**The Relationship between Cognitive Performance, Perceptions of Driving Comfort and Abilities, and Self-reported Driving Restrictions among Healthy Older Drivers**


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**Abstract**

The objective of the present study was to examine the relationship between cognitive performance, driver perceptions and self-reported driving restrictions. A cross-sectional analysis was conducted on baseline data from Candrive II, a five-year prospective cohort study of 928 older drivers aged 70-94 years from seven cities. Cognitive performance was assessed using the Montreal Cognitive Assessment (MoCA) as well as the Trail Making Test, parts A and B. Driver perceptions were assessed using the Day and Night Driving Comfort scales and the Perceived Driving Abilities scale, while driving practices were captured by the Situational Driving Frequency and Avoidance scales, as well as the Driving Habits and Intentions Questionnaire. The baseline data indicates this cohort is largely a cognitively intact group. Univariate regression analysis showed that longer Trails A and B completion times were significantly, but only modestly associated with reduced driving frequency and perceived driving abilities and comfort, as well as a significant tendency to avoid more difficult driving situations (all $p < .05$). Most of these associations persisted after adjusting for age and sex, as well as indicators of health, vision, mood and physical functioning. Exceptions were Trails A and B completion times and situational driving frequency, as well as time to complete Trails B and current driving restrictions. After adjusting for the confounding factors, the total MoCA score was not associated with any of the driving measure scores while the number of errors on Trails A was significantly associated only with situational driving frequency and number of errors on Trails B was significantly associated only with situational driving avoidance. Prospective follow-up will permit examination of whether baseline cognition or changes in cognition are associated with changes in driver perceptions, actual driving restrictions and on-road driving outcomes (e.g., crashes, violations) over time.

**Keywords:** aging, cognitive function, cognitive assessment, drivers, driving behavior, self-report

## 1. Introduction

Older adults are the fastest growing segment of the driving population in North America, and driving is the preferred mode of transportation among seniors (Turcotte, 2006a; 2012b). Driving, however, is a complex cognitive task, requiring high levels of awareness and responsiveness. As individuals grow older, they are more likely to experience a decline in cognitive function that can affect their ability to safely operate a motor vehicle, potentially putting themselves and others at risk. In fact, drivers over the age of 65 have a higher rate of motor vehicle collisions per mile driven than middle-aged drivers (Li et al., 2003) and when injured in a collision, they are more likely to die or sustain serious injury (Zhang et al., 2000, Bédard et al., 2002). Literature to date suggests that cognitive impairment in later life does not predict self-regulation or perceptions of driving abilities (Ball et al., 2006; Crizzle et al., 2013; Kowalski et al., 2011; Molnar & Eby, 2008), and hence the risk to road safety may be particularly concerning. The relationship between driving behavior and cognitive performance remains unclear. Several studies have examined correlations between cognitive measures and driving performance, although findings have been mixed.

The Mini-Mental State Examination (MMSE; Folstein et al., 1975), a 30-point scale that is widely used to screen for cognitive impairment, has been found to lack sensitivity in predicting unsafe driving at an individual level (Adler et al. 2006, Molnar et al. 2006, Frittelli et al., 2009, Crizzle 2012). Another cognitive measure increasingly used in clinical settings is the Montreal Cognitive Assessment (MoCA; Nasreddine et al., 2005). The MoCA is more comprehensive than the MMSE, as it assesses cognitive function across five domains: executive functioning, attention, language, memory and visuospatial skills. The MoCA has shown greater sensitivity and specificity than the MMSE in detecting mild cognitive impairment and early Alzheimer's disease (Luis et al., 2009), but to date there have been no published studies of the association of the MoCA with driving in a large sample of  healthy older adults. A cognitive assessment tool that has been studied more extensively with respect to driving performance in older adults is the Trail Making Test, parts A and B (Brown & Ott, 2004, Grace et al., 2005, Reger et al., 2004). Trails A is a test of psychomotor speed, whereas Trails B is a test of processing speed, divided attention, and executive function (Tombaugh, 2004). In a systematic review, several studies reported positive associations between Trails A and B and driving performance, although findings were variable (Molnar et al., 2006).

One study recently compared healthy and cognitively impaired older drivers with respect to driving status, habits, and intentions to restrict or quit driving in the future (Kowalski et al. 2011). The findings showed that none of the cognitively impaired drivers were restricting or reducing their driving frequency compared to the healthy cohort, nor were any seriously thinking of restricting or quitting driving in the next six months. Insight into one's driving capabilities may play a role in the decision making regarding driving cessation or restriction. Although prior studies have shown that driver perceptions are related to self-regulatory practices in healthy older drivers (Blanchard & Myers, 2010; Myers et al., 2011), those with cognitive impairment may lack the capacity to recognize their driving limitations and restrict their driving practices to compensate appropriately (Herrmann et al., 2006; Rapoport et al., 2007).

The present study provides a unique opportunity to examine how cognitive performance relates to driver perceptions and restrictions in a large cohort of older drivers using the Candrive II (Canadian Driving Research Initiative for Vehicular Safety in the Elderly) baseline data. Candrive II is a five-year longitudinal, multisite study tracking 928 drivers aged 70-94 years of age from seven Canadian cities. The aim of the Candrive II cohort study is to develop a clinical battery of office-based assessments in order to develop a clinical screening tool that will identify those older drivers who are unsafe or require a more in-depth assessment (Man-Son-Hing et al., 2004, Marshall et al., 2013, in this issue). Using the Candrive II baseline data, the primary aim of the present study was to examine the relationship between the MoCA, Trails A and B, driving comfort, perceived driving abilities and self-reported driving restrictions.

## 2. Methods

The Candrive common cohort study is coordinated at the Ottawa Hospital Research Institute (OHRI). Data collection began in 2009 across seven Canadian cities from four provinces including: Toronto, ON, Ottawa, ON, Hamilton, ON, Thunder Bay, ON, Montreal, QC, Winnipeg, MB and Victoria, BC. This study was approved by the research ethics boards at all institutions, and informed written consent was obtained from each participant.

### *2.1 Participants*

Participants were recruited largely through newspaper, television and radio coverage. Interested individuals were then screened for eligibility through a telephone interview by a research associate. Inclusion criteria included: currently driving with a valid driver’s license, age ≥ 70 years, the intention to continue driving for the next five years and the commitment to drive one vehicle ≥ 70% of the time (if sharing a vehicle with someone else in the household). Exclusion criteria included: The intent to move out of the region, a medical contraindication to driving within the last six months, and the diagnosis of a progressive condition that would affect driving (e.g. Alzheimer’s).

### *2.2 Office-based Assessment Battery*

The initial baseline assessment took approximately 2.5 to 4 hours to complete and included general demographics (e.g., age, sex, and the presence or absence of other household members with a valid driver’s license), a battery of tests to measure sensory, physical and cognitive function, as well as self-reports of driving, health, and quality of life. After completing the baseline assessment, participants were given a package of scales (including the measures described in 2.3.3 to 2.3.6 below) to be completed at home and returned within two weeks.

*2.3 Primary Measures*

*2.3.1 The Montreal Cognitive Assessment (MoCA)*

The MoCA is a screening tool developed specifically for the detection of mild cognitive impairment and early Alzheimer's disease (Nasreddine et al., 2005). The MoCA takes about 10-15 minutes to administer and is scored on a 30-point scale.

*2.3.2. Trail Making Test: Parts A and B*

The Trail Making Test (Reitan, 1958) is a reliable, valid and widely used neuropsychological test of psychomotor speed, mental flexibility and executive functioning (Moses, 2004), consisting of two parts (A and B). Part A requires the participant to connect a series of 25 numbers in numerical order, whereas part B requires participants to draw lines between 12 alternating numbers and letters in sequential order. For the present study, parts A and B were classified as continuous measures (time to completion, number of errors).

*2.3.3. Driving Comfort Scales (DCS)*

The 13-item daytime (DCS-D) and 16-item nighttime (DCS-N) driving comfort scales were inductively developed in a series of studies with older drivers (MacDonald et al., 2008; Myers et al., 2008). Possible scores range from 0% to 100%; higher scores indicate greater driving comfort.  Both the daytime and nighttime comfort scales have demonstrated good test-test reliability over a two-week period (ICCs = .70 and .88) and excellent structural properties (unidimensionality, hierarchiality, goodness of fit, interval properties (MacDonald et al., 2008;Myers et al., 2008). A subsequent study with another sample of older drivers supported the test-retest reliability of both the daytime and nighttime driving comfort scales over one week (ICCs =.89 and .92) (Blanchard & Myers, 2010).

*2.3.4. Perceived Driving Abilities (PDA) Scale*

The 15-item Perceived Driving Abilities (PDA) scale asks drivers to rate various aspects of their current abilities (e.g., see road signs at night, make quick driving decisions) on a four-point scale (from 0 = poor to 3 = very good). The PDA scale has strong, internal consistency ($\alpha$ = .92) and moderate test-retest reliability over one week (ICC = .65) (Blanchard & Myers, 2010; MacDonald et al, 2008). Total scores can range from 0-45, with higher scores indicating more positive perceptions of driving abilities.

*2.3.5. Situational Driving Frequency (SDF) and Situational Driving Avoidance (SDA) Scales*

Driving practices were assessed using the Situational Driving Frequency (SDF) and Avoidance (SDA) scales. On the SDF scale, participants are asked how often they drive, on average, in 14 different driving scenarios (e.g., at night, on highways, in rural areas, in heavy traffic or rush hour in town, on trips lasting two hours each way, etc.) on a five-point scale: Never, rarely (less than once a month), occasionally (more than once a month but less than weekly), often (one to three days per week) or very often (four to seven days a week). Each item is scored from 0 (never) to 4 (very often). Scores can range from 0 to 56 with higher scores indicating driving more often in challenging situations. On the SDA scale, people are asked “If possible, do you try and avoid any of these driving situations?”, “check all that apply” on a list of 20 situations (e.g., night, dawn or dusk, bad weather conditions in general, heavy rain, making left hand turns, etc.). The last item, “No I don’t try to avoid any of these situations”, is used to ensure that people have considered all the situations. Scores can range from 0 to 20, with higher scores indicating greater avoidance. Both scales were developed inductively with older drivers and have shown good internal consistency and test-retest reliability (MacDonald et al., 2008; Blanchard & Myers, 2010).

*2.3.6. Driving Habits and Intentions Questionnaire (DHI)*

The Driving Habits and Intentions Questionnaire (Kowlaski et al, 2011 ) was adapted from an existing short questionnaire (Tuokko et al., 2006) designed to assess driving-related thoughts, beliefs and action within the framework of the transtheoretical model of behavior change (Prochaska et al., 1992). The questionnaire contains items related to current driving restrictions (i.e., situations under which they prefer NOT to drive such as turning left at intersections, driving in unfamiliar locations). These were also recoded into a global continuous driving variable ranging from 0 to 17 indicating current driving restrictions, with higher scores representing more restrictions.

*2.4 Secondary Measures*

Other tests of health, vision, mood and physical functioning were used to control for non-cognitive measures that could influence the driving outcomes. The Western Ontario and McMaster Universities Arthritis Index (WOMAC) was used to assess pain, stiffness and physical function (range 0-96; higher scores indicate worse pain, stiffness and functional limitations; Bellamy et al. 1988). The Older Americans Resources and Services (OARS) multidimensional functional assessment questionnaire assessed independence in activities of daily living (range 0-28 with higher scores indicating greater independence; Duke University Centre for the Study of Aging, 1978); the Rapid Pace Walk test to measure motor speed and function, (Staplin et al., 2003); the Pelli-Robson chart for binocular contrast sensitivity (Pelli, et al., 1988; Keay et al., 2009); and, the 15-item Geriatric Depression Scale (GDS) for depression screening (Yesavage et al., 1983).

*2.5 Data Analysis*

Descriptive data on the study population are presented using means and standard deviations. A univariate linear regression approach was used to assess associations between each of the raw scores on the cognitive tests and each of the respective self-reported driving scales (i.e., DCS-D, DCS-N, PDA, SDF, SDA, DHI). Confounding variables (e.g., demographics, indicators of health, mood, vision and physical functioning) were then included and adjusted for using a hierarchical regression model to ensure the validity of the associations drawn between cognitive and self-reported driving scales. More specifically, all demographic, mood, health, vision and physical functioning variables were entered in the first step of this model. In the second step, each cognitive predictor was entered as a continuous measure. Intercorrelations between predictor variables showed no excessive multicollinearity (see Appendix B). Data were analyzed in SPSS version 20.0 (IBM Corporation, Armonk, NY). The significance level was set at 0.05.

**3. Results**

*3.1. Sample Demographics*

As shown in Table 1, the sample ranged in age from 70-94 years (M = 76.2, SD = 4.85), and 62% were male. Education ranged from grade school to post-graduate studies. Over half the sample (55%) had at least one other household member with a valid driver's license. Overall, the group was high functioning with respect to their physical health and level of independence in their activities of daily living (Older Americans Resources and Services total score: M = 27.82, SD = 0.66; Western Ontario and McMaster Universities Arthritis Index total score: M = 7.41, SD = 10.25).

*3.2. Associations between Cognitive Performance with Driver Perceptions and Practices*

*Univariate Analyses*. The MoCA total score was not significantly associated with any scales of driver perceptions or restrictions.. Time to complete parts A and B of the Trail Making Test were significantly associated with lower perceived driving abilities (PDA) and comfort (DCS-D, DCS-N), and a significant tendency to drive less frequently (SDF) and avoid more driving situations (SDA, DHI), ($p < 0 .05$; Table 2). The number of errors on Trails A was significantly associated only with driving frequency (SDF), and the number of errors on Trails B was only significantly associated with perceived driving abilities (PDA) and driving avoidance (SDA).

*Multivariate Analyses*. Age, gender and depressive symptoms were significantly associated with most of the driving scales, and the Western Ontario and McMaster Universities Arthritis Index was significantly associated with all the driving scales other than the Situational Driving Frequency and Avoidance (SDF and SDA) scales (see Appendix A). Having another household member who was a driver was significantly associated with a greater number of driving restrictions as indicated by the Driving Habits and Intentions questionnaire (Appendix A). After adjusting for confounding variables (e.g., age, sex, education, number of other household drivers with a valid driver's license, number of current medications, GDS score, Pelli-Robson binocular contrast sensitivity, OARS total score, WOMAC total score and Rapid Pace Walk time), the MoCA total score was not significantly associated with any of the driving scales. Conversely, most of the associations between the time to complete Trails A and B and the driving scales that were found in the univariate regression analyses still persisted ($p < 0.05$, see Table 2 and Appendix A). Exceptions were that the time to complete Trails A and B were no longer associated with driving frequency (SDF), and time to complete Trails B was no longer associated with the Driving Habits and Intentions score (Table 2). Conversely, the number of errors on Trails A was significantly associated only with the Situational Driving Frequency score, and the number of errors on the Trails B was only significantly associated with Situational Driving Avoidance score. Despite the many significant associations between time to complete Trails A and B and the driving measures, little additional variance in driving comfort, abilities and behavior was explained by adding time to complete Trails A and B to the hierarchical regression model (see Appendix A).

## 4. Discussion

The results indicate that psychomotor speed and executive functioning, as measured by the Trails A and B completion times, were significantly, but only modestly associated with driver perceptions and self-reported driving practices in our cohort of older drivers, whereas MoCA scores were not. Even after adjusting for confounding variables, the associations between the Trail Making Test completion times and driver perceptions and self-reported practices remained. Our findings suggest that older drivers who required more time to complete Trails A and B reported slightly greater avoidance of difficult driving situations. The discrepancy between findings for the Trails completion time and number of errors score may be partially explained by the different cognitive process involved. For example, longer completion time on Trails B has been related to visual scanning difficulties, whereas errors are more closely related to executive functioning and working memory problems (Mahurin et al., 2006). Indeed, in those with specific health conditions, such as stroke, these discrepancies have been similarly documented (Mazer et al., 1998). Additional research is warranted to further determine the sensitivity and specificity of using time to complete and number of errors scores on the Trail Making Test in predicting driving perception and behavior.

Additional research is also required to assess the utility of global cognitive screening measures to predict driving perception and behavior. The MMSE has been inconsistently associated with driving performance (Molnar et al., 2006), and although the MoCA includes items to assess executive function and is a more sensitive measure than the MMSE in detecting cognitive impairment, we failed to find an association between the MoCA and driving variables at the baseline assessment of the Candrive cohort study. The MoCA incorporates 6 points for language and 11 points for aspects of verbal memory (recall and orientation), and hence about half of the total MoCA score is attributed to cognitive domains that have not been found to predict driving (e.g., collisions, simulator or on-road driving assessment)(Molnar et al., 2006). Alternately, "a ceiling effect" with a largely cognitively intact sample, and/or a potential lack of insight of those with lower MoCA scores may lead to a lack of association between the total MoCA score and perceptions of driving comfort and abilities and self-restrictions of driving.

To our knowledge, only one study involving patients with Parkinson's disease and age and gender matched healthy controls has investigated the relationship between Montreal Cognitive Assessment total scores, self-reported driving practices and naturalistic driving (exposure and patterns). Crizzle et al. (2013) found drivers with Parkinson's disease reported more driving restrictions than controls, but actually drove more at night, in bad weather, in rush hour and on highways than the age-matched controls. While the Parkinson's disease group had significantly worse MoCA scores than controls, this score was not related to self-restrictions or actual driving exposure in either group. Although their sample was small, based on their findings, they cautioned researchers and clinicians in taking patient reports of driving practices at face value. In a meta-analysis by Mathias and Lucas (2009), Trails A and B were both strong predictors of driving performance (e.g. at fault crashes, traffic violations). Their report identified that time to complete Trails B compared to Trails A had a stronger association with at fault crashes or failed on-road tests. However, other studies cited by Molnar and Simpson (2010) show no association between either Trails A and B and driving performance, and further studies of the association between various cognitive measures of speed of processing, attention and executive function, and driving behavior have led to mixed results (Molnar et al., 2006; Reger et al., 2004; Scialfa et al., 2010).

The present study has several limitations. The analyses were conducted on the baseline data from the Candrive II cohort study. This cohort is a convenience sample of independent, healthy senior drivers who made a commitment over a 5 year period, and results may not be generalizable to all older drivers, especially those with specific medical illnesses. Although nearly a quarter of participants were classified as having possible impairment of cognitive performance (i.e., 23% scored below the cut-off on one or more of the cognitive tests), the majority of the sample performed relatively well on the measures, limiting the opportunity to identify relationships between their scores with driver perceptions and driving practices. The analysis is also limited by its cross-sectional nature, the limited cognitive measures of various aspects of attention and executive functioning, the lack of application of age- and education-adjusted Trail Making Test norms, and the self-report measures of driving, which may not represent actual driving practices. Indeed, recent research comparing objective driving data to driver self-reports found that the accuracy of driver self-reports is highly questionable, particularly for estimates of exposure (Huebner et al., 2006; Blanchard et al. 2010; Crizzle et al., 2013). Future investigations with Candrive data will incorporate actual driving exposure/practices data to verify older individuals' self-reported driving practices.

Nonetheless, this study provides the foundation to track cognitive performance prospectively over a five-year period relative to self-report and objective driving data, in addition to driving outcomes (crashes and citations). Measures of actual driving exposure and patterns, as well as provincial crash and traffic violation data are being collected, and these will enable further examination between cognitive performance (and changes over time) with driver perceptions and driving behavior in a large cohort of older drivers.

## 5. Conclusion

This was the first study using a large national cohort of healthy older drivers to examine the relationship of cognitive performance with driving perceptions and restrictions, including commonly-used cognitive measures, the Trail Making Test and the Montreal Cognitive Assessment. This study found statistically significant, but only modest associations between Trails A and B completion times with driver perceptions (day and night comfort and perceived driving abilities) and driving restrictions (situational avoidance), even after adjusting for confounding variables in a large sample of older drivers. The modest nature of the associations may be due to the fairly minor degree of cognitive impairment in the sample as a whole, potential reduced self-awareness of driving capabilities in those with cognitive impairment, or a combination of both factors. Results from the prospective follow up of this cohort of older drivers, which will include both self-reported and actual driving data, will help clarify the relationship between cognitive performance, driver perceptions and driving restrictions. It will also be important to explore further details about cognitively impaired drivers who do not restrict driving or do not perceive limitations in their abilities, as they may pose the biggest public safety hazard.

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**Table 1. Group Characteristics (n=928)**

| | Freq (%) | Mean (SD) | Range |
|---|---|---|---|
| Age | | 76.21 (4.85) | 70-94 |
| Gender | | | |
| Male | 577 (62.2) | | |
| Female | 351 (37.8) | | |
| Highest Education Completed | | | |
| Post-Graduate | 201 (21.7) | | |
| Degree/Diploma | 219 (23.7) | | |
| Trade/Technical Certificate | 68 (7.3) | | |
| High School | 241 (26.0) | | |
| Grade School | 95 (10.3) | | |
| Other household member(s) with a valid driver's license | | | |
| Yes | 510 (55.0) | | |
| No | 414 (44.6) | | |
| No. of Current Medications | | 4.51 (3.06) | 0-14 |
| OARS Total Score | | 27.82 (0.66) | 18-28 |
| WOMAC Total Score | | 7.41 (10.25) | 0-60 |
| Rapid Pace Walk Time (sec) | | 6.47 (2.39) | 0-19 |
| Contrast Sensitivity | | 1.92 (0.11) | 1.15-2.25 |
| Geriatric Depressive Score | | 0.75 (1.21) | 0-10 |
| **Cognitive Measures** | | | |
| MoCA Total Score | | 25.95 (2.49) | 13-30 |
| Trails A – Time (sec) | | 38.78 (13.90) | 14-169 |
| Trails A – Errors | | 0.17 (0.45) | 0-3 |
| Trails B – Time (sec) | | 98.15 (44.41) | 30-556 |
| Trails B – Errors | | 0.76 (1.11) | 0-9 |
| **Self-Reported Driving Measures** | | | |
| Situational Driving Frequency – Total | | 35.27 (7.34) | 11-56 |
| Situational Avoidance – Total | | 5.32 (4.12) | 0-20 |
| Driving Comfort Scale – DAY | | 76.21 (15.97) | 23.08-100 |
| Driving Comfort Scale – NIGHT | | 68.15 (20.73) | 1.56-100 |
| Perceived Driving Abilities – CURRENT | | 35.89 (6.10) | 17-45 |
| No. of Driving Conditions Currently Restricting | | 1.31 (2.14) | 0-12 |

**Table 2. Univariate and hierarchal regression[a] coefficients relating cognitive performance to perceptions of driving comfort and abilities, and self-reported driving restrictions.**

| | | **SDF** | | | **SDA** | | | **DCS - Day** | | | **DCS - Night** | | | **PDA** | | | **DHI** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | β | SE | $R^2$ | β | SE | $R^2$ | β | SE | $R^2$ | β | SE | $R^2$ | β | SE | $R^2$ | β | SE | $R^2$ |
| **Cognitive Measures** | | | | | | | | | | | | | | | | | | | |
| MoCA Total Score | U | .086 | .098 | .000 | -.095 | .055 | .002 | .092 | .212 | .000 | -.165 | .277 | .000 | .057 | .082 | .000 | -.032 | .028 | .000 |
| | H | .116 | .097 | .117 | -.084 | .005 | .090 | .076 | .214 | .092 | -.025 | .276 | .114 | -.023 | .083 | .081 | -.048 | .029 | .067 |
| Trails A – Time (sec) | U | .054* | .017 | .010 | .052** | .010 | .030 | -.181** | .037 | .024 | -.169** | .049 | .012 | -.068** | .014 | .023 | .022** | .005 | .019 |
| | H | -.025 | .018 | .119 | .035** | .010 | .101 | .127** | .039 | .101 | -.108* | .050 | .118 | -.042* | .015 | .088 | .019** | .005 | .078 |
| Trails A – Errors | U | -1.351* | .546 | .006 | -.106 | .307 | .000 | .438 | 1.189 | .000 | .442 | 1.544 | .000 | -.114 | .454 | .000 | -.003 | .156 | .000 |
| | H | -1.293* | .519 | .123 | -.091 | .294 | .090 | .552 | 1.143 | .092 | .595 | 1.470 | .114 | -.031 | .440 | .080 | .007 | .153 | .066 |
| Trails B – Time (sec) | U | -.021** | .005 | .015 | .018** | .018 | .035 | -.065** | .012 | .032 | -.069** | .015 | .021 | -.025** | .004 | .033 | .005* | .002 | .008 |
| | H | -.009 | .006 | .121 | .011** | .003 | .099 | -.043** | .013 | .103 | -.047* | .016 | .121 | -.015* | .005 | .091 | .003 | .002 | .068 |
| Trails B – Errors | U | -.384 | .219 | .002 | .377* | .122 | .009 | -.927 | .477 | .003 | -1.056 | .619 | .002 | -.360* | .182 | .003 | .102 | .064 | .002 |
| | H | -.232 | .210 | .120 | .274* | .118 | .092 | -.449 | .463 | .093 | -.600 | .596 | .115 | -.159 | .178 | .083 | .078 | .063 | .067 |

[a] Hierarchal regression model – Step 1: Demographic, mood, health vision and physical functioning variables entered; Step 2: Cognitive predictor entered.

U = Univariate results; H = Hierarchical regression; β = Unstandardized beta; SE = Standard error; $R^2$ = Adjusted $R^2$; * $p < .05$ ** $p \le .001$.
SDF = Situational Driving Frequency; SDA = Situational Driving Avoidance; DCS = Driving Comfort Scale; PDA = Perceived Driving Abilities; DHI = Driving Habits and Intentions

**Appendix A.**

**Hierarchal regression analyses for predicting perceptions of driving comfort and abilities, and self-reported driving restrictions from time to complete the Trails A.**

| | **SDF** | | | **SDA** | | | **DCS - Day** | | | **DCS - Night** | | | **PDA** | | | **DHI** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | β | SE | $R^2$ | β | SE | $R^2$ | β | SE | $R^2$ | β | SE | $R^2$ | β | SE | $R^2$ | β | SE | $R^2$ |
| **Step One** | | | .118 | | | .090 | | | .092 | | | .114 | | | .081 | | | .066 |
| Age | -.262** | .052 | | .115** | .029 | | -.377** | .114 | | -.396* | .148 | | -.120* | .044 | | .025 | .015 | |
| Gender | -3.224** | .552 | | 1.314** | .309 | | -6.490** | 1.205 | | -10.038** | 1.556 | | -.337 | .465 | | .680** | .164 | |
| Other members of household with valid drivers license | -.011 | .006 | | .005 | .003 | | .002 | .013 | | -.020 | .017 | | -.007 | .005 | | .005* | .002 | |
| WOMAC Total | -.031 | .025 | | .022 | .014 | | -.135* | .055 | | -.194* | .071 | | -.076** | .021 | | .017* | .007 | |
| OARS Total | .523 | .397 | | -.351 | .223 | | .505 | .870 | | 1.040 | 1.123 | | -.097 | .335 | | -.103 | .118 | |
| No. of Current Medications | .102 | .081 | | -.013 | .046 | | -.095 | .178 | | .028 | .230 | | -.013 | .069 | | -.003 | .024 | |
| Rapid Pace Walk Time (sec) | .048 | .104 | | .057 | .058 | | -.152 | .228 | | .013 | .294 | | .038 | .088 | | -.030 | .031 | |
| GDS Total | -.849** | .202 | | .292* | .113 | | -1.367* | .442 | | -2.022** | .570 | | -.802** | .170 | | .072 | .060 | |
| Contrast Sensitivity | .358 | 2.165 | | -.454 | 1.216 | | 4.742 | 4.743 | | 10.320 | 6.122 | | 2.558 | 1.827 | | -1.242 | .644 | |
| **Step Two** | | | .119 | | | .101 | | | .102 | | | .118 | | | .088 | | | .078 |
| Trails A – Time (sec) | -.025 | .018 | | .035** | .010 | | .127** | .039 | | -.108* | .050 | | -.042* | .015 | | .019** | .005 | |
| ***F*** | | **13.079**** | | | **11.096**** | | | **11.168**** | | | **12.918**** | | | **9.672**** | | | **8.576**** | |

β = Unstandardized beta; SE = Standard error; $R^2$ = Adjusted R square; * p < .05 ** p ≤ .001.

SDF = Situational Driving Frequency; SDA = Situational Driving Avoidance; DCS = Driving Comfort Scale; PDA = Perceived Driving Abilities; DHI = Driving Habits and Intentions

**Hierarchal regression analyses for predicting perceptions of driving comfort and abilities, and self-reported driving restrictions from time to complete the Trails B.**

| | **SDF** | | | **SDA** | | | **DCS - Day** | | | **DCS - Night** | | | **PDA** | | | **DHI** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | β | SE | $R^2$ | β | SE | $R^2$ | β | SE | $R^2$ | β | SE | $R^2$ | β | SE | $R^2$ | β | SE | $R^2$ |
| **Step One** | | | .119 | | | .089 | | | .092 | | | .114 | | | .082 | | | .066 |
| Age | -.246** | .053 | | .109** | .030 | | -.339* | .117 | | -.335* | .150 | | -.105* | .045 | | .028 | .016 | |
| Gender | -3.280** | .549 | | 1.273** | .309 | | -6.432** | 1.203 | | -10.064** | 1.551 | | -.303 | .464 | | .646** | .164 | |
| Other members of household with valid drivers license | -.011 | .006 | | .005 | .003 | | .001 | .013 | | -.021 | .017 | | -.007 | .005 | | .005* | .002 | |
| WOMAC Total | -.036 | .025 | | .021 | .014 | | -.136* | .055 | | -.199* | .071 | | -.078** | .021 | | .016* | .008 | |
| OARS Total | .557 | .396 | | -.384 | .224 | | .633 | .871 | | 1.152 | 1.123 | | -.055 | .335 | | -.120 | .119 | |
| No. of Current Medications | .097 | .081 | | -.022 | .046 | | -.069 | .178 | | .046 | .229 | | -.004 | .069 | | -.007 | .024 | |
| Rapid Pace Walk Time (sec) | .080 | .104 | | .057 | .059 | | -.124 | .229 | | .072 | .295 | | .053 | .088 | | -.025 | .031 | |
| GDS Total | -.825** | .202 | | .289* | .114 | | -1.322* | .443 | | -1.922** | .571 | | -.778** | .171 | | .083 | .061 | |
| Contrast Sensitivity | .585 | 2.148 | | -.649 | 1.215 | | 5.382 | 4.726 | | 10.576 | 6.090 | | 2.754 | 1.818 | | -1.444* | .645 | |
| **Step Two** | | | .121 | | | .099 | | | .103 | | | .121 | | | .091 | | | .068 |
| Trails B – Time (sec) | -.009 | .006 | | .011** | .003 | | -.043** | .013 | | -.047* | .016 | | -.015* | .005 | | .003 | .002 | |
| ***F*** | | **13.266**** | | | **10.835**** | | | **11.279**** | | | **13.335**** | | | **9.983**** | | | **7.530**** | |

β = Unstandardized beta; SE = Standard error; $R^2$ = Adjusted R square; * p < .05 ** p ≤ .001.

SDF = Situational Driving Frequency; SDA = Situational Driving Avoidance; DCS = Driving Comfort Scale; PDA = Perceived Driving Abilities; DHI = Driving Habits and Intentions

**Appendix B. Correlation matrix of predictors and outcomes**

| | Predictors | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **Predictors** | | | | | | | | | | | | |
| 1. Age | -- | | | | | | | | | | | |
| 2. No. of Current Medications | .10$^{**}$ | -- | | | | | | | | | | |
| 3. OARS Total Score | .10$^{**}$ | .31$^{**}$ | -- | | | | | | | | | |
| 4. WOMAC Total Score | -.16$^{**}$ | -.16$^{**}$ | -.20$^{**}$ | -- | | | | | | | | |
| 5. Rapid Pace Walk Time (sec) | .33$^{**}$ | .21$^{**}$ | .26$^{**}$ | -.24$^{**}$ | -- | | | | | | | |
| 6. Contrast Sensitivity | .12$^{**}$ | .17$^{**}$ | .26$^{**}$ | -.07$^{*}$ | .20$^{**}$ | -- | | | | | | |
| 7. Geriatric Depressive Score | -.16$^{**}$ | -.04 | .00 | .06 | -.15$^{**}$ | -.12$^{**}$ | -- | | | | | |
| 8. MoCA Total Score | -.19$^{**}$ | -.08$^{*}$ | -.03 | .06 | -.16$^{**}$ | -.08$^{*}$ | .07$^{*}$ | -- | | | | |
| 9. Trails A – Time (sec) | .29$^{**}$ | .03 | .04 | -.08$^{*}$ | .32$^{**}$ | .16$^{**}$ | -.17$^{**}$ | -.19$^{**}$ | -- | | | |
| 10. Trails A – Errors | .01 | .01 | -.02 | .03 | .01 | .05 | -.01 | -.05 | .02 | -- | | |
| 11. Trails B – Time (sec) | .36$^{**}$ | .08$^{*}$ | .08$^{*}$ | -.05 | .34$^{**}$ | .18$^{**}$ | -.14$^{**}$ | -.35$^{**}$ | .47$^{**}$ | .05 | -- | |
| 12. Trails B – Errors | .13$^{**}$ | .07$^{*}$ | .03 | -.01 | .13$^{**}$ | .05 | -.05 | -.21$^{**}$ | .14$^{**}$ | .09$^{**}$ | .54$^{**}$ | -- |

Note. * $p < .05$; ** $p < .01$.