research on the older driver and can serve as the basis for advancements in predicting changes in driving patterns. This direction could include a more broadly based examination of possible facets of driving, evaluations of difficulties for different driving manoeuvrers that take into account the use of compensatory strategies, and a more complete examination of the dimensions of self-restrictions. Refinement of both the predictor and criterion variables may enhance our understanding of the extent and type of driving restrictions and their determiners. This, in turn, may enable a more effective use of self-restrictions to enhance the safety of older drivers.

The results of the present research have important clinical implications. Results from Study 1 indicate that self-perceptions of driving competence for cognitively impaired participants are, in general, unrelated to self-restrictions in driving. Although results from that study indicated that the cognitively impaired participants restricted their driving to a greater extent than the cognitively unimpaired participants, the results of Study 3 indicated that even the reduced amount of driving in the cognitively impaired sample is likely to be inappropriate. The reason for this inappropriateness is because a significant majority of the cognitively impaired participants perceived their driving ability to be better than driver examiner ratings. In the majority of cases, the cognitively impaired participants overestimated their abilities, abilities that were judged to be inadequate for safe driving by an expert driving examiner. This is in sharp contrast to the results from the cognitively unimpaired group. For this group, although abilities also were overestimated, their abilities, in general, were judged to be adequate for safe driving by the driving examiner. The pattern of results, taken together, suggests that: a) families, physicians, and other health care providers cannot use the self-reports of individuals with a cognitive impairment as an appropriate basis for decisions about driving, and b) that individuals with a cognitive impairment cannot be relied upon to appropriately *self*-restrict their driving in the face of declining competence.

The clinical implications are such that when there are indications of cognitive impairment, self-reports of driving competence may be particularly misleading. Thus, in assessing driving competence, physicians and other health care professionals will need to rely on some objective form of evaluation (e.g., a validated on-road assessment). In addition, on-road assessments also may be helpful in that they may provide individuals with a cognitive impairment and their families with objective evidence regarding the individuals driving competency. This may help families in convincing the cognitively impaired individual not to drive. A second important clinical implication is that for a significant number of cognitively impaired older drivers, restrictions will have to be externally imposed. This is most likely to come from family or physicians (Dobbs & Dobbs, 1997). Enlisting the aid of the physician is a technique endorsed by older drivers surveyed by Persson (1993). All of the participants in this study felt that the physician should be the one to advise the person about driving. In research by Dobbs and Dobbs (1997), although less than 25% of the caregivers surveyed reported enlisting the aid of the physician to limit or stop an individual with a dementia from driving, more than 85% reported this technique to be effective.

Despite its effectiveness, it may be difficult for the physician to initiate measures that may limit the patient's driving ability because "many patients grow old along with their primary care physicians" (O'Neill, 1997, p. 72). Often, there are concerns that the imposition of driving restrictions will jeopardize the patient-physician relationship. However, there are several alternatives available. Referral to an appropriate specialist (e.g., geriatrician, neurologist) may be preferable. A referral to a geriatric assessment centre with an emphasis not only on interdisciplinary assessment but also on maintaining mobility and exploring transportation needs may be helpful (O'Neill, 1997). Finally, when individuals are beginning to show signs of cognitive decline, it may be helpful for physicians and other health care professionals to discuss with families the need for early planing for driving restrictions and cessation.

The primary implication from the current research for the applied goal of enhancing traffic safety is that the effectiveness of the self-restriction strategy will be limited by the extent to which drivers are aware of their ability declines. This suggests that interventions need to be developed with a special emphasis on ability changes about which individuals are likely to be unaware. These may be especially relevant for illnesses or pathologies that have an insidious onset and slow progression, such as cataracts or strength declines. At the same time, it needs to be acknowledged that intervention programs to increase awareness would be inappropriate for individuals with pathologies affecting insight. In these cases, external means of imposing self-restrictions will be necessary.

Limitations of the Current Research

The principal data used in this investigation were data collected as part of an ongoing research program designed to evaluate the driving abilities of medically at-risk drivers. This database offers unique opportunities as well as some shortcomings for the current goals. The primary opportunities are that it is the largest database of its kind in terms of the sample size and the extensiveness of the measures. It contains comprehensive measures of current driving patterns as noted by both the driver and a collateral source and measures of self-perceptions of driving competence (global and facet). Assessments of driving performance also are included. The measures of driving competence are explicit and tied to data.

There are, of course, shortcomings given that the data were collected for goals other than those of the current project. Some of the questions in the questionnaire might have been different or phrased in a somewhat different way given the orientation of the current project. A limitation of the current research is the absence of direct measures of functional abilities. The inclusion of direct measures of functional abilities in future research would be desirable. The current research also is limited by not having direct measures of driving self-restrictions. In the absence of those direct measures, future research would benefit by having measures of *changes* in driving self-restrictions as a function of ability declines. Of future interest would be an examination of the relationship between *changes* in perceptions of ability and *changes* in driving patterns as a function of ability declines. Finally, future research needs to be carried out on the psychometric properties of the scales used in this investigation. This would include both validity of the constructs and the reliability of their measurements. Importantly, the on-road measures used in this investigation were developed on an initial sample of 33 healthy young drivers, 68 healthy, older drivers, and 173 older drivers with clinically significant cognitive impairment. The on-road evaluation was then validated on an independent sample of drivers. That sample included 370 cognitively impaired, currently driving older individuals referred from hospital and community physicians.

Despite the limitations of the current database, its use provided the opportunity to address fundamental questions related to driving self-restrictions in a way that would otherwise exceed the time and fiscal limitations of a doctoral dissertation. The data collection period spanned five years, the project entailed the cooperation of more than a hundred hospital and community physicians, and utilized the combined collaborative efforts of medical, driving, and research personnel.

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Appendix A

EXISTING DATABASES

There were two phases to the research program. The first phase of the program consisted of the development of a stand-alone driver evaluation for the medically at-risk older driver. In this, the original phase of the research, 173 individuals with clinically significant cognitive impairment were evaluated and compared with 68 older healthy community volunteers and 33 young healthy community volunteers. The cognitively impaired group were referred by physicians from the Memory Clinic and other programs of the Northern Alberta Regional Geriatric Program (NARG). The older and younger community volunteers were recruited for participation in the research through community advertisements. All of the cognitively impaired and unimpaired participants were active drivers at the time they entered the research protocol.

The second phase of the research involved the validation of the driving evaluation, developed during phase one, on an independent sample of drivers. Three hundred and seventy cognitively impaired, currently driving older individuals participated in the validation phase of the research. These participants were referred to the research from NARG physicians and 102 community physicians. All participants in the validation phase of the research were active drivers at the time they entered the research protocol.

All participants were administered a battery of neurocognitive tests developed or selected for their promise in predicting driving performance and were given tests of mental status (e.g., MMSE-Folstein, Folstein, & McHugh, 1975, Appendix E). All participants completed a comprehensive 86 item Driving Questionnaire (Appendix D), which was administered by means of a face-to-face interview by a trained research assistant. Each participant also underwent an on-road evaluation. The on-road test consisted of 34 manoeuvres (e.g., turns, stops, yields) and was about 40 minutes of driving time on commercial and residential streets in a large urban centre

(Edmonton, Alberta). The manoeuvres were selected to maximize those implicated in the crashes of older drivers (e.g., left turns, merges).

For both phases of the research, questionnaire data also were collected from the primary caregiver (or the most knowledgeable careperson in the absence of a primary caregiver) for each of the cognitively impaired individuals and from a collateral source (by self-affirmation, a knowledgeable source regarding the participant's driving behaviors) for the cognitively unimpaired participants. In brief, the Collateral Source Questionnaire was identical to the Driving Questionnaire administered to each of the cognitively impaired and unimpaired participants, but with the wording of the collateral question phrased so as to refer to the participant's ability. The collateral source also provided demographic data about themselves as well as demographic data about the study participant.

Appendix B

COMPARISON OF PARTICIPANTS IN STUDY 1 vs. PARTICIPANTS FROM ORIGINAL DATABASE

The original database from which these data were drawn consisted of 68 older cognitively unimpaired participants and 489 cognitively impaired adults. Each of the participants were to have a collateral source to provide information about their (the participant's) driving. It was decided a priori to eliminate subjects with missing data greater than 10% (Tabachinck & Fidell, 1998). Of the 68 control subjects, eight were deleted from the data set because of complete (ie, no collateral source, n = 6) or partial missing data (n = 2) from the collateral source. The partial missing data (i.e., > 10%) in most instances were of the nature 'do not know'. The cognitively unimpaired participants eliminated from the study (n = 8) were significantly older (76.1 years vs. 68.5 years) than the cognitively unimpaired participants retained in the study F (1,67) = 11.65, p = .001). Those deleted from the sample did not differ significantly from those retained in terms of education (F (1,67) = .05, p > .81) or gender ($\chi^2 = 2.15$, p > .14). For the remaining subjects (ie., those retained in the data set), missing data were random and minimal (< 1% for the data set). For those values that were missing, the values were replaced either with the mean of the set of variables (based on Principal Components analysis), or, in the case of a single variable, with the mean of the sample for that variable.

Of the 489 cognitively impaired participants, 112 did not have a collateral source and in 83 cases, the collateral source did not have sufficient information to complete the questionnaire. Because of the importance of the collateral source for the current investigation, only the data from the remaining 294 participants were retained for analysis. There were no significant differences between those cognitively impaired individuals included in the study versus those deleted from the study sample in terms of age, F (1,471) = 1.41, p >.23, education, F (1,471) =

.41, p >.51, or gender ($\chi^2 = .02$, $p > .87$).

Unfortunately, data relevant to income were collected only from the cognitively impaired participants and not from those providing collateral sources of information. In addition, a substantial percentage of the cognitively impaired sample (23.5%) reported not knowing their pre-retirement household income. Given the potential inaccuracy of the income data, combined with the large amount of missing data, income was not included in any further analyses. After eliminating income, missing data for the remainder of the variables were random and minimal (< 4%). Replacement of missing values for the cognitively impaired sample was identical to that described for the sample of cognitively unimpaired participants.

Appendix C

DESCRIPTION OF DRIVING QUESTIONNAIRE

The Driving Questionnaire is a modified version of an Interview Schedule developed by researchers for the Older Drivers Study at the Gerontological Research Centre, Simon Fraser University, Vancouver, BC (Rothe, 1990). For the current Driving Questionnaire, ten major areas or domains were identified, a priori, as being relevant to driving and sets of items specific to each domain were included in the questionnaire. First, basic information about demographic factors such as age, gender, education, occupation, and marital status is collected in Section I (Participant Information). Section II (Health and Sensory Information) consists of questions concerning health care utilization, self-ratings on physical and mental health, and self-ratings on visual functioning. Information on driving history, such as years driven, tickets, and collisions is obtained in Section III (Driving History). Data on driving patterns are collected in Section IV (Driving Patterns), and include questions on amount (kilometers) and time (e.g., rush hour, week-end) of driving, average length of drives, speed, self-regulatory driving behavior (e.g., winter, rain), and reasons for driving (e.g., shopping, pleasure). Information on driving difficulties, such as difficulties with seeing and/or recognizing traffic signs, lights, and signals, difficulties with night driving, driving manouevre (e.g., turning left at intersections, merging, passing), driving behaviors (e.g., shoulder checking, judging distances), and information on common driving faults is obtained in Section V (Driving Difficulties). Information on an individual's perceived competency, their family's perception of their driving competency, and responses to others driving behaviors is obtained in Section VI (Feeling About Driving). Section VII (Changes Over Time) consists of questions regarding changes in driving behavior over time (e.g., night driving, driving in winter, rain, rush hour). Opinions on licensing issues (e.g., criteria, who should make decisions about driving cessation) are obtained in Section VIII (Licensure). Information regarding the individual's concerns about driving (e.g., losing license, injuring self or other), anticipated life changes as a result of not driving, and feelings regarding driving cessation is collected in Section IX (Concerns About Driving). The final section (Section X: Characteristics of Vehicle Driven) contains questions about the characteristics of the vehicle most often driven (e.g., year, model, steering, front or rear wheel drive) and the presence and use of safety features (e.g., airbags, anti-locking braking systems, and seatbelts).

Appendix D

DRIVING QUESTIONNAIRE

(PARTICIPANT)

Identification Number : ________________

Date ____________________

(Year) (Month)

DRIVING STUDY

DRIVING QUESTIONNAIRE

(Participant)

DRIVING QUESTIONNAIRE

Since we need to be able to describe the people who took part in this study, we would like you to answer some questions about yourself and your household. First of all:

I. PARTICIPANT INFORMATION

A: Demographics

1.Name:____

2.Address:____

____

city province postal code

3. Telephone #:________________ (home) ________________ (business)

4. Age_____ Sex___ Date of Birth____________________________

5. Place of Birth______________________________________

6. Are you presently employed? ___[1] yes ___[0] no ___[99] DK

   If Yes: Are you: ___[1] full-time ___[2] part-time ___[3] semi-retired

   If No: Are you: ___[1] between jobs
   ____[2] retired
   ____[3] on compensation
   ____[4] on disability pension
   ____[5] other (specify) ________________
   ____[6] never worked outside the home

   If retired or semi-retired; When did you retire? ____ Year [__|__]

7. What is/was your occupation? ____________________________________

8. Could you please estimate your total annual gross household income before retirement (or now if not retired):

   ___[1] Less than or equal to 15,000 per year
   ___[2] Between 5,001 - 10,000 per year
   ___[3] Between 10,001 -15,000 per year

___[4] Between 15,001 - 25,000 per year
___[5] Between 25,001 - 35,000 per year
___[6] Between 35,001 - 50,000 per year
___[7] Between 50,001 - 75,000 per year
___[8} Over 75,001 per year
___[99] DK

9. What is your first language? ______________________________

10. How long have you spoken English? __________________________

11. Does anyone live with you? (check each category: yes = 1 no = 0 DK = 99)

___[1] No one____
___[2] Spouse ____
___[3] Children ____
___[4] Grandchildren____
___[5] Parent/s____
___[6] Grandparent/s____
___[7] Brothers and/or sisters_________________________________
___[8] Other relatives (NOT IN-LAWS covered above)__________________
___[9] Friends__ ____
___[10] Non-related paid helper____________________________________
___[11] Other (Specify)____

12. What is your marital status?
___[1] Married ___[2] Single ___[3] Common-Law ___[4] Widowed
___[5] Divorced ___[6] Separated ___[99] DK

13. a) What is your highest level of education (e.g, public or separate school)?

(i.e., grade 1-13)____

b) What degrees, certificates or diplomas have you ever obtained?

(Mark as many boxes as applicable)

___[0] None
___[1] Elementary
___[2] Jr. High
___[3] Technical
___[4] University
___[5] Other non-university certificate or diploma (obtained at community college, CEGEP, institute of technology, etc.)
___[6] University certificate or diploma below bachelor level

___[7] Bachelor's degree (e.g., BA, BSc, BASc, LLB)
___[8] University certificate or diploma above bachelor level
___[9] Master's degree (e.g., MA, MSc, MEd)
___[10] Degree in medicine, dentistry, veterinary medicine or optometry (MD, DDS, DMD, DVM, OD)
___[11] Earned doctorate (PhD, DSC, DEd)
___[12] Other (Specify)______________________________
___[13] DK

If necessary, use the following space to explain further about post-secondary education (participant) as obtained, being sure to indicate any certificates, diplomas, or degrees obtained and the number of years COMPLETED as well as the name of the institution attended.

____

II: HEALTH AND SENSORY INFORMATION

1. What is the name of your family doctor?

____
(name, initial if possible) (Clinic)

2. How many times per year do you visit your family doctor?____________________

3. How many other times in the past year have you seen a medical doctor? **(Exclude Psychiatrists, Podiatrists, Optometrists, Chiropractors)**

____

4. How many times in the past year have you been in a hospital for physical health problems?

____

5. How would you rate your physical health now?
___[1] poor ___[2] fair ___[3] good ___[4] excellent

6. To what extent does your physical health interfere with your ability to carry out everyday activities?

___[1] never ___[2] rarely ___[3] sometimes ___[4] frequently ___[5] all of the time

7. How would your rate your mental health now?

___[1] poor ___[2] fair ___[3] good ___[4] excellent

_____**1**_____/ _____**2**_____/ _____**3**_____/ _____**4**_____

poor **fair** **good** **excellent**

8. Using the above scale, how would you rate your:

___ [1] vision
___ [2] hearing
___ [3] ability to see in different directions
___ [4] ability to see to the side when looking straight ahead
___ [5] ability to see in the sunlight
___ [6] ability to see at night
___ [7] ability to see in the presence of glare
___ [8] ability to see the difference between colors
___ [9] ability to adjust to changes in lighting

9. Do you wear a hearing aid? ___[1] yes ___[0] no ___ [99] DK

10. Do you smoke? ___[1] yes ___[0] no ___ [99] DK

III. DRIVING HISTORY

I'd now like to ask you some questions about your driving history.

1. How many years ago did you learn to drive?

___[1] less than 5 ___[2] 5-9 ___[3] 10-19 ___[4] 20-29

___[5] 30-39 ___[6] 40-49 ___[7] 50 or more ___[99] DK

2. Have you ever completed a formal Driver Education or training course?

___[1] yes ___[0] no ___ [99] DK

A. If yes, how long ago? ______________________

3. How did you originally learn to drive?

___[1] self-taught ___[2] parent taught ___[3] friend/other relative taught

___[4] school course ___[5] driving school ___[99] DK

4. In the last year, has any of the following ever happened while you were driving? If yes, how many times?

(Check each category with the frequency of occurrence, e.g., 0 = none)

___ backed into something
___ bumped something with front bumper
___ turned wrong way on a one-way street or zone
___ scraped something with the car
___ failed to see another car and almost hit it
___ didn't see a car backing and almost hit it
___ almost had an accident making a left turn
___ been stopped by a police officer while driving
___ almost got hit by another driver
___ other drivers honked or gestured at you
___ ran over curb (backing or turning)
___ had to hit brakes hard or slam on brakes to avoid hitting someone or something
___ didn't see a stop sign or stoplight as early as you should have and had to hit brakes hard or slam on brakes to stop in time
___ any other incident

5. In the last year, how many tickets have you received for:

___ failure to yield
___ speeding
___ going too slowly
___ not obeying traffic lights
___ not obeying traffic signs
___ improper passing
___ improper turning
___ reckless driving
___ tailgating or following too closely
___ other (specify)____________________

6. How many tickets have you received in the preceding 5 years including this last year (excluding parking tickets)? __________

7. In the last year, how many collisions have you had while driving:

___ that did not involve another vehicle or person
___ that involved another vehicle
___ in which someone was injured
___ that involved a pedestrian or cyclist

8. How recent was your last collision?

___ [1] within the last week
___ [2] within the last month
___ [3] within the last 3 months
___ [4] within the last 6 months
___ [5] within the last 9 months
___ [88] NA
___ [99] DK

9. How many collisions have you had while driving in the preceding 5 years including this last year? ___________

10. Has the number of collisions you have had increased in the last 5 years?

___[1] yes ___[0] no ___[88] NA ___[99] DK

IV. DRIVING PATTERNS

Now I'd like to ask you about your driving patterns.

1. In an average week how many **days** do you usually drive:

___[1] weekday morning rush hour
___[2] weekday morning excluding rush hour
___[3] weekday afternoon rush hour
___[4] weekday afternoon excluding rush hour
___[5] weekday evening after dark
___[6] weekends

2. Approximately how many kilometers do you drive a week? Would you say:

___[1] less than 50 km (30 or less miles)
___[2] 51-100 km (31-60 miles)
___[3] 101-150 km (61-90 miles)
___[4] 151-200 km (91-120 miles)
___[5] 201-250 km (121-150 miles)
___[6] 251 or more (151 or more miles)
___[99] DK

3. Approximately how much of this driving is done on the highway?

___[1] < 1/4 ___[2] 1/4 ___[3] 1/2 ___[4] 3/4 ___[5] > 3/4

4. How long is your average drive?

___[1] 5-10 minutes ___[2] 10-20 minutes ___[3] 20-30 minutes

___[4] 30-60 minutes ___[5] 1-2 hours ___[6] more than 2 hours

5. How long have you been driving in the area where you live now?
___[1] less than 6 months
___[2] 6 months - 1 year
___[3] 1 year -3 years
___[4] 3 years - 5 years
___[5] 5 years or more

6. Do you usually drive less frequently: (Check each category: yes = 1 no = 0 DK = 99)

___ [1] in the winter months (i.e., November to March) as compared to summer
___ [2] when it is raining compared to when it is nice
___ [3] when it is snowing compared to when it is clear
___ [4] when you are not feeling physically well or tired, or not feeling mentally alert compared to when you are feeling well
___ [5] when you are upset about something compared to when you are feeling calm

7. How often does someone ride with you when you drive?

___[1] never ___[2] rarely ___[3] sometimes

___[4] frequently ___[5] all the time

8. Who most often rides with you when you drive?

___[1] mate or spouse
___[2] children
___[3] grandchildren
___[4] other relatives (e.g., brothers, sisters)
___[5] others (specify)

_____1_____/ _____2_____/ _____3_____/ _____4_____/ _____5_____

never	rarely	sometimes	frequently	all the time

Using the above scale:

9. When (__________) rides with you, how often do they:

___ [1] provide advice about driving
___ [2] criticize your driving
___ [3] provide help in finding your way around
___ [4] provide help with watching for other cars, traffic signs, or other hazards
___ [5] other ____

a. How often do you find it helpful that they:
___ [1] provide advice about driving?
___ [2] criticize your driving?
___ [3] provide help in finding your way around?
___ [4] provide help with watching for other cars, traffic signs, or other hazards?
___ [5] other ____

10. When you drive, how often do you:

___ [1] listen to the radio
___ [2] converse with passengers
___ [3] smoke when you drive
___ [4] drive when on medication
___ [5] drink and drive

_______1______/ ______2______/ ______3______

< posted speed limit	posted speed limit	> posted speed limit

11. Using the above scale, in general, what is your preferred speed?

___[1] in the city ___[2] on a double lane highway

___[3] on a single lane highway __ [4] in rural areas

12. In a typical week, other than driving there yourself, how do you get to

places? (Check each category: yes = 1 no = 0 DK = 99)

___[1] walk ___[2] bus ___[3] others drive me

___[4] bicycle ___[5] taxi ___[6] other ____________________________

13. Are there family members or friends who can drive you if necessary?

___[1] yes ___[0] no ___[99] DK

If answer is yes, who:____

Using this scale:

____1____/ ____2____/ ____3____/ ____4____/ ____5____

never rarely sometimes frequently all the time

14. People use their cars for a number of purposes. How often do you use your car for:

___[1] shopping
___[2] driving for pleasure
___[3] visiting family or friends
___[4] going to church
___[5] vacation travel
___[6] attending social or cultural events or entertainment
___[7] engaging in sports (e.g., golf) or attending sporting events
___[8] going to the doctor or other health care related services
___[9] volunteer activity
___[10] attending meetings
___[11] getting to/from work
___[12] other (specify)____

V. DRIVING DIFFICULTIES

I would like to ask you about difficulties that some people say they experience.

Using this scale:

_____1_____ / _____2_____ / _____3_____ / _____4_____ / _____5_____

never rarely sometimes frequently all the time

1. With regard to traffic signs on city streets, how often do you have difficulty with the:

   ___[1] size of letters ___[2] clarity of letters ___[3] size of sign

   ___[4] shape of sign ___[5] clarity of message ___[6] color of sign

   ___[7] placement of sign ___[8] other ______________________________

   a. Do you think your difficulty with signs while driving on city streets is due to: (Check each category: yes = 1 no = 0 NA = 88 DK = 99)

   ___ [1] your vision ___ [2] your reaction time ___ [3] the sign itself

   ___ [4] the speed of the car ___ [5] other __________________________

2. With regard to traffic signs on highways and freeways, how often do you have difficulty with the:

   ___[1] size of letters ___[2] clarity of letters ___[3] size of sign

   ___[4] shape of sign ___[5] clarity of message ___[6] color of sign

   ___[7] placement of sign ___[8] other ______________________________

   a. Do you think your difficulty with signs while driving on the highway or freeway is due to: (Check each category: yes = 1 no = 0 NA = 88 DK = 99)

   ___[1] your vision ___[2] your reaction time ___[3] the sign itself

   ___[4] the speed of the car ___[5] other __________________________

3. With regard to traffic lights and signals, how often do you have difficulty

with:

___[1] size ___[2] color ___[3] placement of lights ___[4] other ________________

Using this scale:

_____1_____/_____2_____/_____3_____/_____4_____/_____5_____

never **rarely** **sometimes** **frequently** **all the time**

4. How often do you have difficulty with:

___[1] seeing at night while driving
___[2] oncoming headlight glare at night
___[3] rear or side mirror glare at night
___[4] daytime glare (e.g., sun, reflections)
___[5] shoulder checking
___[6] changing lanes
___[7] staying alert
___[8] steering your car
___[9] making right turns
___[10] making left turn at **controlled** intersection (stop signs or lights)
___[11] making left turn at **uncontrolled** intersection (no signs or lights)
___[12] keeping up with the flow of traffic
___[13] entering stream of city traffic
___[14] parking your car
___[15] passing other cars
___[16] backing your car
___[17] entering **controlled** intersection
___[18] entering **uncontrolled** intersection
___[19] entering freeway
___[20] keeping the car in its lane
___[21] judging distances
___[22] keeping an appropriate distance behind other cars
___[23] left/right confusion
___[24] losing your way on familiar routes
___[25] other (specify) ________________________________

5. Below is a list of common driving faults people often make.

Using the scale,

____**1**____ / ____**2**____ / ____**3**____ / ____**4**____ / ____**5**____

never **rarely** **sometimes** **frequently** **all the time**

Please tell me how often you:

___[1] drive too fast for road conditions
___[2] speed
___[3] fail to yield right of way
___[4] fail to come to a complete stop at stop sign
___[5] run a red light
___[6] run a yellow light
___[7] drive left of center
___[8] make an improper pass
___[9] make an improper turn
___[10] follow too closely
___[11] drive too slow for the traffic flow
___[12] fail to signal
___[13] other (specify) ________________________________

VI. FEELINGS ABOUT DRIVING

1. Compared to drivers of your own age, do you think you are:

___[1] more able ___[2] about as good ___[3] less able ___[99] DK

2. Compared to drivers that are (older/younger) than you, do you think you are:

___[1] more able ___[2] about as good ___[3] less able ___[99] DK

3. What does your family think about you as a driver? Would you say they think you are:

___[1] an excellent driver ___[2] a good driver ___[3] an average driver

___[4] a poor driver ___[5] a very poor driver ___[99] DK

4. In general, how do you feel about having passengers when you drive?

Would you say: ___[1] very comfortable ___[2] comfortable

___[3] uncomfortable ___[99] DK

5. When you are driving, how does having passengers in the car affect your ability to attend to driving? Would you say they:

___[1] distract you very much ___[2] distract you a little

___[3] do not distract you at all ___[99] DK

6. When the driving behaviour of other drivers annoys you, how are you most likely to respond? Do you: (yes = 1 no = 0 DK = 99)

___[1] drive more aggressively ___[2] slow down and block them

___[3] move out of the way ___[4] do nothing

___[5] swear, curse, or gesture ___[6] other _______________ ___[99] DK

7. How do you react to displays of anger from other drivers (e.g., rude hand gestures, honking, or yelling)? Do you: (yes = 1 no = 0 DK = 99)

___[1] drive more aggressively ___[2] slow down and block them

___[3] move out of the way ___[4] do nothing

___[5] swear, curse, or gesture ___[6] other _______________ ___[99] DK

8. Do you like driving?

___[1] like it ___[2] neutral ___[3] don't like it ___[99] DK

9. How often do you feel comfortable and confident about driving?

___[1] never ___[2] rarely ___[3] sometimes

___[4] frequently ___[5] all the time

VII. CHANGES OVER TIME

1. Compared to 10-15 years ago, do you find that you:

   (Check each category: yes = 1 no = 0 DK = 99)

   ___[1] drive more cautiously ___[2] drive more defensively
   ___[3] drive slower ___[4] drive faster
   ___[5] get less upset ___[6] get more upset
   ___[7] other ____

2. I'm going to read you a list of 9 different driving conditions. For each condition I read, please tell me whether you feel your driving has changed over the years, making these driving conditions more difficult or demanding.

(Check each category: [1] = yes [0] = no [99] = DK
   ___[1] night driving
   ___[2] coping with headlight glare
   ___[3] driving in rain and fog
   ___[4] driving in winter (i.e., snow, sleet or slush, slippery roads)
   ___[5] freeway driving
   ___[6] driving on city streets
   ___[7] driving during rush hour
   ___[8] driving while tired, upset, or not feeling well
   ___[9] holiday/vacation driving

VIII. LICENSURE

I now have some questions about licensing.

1. Which of these reasons might cause you to decide to stop driving in the future? (Check each category: yes = 1 no = 0 DK = 99)
   ___[1] poor health
   ___[2] poor vision
   ___[3] causing a collision or narrow escape
   ___[4] physical impairment
   ___[5] knowledge that skill slipping
   ___[6] can't afford it
   ___[7] family's advice
   ___[8] physician's advice
   ___[9] other (specify)____

2. Who should make the decision about when it is time to give up driving?

(Check each category: yes = 1 no = 0 DK = 99)

___[1] the driver
___[2] family members
___[3] a doctor
___[5] the Motor Vehicle License Department
___[6] insurance companies
___[7] the police department
___[8] other (specify)________________________________

3. What things would you consider in determining whether you should give up driving? (Check each category: yes = 1 no = 0 DK = 99)

___[1] health
___[2] collision record
___[3] need for mobility
___[4] other available transportation
___[5] road test
___[6] written test
___[7] other (specify)________________________________

4. Do you think an on-road driving examination should be required before a person's license is renewed? ___[1] yes ___[0] no ___[99] DK

5. Do you think there is an age at which older drivers should always be re-examined? ___[1] yes ___[0] no ___[99] DK

If yes, what age? ____________________

6. What kind of periodic driver re-examination would you favour for older drivers?

(Check each category: yes = 1 no = 0 DK = 99)

___[1] an eye test
___[2] total physical exam
___[3] a written driving test
___[4] a driving (road) test
___[5] other (specify)________________________________

7. Would you favour the same test/s for periodic re-examination of all drivers

regardless of age? ___[1] yes ___[0] no ___[99] DK

If no, what test/s would you favour? ____________________________________

8. Would periodic re-examination make you feel nervous or threatened?

___[1] yes ___[0] no ___[99] DK

IX. CONCERNS ABOUT DRIVING

1. What are your greatest concerns about changes in your driving? Is it:

(check each category [1] = yes [0] = no [99] = DK

___[1] loss of attention or concentration
___[2] losing license or having to quit driving
___[3] getting hurt
___[4] injuring a pedestrian
___[5] losing your driving abilities
___[6] hitting another car
___[7] other (specify)____

2. How would your life change if you could no longer drive? Would you:

(Check each category: [1] = yes [0] = no [99)] = DK)

___[1] have to rely on other forms of transportation
___[2] have to rely on family or friends for transportation
___[3] have to move (in order to be near to transit)
___[4] feel less independent/free
___[5] have to stay close to home
___[6] have to be less social
___[7] have to change your lifestyle
___[8] have to be less mobile
___[9] other (specify)____

3. How would you feel if someone recommended that you not drive? Would you feel: (Check each category: [1] = yes [0] = no [99] = DK)

___[1] angry ___[4] uncertain/ambivalent ___[7]other(specify)
___[2] sad ___[5] relieved ____________________
___[3] frustrated ___[6] pleased

X. CHARACTERISTICS OF VEHICLES DRIVEN

Now I'd like to ask you some questions about the vehicles your drive.

1. How many vehicles do you personally drive?

___[1] one ___[2] two ___[3] three or more ___[99] DK

2. What is the year, make, and model of the car that you drive most often?

Year _______ Make ___________ Model _____________

3. How long have you been driving this car?

___[1] less than 1 year ___[2] 1-2 years ___[3] 3-4 years

___[4] more than 4 years ___[99] DK

4. What type of brakes are in this car?

___[1] power ___[2] standard ___[99] DK

5. What type of steering is in this car?

___[1] power ___[2] standard ___[99] DK

6. What type of transmission is in this car?

___[1] power ___[2] standard ___[99] DK

7. Does this car have: ___[1] front wheel drive ___[2] rear wheel drive

___[3] four wheel drive

8. What kinds of safety features do you have on your vehicle?

___[1] Anti-lock braking system (ABS) ___[2] airbag

___[3] Anti-glare windows

9. Do you use a seatbelt when you drive? ___[1] yes___[0] no ___[99] DK

10. Do you service or have regular maintenance done on your vehicle?

___[1] yes___[0] no ___[99] DK

Appendix E

MINI-MENTAL STATE EXAMINATION

Score		
	ORIENTATION	
( )	What is the (year) (season) (month) (date) (day) ?	(5 points)
( )	Where are we? (province) (country) (town) (hospital) (floor)	(5 points)
	REGISTRATION	
( )	Name 3 objects: 1 second to say each. Then ask the patient to repeat all three after you have said them. 1 point for each correct. Then repeat them until he learns them. Count trials and record _______.	(3 points)
	ATTENTION AND CALCULATION	
( )	Serial 7's. 1 point for each correct. Stop at 5 answers. Or spell "world" backwards. (Number correct equals letters before first mistake - i.e., dlorw = 2 correct).	(5 points)
	RECALL	
( )	Ask for objects above. Give 1 point for each correct.	(3 points)
	LANGUAGE TESTS	
( )	name - pencil, watch	(2 points)
( )	repeat- no ifs, ands or buts	
( )	follow a 3-stage command: "Take the paper in your right hand, fold it in half, and put it on the floor."	(3 points)
	Read and obey the following:	
( )	CLOSE YOUR EYES.	(1 point)
( )	Write a sentence spontaneously below.	(1 points)
( )	Copy a design below.	(1 point)
( )	TOTAL 30 POINTS	

Folstein et al., 1975

Appendix F

DRIVING QUESTIONNAIRE

NON-REFERRED SAMPLE

(Used for Geriatric/Memory Clinic Sample)

Identification Number______________________

Date ______________________

(Year) (Month)

NON-REFERRED SAMPLE

DRIVING QUESTIONNAIRE

DRIVING QUESTIONNAIRE

Since we need to be able to describe the people who took part in this study, I would like you to answer some questions about yourself and your household. First of all:

I. PARTICIPANT INFORMATION

A: Demographics

1.Name:____

2.Address:____

____

city province postal code

3. Telephone #:______________ (home) ______________ (business)

4. Age_____ Sex___ Date of Birth________________________

5. Place of Birth____________________________________

6. Are you presently employed? ___[1] yes ___[0] no ___[99] DK

   If Yes: Are you: ___[1] full-time ___[2] part-time ___[3] semi-retired

7. Could you please estimate your total annual gross household income before retirement (or now, if not retired):

   ___[1] Less than or equal to $15,000 per year
   ___[2] Between $15,001 - $25,000 per year
   ___[3] More than $25,0000

8. Does anyone live with you? (check each category: yes = 1 no = 0 DK = 99)

   ___[1] No one____________________________________
   ___[2] Spouse____________________________________
   ___[3] Children___________________________________
   ___[4] Other (Specify)______________________________

9. What is your marital status?

   ___[1] Married ___[2] Single ___[3] Common-Law ___[4] Widowed
   ___[5] Divorced ___[6] Separated ___[99] DK

10. a) What is your highest level of education (e.g., public or separate school)?

(i.e., grade 1-13)____

b) What degrees, certificates or diplomas have you ever obtained?

Please specify_______________________

II: HEALTH AND SENSORY INFORMATION

1. How many times per year do you visit your family doctor?________________

2. How many other times in the past year have you seen a medical doctor?_________

(Exclude Psychiatrists, Podiatrists, Optometrists, Chiropractors)

3. How many times in the past year have you been in a hospital for physical health problems?

____

4. How would you rate your physical health now?

___[1] poor ___[2] fair ___[3] good ___[4] excellent

5. To what extent does your physical health interfere with your ability to carry out everyday activities

___[1] never ___[2] rarely ___[3] sometimes

___[4] frequently ___[5] all of the time

6. How would your rate your mental health now?

___[1] poor ___[2] fair ___[3] good ___[4] excellent

III. DRIVING HISTORY

I'd now like to ask you some questions about your driving history.

1. How many years ago did you learn to drive?

___[1] less than 5 ___[2] 6-9 ___[3] 10-19 ___[4] 20-29

___[5] 30-39 ___[6] 40-49 ___[7] 50 or more ___[99] DK

2. How many tickets (excluding parking tickets) have you received in the preceding 5 years including this last year? __________

3. How many collisions have you had while driving in the preceding 5 years including this last year? __________

IV. DRIVING PATTERNS

Now I'd like to ask you about your driving patterns.

1. In an average week how many **days** do you usually drive:
   ___[1] weekday morning rush hour
   ___[2] weekday morning excluding rush hour
   ___[3] weekday afternoon rush hour
   ___[4] weekday afternoon excluding rush hour
   ___[5] weekday evening after dark
   ___[6] weekends

2. Approximately how many kilometres do you drive a week? Would you say:
   ___[1] less than 50 km (30 or less miles)
   ___[2] 51-100 km (31-60 miles)
   ___[3] 101-150 km (61-90 miles)
   ___[4] 151-200 km (91-120 miles)
   ___[5] 201-250 km (121-150 miles)
   ___[6] 250 or more (151 or more miles)
   ___[99] DK

3. How long is your average drive?

   ___[1] 5-10 minutes ___[2] 10-20 minutes ___[3] 20-30 minutes

   ___[4] 30-60 minutes ___[5] 1-2 hours ___[6] more than 2 hours

4. Do you usually drive less frequently: (Check each category: yes = 1 no = 0 DK = 99)
   ___ [1] in the winter months (i.e., November to March) as compared to summer
   ___ [2] when it is raining compared to when it is nice
   ___ [3] when it is snowing compared to when it is clear
   ___ [4] when you are not feeling physically well or tired, or not feeling mentally alert compared to when you are feeling well
   ___ [5] when you are upset about something compared to when you are feeling calm

1	2	3
< posted speed limit	**posted speed limit**	**> posted speed limit**

5. Using the above scale, in general, what is your preferred speed?
   ___[1] in the city ___[2] on a double lane highway
   ___[3] on a single lane highway __ [4]in rural areas

V. DRIVING DIFFICULTIES

I would like to ask you about difficulties that some people say they experience.

Using this scale:

1	2	3	4	5
never	**rarely**	**sometimes**	**frequently**	**all the time**

1. How often do you have difficulty with:
   ___[1] seeing at night while driving
   ___[2] oncoming headlight glare at night
   ___[3] rear or side mirror glare at night
   ___[4] daytime glare (e.g., sun, reflections)
   ___[5] shoulder checking
   ___[6] changing lanes
   ___[7] staying alert
   ___[8] steering your car
   ___[9] making right turns
   ___[10] making left turn at **controlled** intersection (stop signs or lights)
   ___[11] making left turn at **uncontrolled** intersection (no signs or lights)
   ___[12] keeping up with the flow of traffic
   ___[13] entering stream of city traffic
   ___[14] parking your car
   ___[15] passing other cars
   ___[16] backing your car
   ___[17] entering **controlled** intersection
   ___[18] entering **uncontrolled** intersection
   ___[19] entering freeway
   ___[20] keeping the car in its lane
   ___[21] judging distances
   ___[22] keeping an appropriate distance behind other cars
   ___[23] left/right confusion
   ___[24] losing your way on familiar routes
   ___[25] other (specify) ______________________________

VI. FEELINGS ABOUT DRIVING

1. Compared to drivers of your own age, do you think you are:

___[1] more able ___[2] about as good ____[3] less able ____[99] DK

2. Compared to drivers that are (younger) than you, do you think you are:

___[1] more able ___[2] about as good ____[3] less able ____[99] DK

3. What does you family think about you as a driver? Would you say they think you are:

___[1] an excellent driver ___[2] a good driver ____[3] an average driver

___[4] a poor driver ___[5] a very good driver ____[99] DK

Appendix G

DESCRIPTIVE DATA FOR STUDY 1

Table G-1. Functional Ability Measures (Means and Standard Deviations).

	Cognitively Unimpaired (n = 60)	Cognitively Impaired (n = 294)
1. Physical Health	3.33 (SD = 0.57)	2.71 (SD = 0.82)
2. Extent physical health interferes with ability to carry out everyday activities	4.37 (SD = 0.74)	3.54 (SD = 1.11)
3. Vision	3.25 (SD = 0.54)	2.99 (SD = 0.65)
4. Mental Status (MMSE score)	28.93 (SD = 1.13)	23.87 (SD = 3.85)

1. Physical health responses coded as 1 = poor, 2 = fair, 3 = good, 4 = excellent

2. Physical health interfering... responses re-coded as 1 = all the time, 2 = frequently, 3 = sometimes, 4 = rarely, 5 = never

3. Vision responses coded as 1 = poor, 2 = fair, 3 = good, 4 = excellent

Table G-2. Self-Perceptions of Driving Competence (Global and Facet Measures) as a Function of Cognitive Status (Means and Standard Deviations).

	Cognitively Unimpaired (CU) (n = 60)	Cognitively Impaired (CI) (n = 294)
Global Measure:		
Compared to drivers your own age, do you think you are: [1] more able [2] about as good [3] less able	1.73 (SD = 0.45)	1.76 (SD = 0.45)
Facet Measures:[+]		
1. Seeing at night while driving	2.30 (SD = 1.03)	1.76 (SD = 0.99)
2. Oncoming headlight glare at night	2.60 (SD = 0.92)	2.05 (SD = 1.10)
3. Rear or side mirror glare at night	1.73 (SD = 0.88)	1.70 (SD = 0.97)
4. Daytime glare (sun, reflections)	2.15 (SD = 1.02)	1.60 (SD = 0.81)
5. Shoulder checking	1.35 (SD = 0.71)	1.29 (SD = 0.65)
6. Changing lanes	1.27 (SD = 0.52)	1.28 (SD = 0.60)

(continued)

	CU	CI
7. Staying alert	1.42 (SD = 0.72)	1.22 (SD = 0.57)
8. Steering your car	1.12 (SD = 0.32)	1.07 (SD = 0.28)
9. Making right turns	1.17 (SD = 0.42)	1.12 (SD = 0.42)
10. Making left turn at controlled intersection	1.27 (SD = 0.58)	1.18 (SD = 0.48)
11. Making left turn at uncontrolled intersection	1.28 (SD = 0.61)	1.19 (SD = 0.54)
12. Keeping up with the flow of traffic	1.22 (SD = 0.52)	1.29 (SD = 0.65)
13. Entering stream of city traffic	1.40 (SD = 0.69)	1.41 (SD = 0.74)
14. Parking your car	1.28 (SD = 0.64)	1.30 (SD = 0.61)
15. Passing other cars	1.28 (SD = 0.56)	1.23 (SD = 0.51)
16. Backing your car	1.38 (SD = 0.69)	1.22 (SD = 0.55)

(Continued)

	CU	CI
17. Entering controlled intersection	1.20 (SD = 0.44)	1.18 (SD = 0.52)
18. Entering uncontrolled intersection	1.32 (SD = 0.60	1.13 (SD = 0.44)
19. Entering freeway	1.38 (SD = 0.67)	1.27 (SD = 0.59)
20. Keeping the car in its lane	1.17 (SD = 0.42)	1.13 (SD = 0.44)
21. Judging distances	1.47 (SD = 0.77)	1.23 (SD = 0.53)
22. Keeping an appropriate distance behind other cars	1.25 (SD = 0.51)	1.20 (SD = 0.55)
23. Left/right confusion	1.08 (SD = 0.28)	1.09 (SD = 0.33)
24. Losing your way on familiar routes	1.18 (SD = 0.50)	1.26 (SD = 0.60)

† Responses based on the following scale:

_____1____/_____2____/_____3____/_____4____/_____5_____

never rarely sometimes frequently all the time

Table G-3. Collateral Ratings of Participant's Driving Restrictions as a Function of Cognitive Status (Means and Standard Deviations).

Items	Cognitively Unimpaired (n = 60)	Cognitively Impaired (n = 294)
1. Days driven weekday morning rush hour	1.20 (SD = 1.65)	0.54 (SD = 1.35)
2. Days driven weekday afternoon rush hour	1.33 (SD = 1.46)	0.81 (SD = 1.51)
3. Weekdays driven evening after dark	3.38 (SD = 1.55)	2.56 (SD = 1.71)
4. Days driven on weekends	1.67 (SD = 0.86)	1.24 (SD = 0.78)
5. Kilometers driven per week	50-100 km (modal)	50 km (modal)
6. Drive less frequently in winter months compared to summer months†	0.23 (SD = 0.43)	0.63 (SD = 0.48)
7. Drive less frequently when raining compared to when it is nice †	0.15 (SD = 0.36)	1.78 (SD = 0.60)
8. Drive less frequently when snowing compared to when it is clear †	0.35 (SD = 0.48)	0.65 (SD = 0.48)
9. Preferred speed in the city ††	1.95 (SD = 0.53)	1.72 (SD = 0.56)

(continued)

	CU	CI
10. Preferred speed on double lane highways ††	2.13 (SD = 0.57)	1.82 (SD = 0.53)
11. Preferred speed on single lane highways ††	1.99 (SD = 0.52)	1.78 (SD = 0.60)
12. Preferred speed in rural areas ††	1.89 (SD = 0.48)	1.65 (SD = 0.54)

† Ratings based on the following scale: [0] = no [1] = yes

†† Ratings based on the following scale:

[1] < posted speed limit [2] posted speed limit [3] > posted speed limit

Table G-4. Rotated Factor Matrix and Factor Loadings for Driving Self-Restriction Measures (Cognitively Impaired Group).*

Item	Factor 1	Factor 2	Factor 3
Preferred speed on a double lane highway	**0.87**	-0.01	-0.02
Preferred speed on a single lane highway	**0.84**	0.09	-0.07
Preferred speed in rural areas	**0.79**	0.15	-0.04
Preferred speed in the city	**0.78**	0.06	-0.16
Days driven PM rush hour	0.02	**0.85**	-0.19
Days driven AM rush hour	0.00	**0.82**	-0.09
Days driven after dark	-0.03	**0.72**	-0.29
Kilometers driven/week	0.10	**0.57**	0.06
Days driven/week on weekends	0.18	**0.39**	-0.09
Drive less frequently when snowing	-0.09	-0.21	**0.87**
Drive less frequently in winter months	-0.04	-0.22	**0.82**
Days driven when raining	-0.13	-0.06	**0.81**

* Accounted for 62.8% of the variance

Table G-5. Rotated Factor Matrix and Factor Loadings for Perceived Competence-Facet Measures (Cognitively Impaired Group).*

Item	Fact 1	Fact 2	Fact.3	Fact.4	Fact 5
Left turn at controlled intersection	**0.77**	0.19	0.10	0.01	0.09
Left turn at uncontrolled intersection	**0.77**	0.16	0.10	0.11	0.11
Entering uncontrolled intersection	**0.65**	0.08	0.52	0.18	0.14
Entering controlled intersection	**0.65**	0.09	0.44	0.14	0.07
Steering car	**0.80**	0.41	0.09	0.05	0.20
Making right turns	**0.55**	0.27	0.05	0.01	0.38
Left/right confusion	0.19	0.74	0.10	-0.02	0.24
Keeping car in its lane	0.19	**0.69**	0.14	0.06	0.10
Backing up	0.22	**0.59**	0.33	0.15	0.12
Keeping appropriate distance behind other cars	0.17	**0.50**	0.22	0.11	0.34
Entering stream of city traffic	0.22	0.20	**0.69**	0.08	0.24
Parking car	0.13	0.46	**0.66**	0.07	-0.04
Entering freeway	0.12	0.17	**0.61**	0.12	0.35
Judging distance	0.29	0.39	**0.45**	0.16	0.26
Passing other cars	0.31	0.33	**0.44**	0.23	0.22
Headlight glare at night	0.09	0.01	0.08	**0.89**	0.07
Seeing at night	0.07	0.06	0.07	**0.87**	0.06
Rear or side mirror glare	0.08	0.06	0.06	**0.85**	0.03
Daytime glare	0.04	0.13	0.21	**0.48**	0.26
Staying alert	0.21	0.24	-0.11	0.12	**0.65**
Keeping up with flow of traffic	0.08	-0.09	0.44	0.12	**0.62**
Shoulder checking	0.09	0.15	0.12	0.07	**0.57**
Changing lanes	0.19	0.42	0.24	0.10	**0.53**
Losing way on familiar routes	0.09	0.15	0.25	0.03	**0.50**

* Accounted for 58.5% of the variance

Appendix H

DESCRIPTIVE DATA FOR STUDY 2

Table H-1. Self-Perceptions of Driving Competency (Global and Facet Measures) as a Function of Referral (Means and Standard Deviations).

	Non-Referred (n = 26)	Referred (n = 26)
Global Measure:		
Compared to drivers your own age, do you think you are: [1] more able [2] about as good [3] less able	1.65 (SD = 0.56)	1.69 (SD = 0.47)
Facet Measures: †		
1. Seeing at night while driving	1.77 (SD = 1.24)	1.96 (SD = 1.28)
2. Oncoming headlight glare at night	2.27 (SD = 1.48)	2.22 (SD = 1.33)
3. Rear or side mirror glare at night	1.65 (SD = 1.13)	1.88 (SD = 1.31)
4. Daytime glare (sun, reflections)	1.35 (SD = 0.75)	1.69 (SD = 0.84)
5. Shoulder checking	1.31 (SD = 0.68)	1.35 (SD = 0.75)
6. Changing lanes	1.08 (SD = 0.39)	1.31 (SD = 0.55)

(continued)

	Non-Referred (n = 26)	Referred (n = 26)
7. Staying alert	1.46 (SD = 0.95)	1.27 (SD = 0.45)
8. Steering your car	1.00 (SD = 0.00)	1.12 (SD = 0.33)
9. Making right turns	1.00 (SD = 0.00)	1.92 (SD = 0.49)
10. Making left turn at controlled intersection	1.04 (SD = 0.20)	1.27 (SD = 0.60)
11. Making left turn at uncontrolled intersection	1.31 (SD = 0.79)	1.27 (SD = 0.60)
12. Keeping up with the flow of traffic	1.08 (SD = 0.39)	1.15 (SD = 0.37)
13. Entering stream of city traffic	1.42 (SD = 0.81)	1.38 (SD = 0.64)
14. Parking your car	1.23 (SD = 0.71)	1.23 (SD = 0.51)
15. Passing other cars	1.08 (SD = 0.27)	1.31 (SD = 0.62)
16. Backing your car	1.35 (SD = 0.98)	1.38 (SD = 0.70)
17. Entering controlled intersection	1.12 (SD = 0.43)	1.24 (SD = 0.59)

(continued)

	Non-Referred (n = 26)	Referred (n = 26)
18. Entering uncontrolled intersection	1.15 (SD = 0.46)	1.13 (SD = 0.44)
19. Entering freeway	1.16 (SD = 0.43)	1.26 (SD = 0.53)
20. Keeping the car in its lane	1.00 (SD = 0.00)	1.12 (SD = 0.33)
21. Judging distances	1.35 (SD = 0.69)	1.42 (SD = 0.64)
22. Keeping an appropriate distance behind other cars	1.19 (SD = 0.49)	1.19 (SD = 0.49)
23. Left/right confusion	1.15 (SD = 0.61)	1.23 (SD = 0.51)
24. Losing your way on familiar routes	1.65 (SD = 1.05)	1.35 (SD = 0.56)

† Responses based on the following scale:

____1____/_____2_____/_____3_____/_____4_____/_____5_____

never rarely sometimes frequently all the time

Appendix I

DESCRIPTIVE DATA FOR STUDY 3

Table I-1. Participant Perceptions of Driving Competence (Global and Facet Measures) as a Function of Diagnosis (Means and Standard Deviations).

Item	CU†	AD's	MID's
Global Measure:			
Compared to drivers your own age, do you think you are: [1] less able [2] about as good [3] more able (re-coded)	2.28 (SD = 0.45)	2.24 (SD = 0.45)	2.96 (SD = 0.52)
Facet Measures:†			
Making left turn turns (Average of left turns at controlled and uncontrolled intersections)	1.30 (SD = 0.61)	1.20 (SD = 0.46)	1.17 (SD = 0.47)
Making right turns	1.16 (SD = 0.41)	1.13 (SD = 0.42)	1.05 (SD = 0.23)
Keeping up with the flow of traffic	1.27 (SD = 0.60)	1.25 (SD = 0.58)	1.28 (SD = 0.63)
Changing lanes	1.30 (SD = 0.55)	1.22 (SD = 0.50)	1.31 (SD = 0.66)

† Responses based on the following scale:

____1___/____2____/____3____/____4____/____5____

never rarely sometimes frequently all the time

Table I-2. Driver Examiner Ratings of Driving Competence (Global and Facet Measures) as a Function of Diagnosis (Means and Standard Deviations).

	CU†	AD's	MID's
Global Measure:			
Global ratings of drivers skill	1.95 (SD = 0.42)	1.32 (SD = 0.51)	1.28 (SD = 0.45)
Facet Measures:[†]			
Making left turn turns (Average of left turns at controlled and uncontrolled intersections)	1.44 (SD = 0.75)	2.17 (SD = 1.09)	2.19 (SD = 0.97)
Making right turns	1.39 (SD = 0.60)	2.04 (SD = 0.96)	2.07 (SD = 0.85)
Keeping up with the flow of traffic	1.41 (SD = 0.66)	2.32 (SD = 0.92)	2.26 (SD = 0.96)
Changing lanes	1.54 (SD = 0.95)	2.29 (SD = 1.10)	2.19 (SD = 1.13)

[†] Expert Ratings based on the following scale:

____1___/____2____/____3____/____4____/____5____

never rarely sometimes frequently all the time