The Impact of Subclinical Sleep Problems on Self-Reported Driving Patterns and Perceived Driving Abilities in a Cohort of Active Older Drivers

Andrea Jane Hickey[a,] Kelly Weegar[b], Yara Kadulina[a], Sylvain Gagnon[a]

Shawn Marshall[b,] Anita Myers[c,] Holly Tuokko[d] , Michel Bédard[e], Isabelle Gélinas[f],

Malcolm Man-Son-Hing[b], Barbara Mazer[f], Gary Naglie [g,h,i,j], Michelle Porter[k], Mark Rapoport[l]

& Brenda Vrkljan[m] for the Candrive Research Team

[a] School of psychology, University of Ottawa, [b]Ottawa Hospital Research Institute, University of Ottawa, [c]University of Waterloo, [d]Centre on Aging, University of Victoria, [e]Centre for Research on Safe Driving, Lakehead University, [f]School of Physical & Occupational Therapy, McGill Uniersity, [g]Research Department, Toronto Rehabilitation Institute, [h]University Health Network; [i]Department of Medicine and Rotman Research Institute, Baycrest Geriatric Health Care Centre; [j]Department of Medicine and Institute of Health Policy, Management and Evaluation, University of Toronto,[k] Faculty of Kinesiology and Recreation Management, University of Manitoba, [l]Department of Psychiatry, University of Toronto,

[m] School of Rehabilitation Science, McMaster University

Corresponding author:
Sylvain Gagnon, Ph.D.
School of Psychology, University of Ottawa
Cognitive Aging and Driving Laboratory
136 Jean Jacques Lussier
Vanier Hall (3042)
Ottawa ON K1N 6N5
Email: sgagnon@uottawa.ca
Tel: (613) 562-5800 x2515
Fax: (613) 562-5147

Abstract

The present study sought to investigate the influence of subclinical sleep disturbances on driving practices and driver perceptions in a large cohort of healthy older drivers. Participants from the Candrive II prospective cohort study were investigated. Self-reported measures of sleep problems were used to determine the influence of sleep disturbance on self-reported driving practices and perceived driving abilities, as measured by the Situational Driving Frequency, Situational Driving Avoidance, and Perceived Driving Abilities scales. Hierarchical regression analyses were used to estimate whether mild self-reported sleep problems were predictive of driving restrictions and perceived abilities, while controlling for a variety of health-related factors and demographic variables known to mediate sleep problems or to impact driving. Cross-sectional analysis of baseline data from the Candrive II study suggests that subclinical sleep problems do not significantly influence self-reported driving patterns or perceived driving abilities in older drivers once control variables are considered. The relationship between sleep problems, driving frequency, avoidance and perceived abilities is better explained by mediating demographic, health, and cognitive factors. Further research examining sleep disturbances and driving should include objective measures of driving practices (exposure, patterns) and outcomes (crashes, violations) and should take in consideration the severity of sleep problems.

Keywords: Sleep problems; self-regulatory driving behaviors; older drivers.

1. Introduction

Approximately 20 to 50% of older adults report having sleep problems (Chen et al., 2011; Lopez-Torres Hidalgo et al., 2011; Vitiello, 1997) compared to roughly 5 to 30% in the general population (Bjorngaard et al., 2011; Ohayon, 2002). In an epidemiological study of 9,000 participants aged 65 and older, the National Institute on Aging found that over half of older adults reported at least one of these complaints as occurring most of the time: trouble falling asleep, waking up, awaking too early, needing to nap and not feeling rested (Foley et al., 1995). It is generally argued that the increase in concurrent medical conditions can produce greater sleep disruption with age, such that sleep complaints common in older adults are often secondary to their comorbidities (Foley et al., 2004). Sleep disturbances, however, are found to independently produce abnormalities in functioning (Peppard et al., 2000), leading to errors, slowed reaction time, or even catastrophic events, such as fatal motor vehicle accidents (Cohen et al., 2010; Czeisler, 2011). Research on sleep-related problems and driving suggests that sleepiness is a significant risk factor for motor vehicle collisions and impaired driving performance (Connor et al., 2002). For instance, both driving simulator and on-road driving performance tests demonstrate that sleep deprivation significantly slows down reaction time (Philip et al., 2003, 2005; Ting et al., 2008).

Despite the awareness of the risks involved, polls of drivers conducted worldwide find that many drivers admit to driving while drowsy (Sagaspe et al., 2010; *Sleep in America poll,* 2012; Vanlaar et al., 2008), and older drivers are no exception. In a sample of 430 active older drivers (aged ≥ 70 years old), Vaz Fragoso and colleagues (2008) found that a large percentage continued to drive regularly (at least once a week) despite reporting dissatisfaction with their sleep. The important question that remains is whether sleep problems can partly explain the changes in driving behaviors observed in older adults such as the avoidance of high-risk settings (e.g., nighttime) (Ball et al., 1998; Lyman et al., 2001).

Comparative models of sleep deprived and alcohol-challenged individuals go so far as to suggest that sleepy driving may be as dangerous as driving under the influence of alcohol. In a study by Powell and colleagues (2001), sleep deprived drivers were found to perform as poorly as drivers under the influence of alcohol in a closed-course driving test and displayed little awareness of their driving errors. These associations are further corroborated by findings from epidemiological crash studies, which identify lack of sleep as a significant contributor in 20% of all traffic accidents (Howard et al., 2004; Nabi et al., 2006; Sagaspe et al., 2010). For instance, in a retrospective analysis of 4871 crash reports for drivers of all ages in Japan, Abe and colleagues (2010) found that short sleep duration (<6h) the previous night was significantly associated with both rear-end collisions and single-car accidents.

Similarly, old age has long been associated with increased crash risk causing serious injury (Koppel et al., 2011). Although older drivers are currently involved in few crashes in terms of absolute numbers, they display some of the highest rates of morbidity or mortality per number of drivers and per distance traveled (Langford & Koppel, 2006). Specifically, in analyses of Australian 1996–1999 fatal crash data, Langford and Koppel (2006) found that drivers over the age of 65 accounted for a disproportionate number of serious injuries and crash fatalities, compared to younger drivers. Other empirical studies of older drivers also identify that declines in attention, reaction time, vision and physical and executive functioning with age are significantly associated with driving outcomes (Anstey et al., 2005); namely, driving is a demanding task that requires a high level of visual, cognitive and motor/somatosensory skills.

While declines in driving performance may not be due to age per se, health conditions and related functional impairments that increase with age impact the ability to drive safely (McGwin et al., 2000; Sagberg, 2006). Among these age-related health conditions, sleep problems are common and significantly impact multiple aspects of driving abilities (e.g., slowed reaction time and decreased attention); consequently, sleep problems could potentially elevate crash risk.

The majority of research to date on sleep and driving in older adults has focused on sleep disorders, such as obstructive sleep apnea, or other clinically significant sleep problems as indicated by various sleep measures (e.g., the Sleep Impairment Index; Filtness et al., 2011; for a review see Marshall, 2008). Nevertheless, the presence of less serious sleep disturbances may still influence driving patterns in older drivers. To our knowledge, the impact of subclinical sleep problems on driving in older adults has yet to be fully understood; findings remain mixed regarding whether perceived sleepiness is associated with crash risk and impaired driving performance in older drivers (Ellen et al., 2006). For instance, Vaz Fragoso et al (2008) found that older drivers with sleep problems self-reported lower levels of nighttime driving and lower levels of driving mileage. They also found that these individuals had more health issues in general, but did not examine whether these issues may have influenced the relationship between sleep problems and self-rated driving.

1.1 Study objective

The aim of the present study was to investigate the independent influence of subclinical sleep problems on self-reported driving practices and perceived driving abilities in active older drivers. Specifically, using baseline data from the Canadian Driving Research Initiative for Vehicular Safety in the Elderly (Candrive) common cohort of older drivers, we examined the contribution of self-reported sleep problems, while controlling for medical conditions, cognitive function, age and driver characteristics. We hypothesized that subclinical sleep problems would be associated with self-reported driving restrictions and poorer perceived driving abilities.

2. Methods

2.1. *Participants*

Baseline data from the Candrive II prospective cohort study includes 928 older drivers (ranging in age from 70 to 94). Candrive II is a Canadian Institutes of Health Research (CIHR)-funded interdisciplinary research team interested in health-related safety and quality-of-life issues pertinent to active older drivers (see Marshall et al., in this issue). Participants were recruited largely through media from seven Canadian cities in four provinces: Toronto, ON, Ottawa, ON, Hamilton, ON, Thunder Bay, ON, Montreal, QC, Winnipeg, MB and Victoria, BC. For further details on recruitment and eligibility refer to Marshall et al. (this issue). The study was approved by the research ethics boards at each institution involved in the Candrive II study, and each participant provided written informed consent.

2.2. *Procedures*

As part of the Candrive II protocol, all participants underwent a comprehensive baseline assessment, which included demographic, health and driving information, as well as measures of sensory, physical, and cognitive functioning (see Marshall et al. in this issue for a detailed description of the procedure). After completing the in-person assessment, participants were given a package of scales (including those described in section 2.3.2 below) to complete at home and return within two weeks. The following analyses pertaining to the present study will only be applied to a subset of the variables collected at baseline.

2.3. Measures of Interest in the Present Study

2.3.1. Sleep Impairment

All participants were asked "Do you have any sleep problems?" with a dichotomous response, yes or no. Participants who responded "yes" were also asked to complete the Sleep Impairment Index (SII) questionnaire, a self-report instrument that elicits the subject's perception of the level of severity, distress and impairment of daytime functioning associated with his or her sleep problems (Morin et al., 1994). In clinical use, the SII has demonstrated adequate psychometric properties: adequate internal consistency (0.74), reliability and validity (Bastien et al., 2001; Morin & Azrin, 1988). The SII is comprised of seven items that assess severity of sleep-onset, sleep maintenance, early awakening, satisfaction with current sleep patterns, disturbance and distress caused by the sleep problems, and the extent to which sleep problems were noticeable by others, with higher scores indicating more severe insomnia (Morin, 1993). The Candrive study included 5 of the 7 items due to time constraints of the larger clinical assessment (Bryant et al., 2010). Each item was rated on a 5-point scale, from 0 (none or not at all) to 4 (very severe or very much) for a possible range of 0 to 20, with higher scores meaning greater sleep impairment. Both the SII and the endorsement of self-reported sleep problems on the single item dichotomous question were used as predictors in the present study. Although the self-reported declaration of sleep problems is arguably subjective, previous researchers suggest that self-perception of fatigue in older individuals may be a better predictor of performance decrement than objectively measured sleepiness (Philip et al., 2004). For participants who indicated problems with sleep, the SII scores were used to differentiate the subclinical sleep problems, namely the perceived sleep problems that do not meet clinical cut-offs for a sleep disorder. Accordingly, the predictive value of self-reported perception of sleep problems on driving perceptions and behaviour was examined in two separate sets of analyses. In one set, the entire Candrive II sample was used to examine whether perceived sleep problems influence self-reported driving practices and abilities. In the second set, the severity of the sleep problems was considered in the subgroup of individuals who reported having problems with sleep.

2.3.2. Driving Practices and Driver Perceptions

Driving practices were assessed using the Situational Driving Frequency (SDF) and Avoidance (SDA) scales (MacDonald, Myers & Blanchard, 2008). On the SDF, 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 2 hours each way, etc.) on a 5-point scale: never, rarely (less than once a month), occasionally (more than once a month but less than weekly), often (1 to 3 days per week) or very often (4 to 7 days a week). Each item is scored from 0 (never) to 4 (very often) for a possible range of 0 to 56. On the SDA, 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 and avoid any of these situations", is used to verify 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 (Blanchard & Myers, 2010; MacDonald et al., 2008).

Driver perceptions were assessed using the 15-item Perceived Driving Abilities (PDA) scale, which asks participants to rate various aspects of their abilities (e.g., see road signs at night, make quick driving decisions, etc.) on a 4-point scale (from 0= poor to 3=very good). The PDA scale has good psychometric properties: specifically, unidimensional and hierarchical with good person (.92) and item reliabilities (.96) (MacDonald et al., 2008) and moderate test-retest reliability over one-week (ICC=.65) (Blanchard & Myers, 2010). Total scores can range from 0-45, with higher scores indicating more positive perceptions of current abilities.

2.3.3. Control Variables

Demographic (age, gender) and health information (self-reported chronic conditions referred to below as number of medical conditions, Body Mass Index [BMI], depression and medication list) were included to describe the sample and examine potential mediating effects in the statistical models. The inclusion of the above variables is justified by the known influence of one's lifestyle and health-related factors on sleep as well as on driving (e.g., Barrash et al., 2010; Leproust et al., 2008; Verster et al., 2004). Individual height and weight measurements were used to calculate Body Mass Index (BMI). BMI scores were used as a mediator variable for the present study as previous researchers have found increased sleep problems in overweight individuals (Beebe et al., 2006). Depression was assessed using the 15-item Geriatric Depression Scale (GDS-15), a yes/no response format (Yesavage et al., 1982), with scores above 5 considered to be suggestive of depression (Dennis et al., 2012). Participants were also asked how many medications they took in total and specifically whether they were currently taking anticholinergics or benzodiazepines (yes, no) as these medications have been recognized to increase at-fault motor vehicle crash risk in older drivers (Rapoport et al., 2011), as well as unsafe driving actions in relation to collisions (e.g., speeding; Dubois et al., 2008).

Some researchers have found a relationship between driving ability and cognitive functioning, such that poorer cognitive functioning predicts lower driving ability in the elderly (Hunt et al., 1993). However, other researchers have not found such a relationship between global measures of cognitive status and driving ability (e.g., Crizzle & Myers, 2012; Kowalski, et al., 2012). Despite these inconsistent findings, for the present study, participants' cognitive functioning scores were also included as a covariate. Cognitive functioning was assessed using the Montreal Cognitive Assessment (MoCA), a validated office-based screening measures for mild cognitive impairment (MCI) (Nasreddine et al., 2005). Items relate to the domains of memory, attention, language, visuospatial and executive functions. A total score for the MoCA was obtained by summing participants' correct responses across all items, with one point added for any individual who had 12 years or less of formal education, for a possible maximum of 30 points. A cut-off score of < 26 was used, since scores less than 26 are indicative of MCI (Ismail et al., 2010).

2.4. Statistical Analyses

Descriptive data are presented using frequencies, means and standard deviations. Independent samples *t* tests and Pearson's chi-square analyses were performed where applicable to compare older drivers with and without sleep problems. Pearson correlation coefficients were also computed to estimate associations between severity of sleep problems (SII scores) with driving practices and perceptions. Hierarchical regression analyses were used to test whether subclinical sleep problems (when self-reported [yes/no]) and severity of sleep problem (as assessed by the SII) could predict restricted driving practices and perceived driving abilities (measured by the SDF, SDA, and PDA scales) after controlling for a number of variables (e.g., age, gender, BMI, health, medication use, mood and cognitive functioning). Participants with obstructive sleep apnea were excluded from the analysis (n = 66) due to the known influence of this condition on driving performance and risk of crash. Tolerances showed no excessive multicollinearity (with values ranging from .84 to .96).

3. Results

3.1. Self-reported sleep problems

Table 1 presents demographics, health, medication use, mood, and cognitive functioning between older drivers with self-reported sleep problems ($N = 194$) and those without ($N = 668$). The two groups had similar BMI scores, MoCA scores, and were of similar age. The comparison of anticholinergic use between those with no reported sleep problems and those with reported sleep problems was significant. Furthermore, a larger proportion of older drivers without reported sleep problems were male. Table 1 also shows that, on average, older drivers without reported sleep problems had significantly fewer chronic medical conditions (M(SD) = 7.0(3.32) versus 8.5(3.64), $t(834) = 5.52$, $p < 0.05$, and were significantly less likely to be using benzodiazepines and to have depression scores greater than 5. Participants with self-reported sleep problems scored significantly lower on the SDF, $t(844) = 2.90$, $p < .01$; and PDA $t(846) = 4.26$, $p < .01$ scales compared to those without self reported sleep problems. No significant difference between groups was found for the SDA scale. In order to assess whether the observed differences remain after controlling for demographic and health related variables, hierarchical regressions models were conducted for each one of the driving variables.

3.1.2. Situational Driving Frequency (SDF)

Age, gender, BMI and MoCA scores, number of medical conditions, use of anticholinergics and benzodiazepine (yes/no) and depression were entered at Step 1, explaining 12% of the variance in the SDF of older drivers. After entry of self-reported sleep problems at Step 2, the total variance explained by the model as a whole was 13%, $F(8, 831) = 13.76$, $p < .001$. Sleep problems did not explain any additional variance in SDF scores after controlling for age, gender, BMI and MoCA scores, the number of medical conditions, anticholinergics and benzodiazepine use, as well as depression (R square change = .00, *F* change (1, 831) = 2.42, $p >$ .05).

The following analysis examined the contribution of each of the control variables once entered at Step 1 of the regression analysis (see Table 2). For the variable age, we found that β = -.17, $t(831) = 5.03$, $p < .05$. Namely, age made a negative contribution to SDF (as age increases, SDF scores decrease), explaining 3% of SDF, (squared semipartial correlation = .03). Similarly, gender made a negative contribution to SDF (women had lower SDF scores than men), explaining an additional 5% of SDF, (squared semipartial correlation = .05); $\beta = -.23$, $t(831) =$ 6.71, $p < .01$. For the number of medical conditions, $\beta = -.13$, $t(831) = 3.74$, $p < .01$, indicating that the number of medical conditions also made a negative contribution (2%, squared semipartial correlation =.02) to SDF (as the number of medical conditions increase, SDF scores decrease). BMI made a positive contribution to SDF, $\beta = .15$, t(831) = 4.33, p < .01 (as BMI increases SDF scores increase), explaining an additional 2% of SDF, (squared semipartial correlation = .02).

3.1.3. Situational Driving Avoidance (SDA)

Age, gender, BMI and MoCA scores, number of medical conditions, anticholinergics and benzodiazepine use as well as depression were again entered at Step 1, explaining 8% of the variance in SDA (Table 2). After entry of sleep problems at Step 2, the total variance explained by the model as a whole remained at 8%, $F(9, 842) = 9.07$, $p < .001$.

Once entered at Step 1, age and gender again made a significant positive contribution to SDA (avoidance) scores and both explained an additional 3% of SDA, respectively, (squared semipartial correlation for age and for gender = .03). Conversely, BMI and MoCA scores made a negative contribution to SDA and explained an additional 1% and 0.5% of SDA respectively (squared semipartial correlation for BMI = .01; squared semipartial correlation for MoCA scores = .005; as BMI and MoCA scores increase, SDA scores decrease) (See Table 2).

3.1.4. Perceived Driving Abilities (PDA)

Age, gender, BMI and MoCA scores, the number of medical conditions, anticholinergics and benzodiazepine use and depression were entered at Step 1, explaining 7.1% of the variance in PDA (Table 2). After entry of sleep problems at Step 2, the total variance explained by the model as a whole was 8.3%, $F(9, 842) = 8.36$, $p < .001$. Sleep problems explained an additional 1% of the variance in perceived driving ability (PDA) scores, after controlling for age, gender, BMI and MoCA scores, the number of medical conditions, anticholinergics and benzodiazepine use, and depression, R square change = .01, F change $(1, 842) = 11.15$, $p < .01$

Age and the number of medical conditions made significant negative contributions to PDA and explained 2% and 3% respectively (squared semipartial correlation for age = .02; for number of medical conditions = .03). Conversely, the BMI scores made a significant positive contribution to PDA and explained an additional 1% of PDA (squared semipartial correlation for BMI = .01).

3.2. Sleep Impairment Index Score

The following analyses were performed on the subset of 194 participants who reported having sleep problems and were thus administered the SII (mean SII score = 6.76, SD = 3.37). Initially, Pearson correlation analyses were conducted between SII scores and PDF, PDA, and SDA. Results revealed no significant associations between SII scores and SDF ($r = -.08$, $p = .29$), PDA ($r = -.05$, $p = .47$) or SDA ($r = .05$, $p = .46$) scores. Hierarchical regression analyses were performed to assess whether SII scores predict self-reported driving practices and perceptions after controlling for age, gender, number of medical conditions, medication use, MoCA and BMI scores and depression.

3.2.1. Situational Driving Frequency (SDF)

Age, gender, BMI and MoCA scores, the number of medical conditions, anticholinergics and benzodiazepine use and depression were entered into the hierarchical regression at Step 1, explaining 15% of the variance in SDF scores. After entry of sleep problems at Step 2, the total variance explained by the model as a whole was 16%, $F(9, 180) = 3.67$, $p < .001$. Sleep impairment explained 0% of the variance in SDF scores, after controlling for age, gender, BMI and MoCA scores, the number of medical conditions, anticholinergics and benzodiazepine use, and depression, R square change = .00, F change $(1, 180) = 1.53$, $p > .05$.

Gender, age and number of medical conditions made significant negative contributions to SDF scores with gender explaining 5%; age explaining an additional 6%; and number of medical conditions explaining an additional 1% (squared semipartial correlation for gender = .05; for age = .06; for number of medical conditions = .01; See Table 3).

3.2.2. Situational Driving Avoidance (SDA)

Age, gender, BMI and MoCA scores, the number of medical conditions, anticholinergics and benzodiazepine use and depression were again entered at Step 1, explaining 11% of the variance in SDA scores. After entry of sleep impairment at Step 2, the total variance explained by the model as a whole was still 11%, $F(9, 181) = 2.45$, $p < .05$. Sleep impairment as assessed by the SII explained 0% of the variance in SDA scores, R square change = .00, F change (1, 181) = .60, $p > .05$.

As demonstrated in Table 3, the control variables age and gender made significant positive contributions to SDA scores, explaining 5% and 2% of the variance, respectively (age squared semipartial correlation = .05; gender squared semipartial correlation = .02). BMI scores made a negative contribution and explained an additional 2% (semipartial correlation = .02).

3.2.3. Perceived Driving Abilities (PDA)

Age, gender, BMI and MoCA scores, the number of medical conditions, anticholinergics and benzodiazepine use and depression were entered at Step 1, explaining 11% of the variance in PDA scores. After entry of sleep impairment at Step 2, the total variance explained by the model remained at 11%, $F(9, 181) = 2.68$, $p < .01$. Sleep impairment did not explain any additional variance in PDA, after controlling for age, gender, BMI and MoCA scores, the number of medical conditions, anticholinergics and benzodiazepine use, as well as depression, R square change = .00, F change $(1, 181) = .91$, $p > .05$.

At Step 1 of the regression analysis, BMI made significant positive contributions, explaining an additional 3% of the variance in PDA scores (squared semipartial correlation for BMI = .03; Table 3). In contrast, age, and total number of medication conditions made significant negative contributions to PDA scores, each explaining an additional 4% of variance (squared semipartial correlation for age and number of medical conditions = .04; Table 3).

4. Discussion

This study examined the relationship between self-reported sleep problems and driving practices and perceptions in a large cohort of older drivers. The presence of sleep problems was examined in two ways: self-reported declaration of sleep problems (experiencing problems with sleep or not) and severity of sleep problems based on scores on the Sleep Impairment Index. The first method allowed for the inclusion of all Candrive II participants in the analysis, while the second analysis concerning severity of sleep problems included only the participants who reported experiencing sleep problems (194 of the 668 or 29% of the sample).

We hypothesized that reported problems with sleep would predict older drivers' perceptions of their driving abilities and driving restrictions after controlling for potential confounders, such as demographics, health, mood, and cognitive functioning. Initial comparisons showed that older drivers who said they experienced sleep problems did have significantly lower driving frequency (SDF) scores and poorer perceptions of their driving abilities (PDA scores) compared to those who did not report sleep problems. However, contrary to our predictions, after controlling for a number of variables that could potentially influence the relationship between sleep and driving (age, gender, BMI, cognitive functioning, number of current medical conditions, medication use, and depression), self-reported sleep problems did not predict SDF scores, and only explained 1% of the variance in perceived driving abilities. Moreover, the relationship between perceived sleep problems and SDF and PDA scores was not sustained when severity of sleep problems was examined using SII scores. These results demonstrate that self-reported subclinical sleep problems, or lack thereof, do not appear to significantly influence self-reported driving frequency, avoidance or perceived driving abilities. Indeed, it seems as though other factors contribute to the relationship between perceived sleep disturbances and self-reported driving practices and perception (e.g., age, gender, number of medical conditions).

In a previous study by Vaz Fragazo and colleagues (2008), sleep problems in older drivers were found to be associated with lower self-rated driving capacity especially with respect to night driving. Vaz Fragoso and colleagues (2008) surveyed 430 active older drivers aged ≥ 70 years to determine the prevalence of sleep disturbances (e.g., insomnia, daytime drowsiness, and sleep apnea risk) and to assess the impact of sleep disturbances on self-reported driving capacity. In their study, sleep was assessed using an index of insomnia (the Insomnia

Severity Index; Bastien et al., 2001), and daytime drowsiness (as measured by the Epworth Sleepiness Scale; Johns, 1991). Driving measures consisted of two items on "overall" and "nighttime" driving abilities with ratings from 0-100, as well as self-reported driving mileage (average number of miles per day) and adverse driving events in the prior year (crashes, near-crashes, traffic infractions, and getting lost). Their findings indicated that older persons continue to drive despite expressing dissatisfaction with their sleep patterns. Furthermore, with respect to self-rated driving abilities, scores were lower in participants with abnormal sleep but only with respect to self-ratings of nighttime driving. However, while Vaz Fragoso and colleagues (2008) reported that participants with abnormal sleep ratings differed from participants without sleep problems on a number of variables (e.g. depression, pain, arthritis, hypertension, and on an index of loneliness), these factors were not statistically considered. Similarly, the influence of age, gender, medication use and type, as well as overall cognitive decline was disregarded. In the present study, we considered these variables in order to better circumscribe the influence of sleep problems on self-reported practices and abilities and, most importantly, to assess the unique contribution of sleep on driving-related outcomes.

Our findings demonstrate that self-reported sleep problems, regardless of severity, have little to no influence on driving practices and abilities as reported by the older driver after excluding those with obstructive sleep apnea. The group differences that were found between the older drivers who stated that their sleep was impaired and those who did not, no longer remained after controlling for a number of other variables. In support of these conclusions, Vaz Fragoso et al. (2008) also concluded that the importance of sleep problems regarding driving was surprisingly minimal, but deserved to be further studied. Using a large prospective cohort of older drivers, we are able to support their conclusion.

Despite their clarity, our findings might have been influenced by a number of methodological issues. Firstly, Candrive II participants were generally healthy older drivers at the time of enrollment. As such, only 22% of participants reported experiencing problems with sleep. Had we included older adults suffering from obstructive sleep apnea in our analysis, the proportion of drivers with sleep problems would reach 28%. This percentage is comparable to what was observed by Vaz Fragoso et al. (2008) who found that one quarter to a third of their sample had an abnormal sleep-related condition. Vaz Fragozo also used two sleep indexes to document abnormal sleep, while sleep was rated using a yes/no question with the Candrive participants. Indeed, for those who completed the SII, only 17 of the 194 (8.8%) participants met criteria (scores of 12 or greater) for impaired sleep (Morin et al. 1994). For most of the other drivers, the reported sleep problem was either minimal or mild as estimated by SII. Although previous researchers suggest that self-report measures may produce misclassification of true sleep patterns (Carskadon et al., 1997; Lauderdale et al., 2008) and driving behaviors (Blanchard et al., 2010; Crizzle et al., 2012), it has also been found that self-reported problems related to sleep quality may be less prone to misclassification than self-reported sleep duration (Stranges et al., 2012).

Nevertheless, the findings of the present study suggest that self-rated severity of sleep problems does not play a large role in self-ratings of driving restrictions or older drivers' perceptions of their abilities. We found no significant relationship between SII scores and scores on the SDF, SDA and PDA. Furthermore, Vaz Fragoso and colleagues (2008) included participants with more severe sleep problems (such as sleep apnea) in their analysis and did not find a relationship between sleep problems and self-ratings of driving. Thus, while sleep disturbances have been found to contribute to lower levels of driving capacity in younger individuals (Garbarino et al., 2001; Lyznicki et al., 1998), sleep-related conditions do not seem to influence self-reported driving frequency, avoidance or perceived driving abilities in older adults.

The representativeness of the Candrive II sample is another issue to consider. To our benefit, we were able to recruit a larger proportion of older females (38.9%) in comparison to the study of Vaz Fragoso et al. (2008, 15%). Moreover, participants were recruited from 7 different urban areas across four Canadian provinces (see Marshall et al., this issue for further description of the sample). Finally, the greatest limitation of this study is our reliance on self-reported data pertaining to both sleep and driving restrictions. Although self-report is the only way to assess driving perceptions of comfort or ability, definitive conclusions regarding the influence of sleep problems on driving behaviour in older drivers will only be ascertained though objective measurement of actual driving patterns that are gathered in a prospective manner. The prospective and longitudinal nature of the Candrive II study will be instrumental in filling this knowledge gap. As indicated by Marshall and colleagues (in this issue), the driving patterns of each participant (as gathered through an in-vehicle GPS device), as well as driving record including the occurrence of crashes, will be documented in the Candrive II study. In addition, it is likely that over time, more Candrive II participants will report having problems with sleep as the prevalence of sleep problems increases with age (Lopez-Torres et al., 2011). Future comparisons will tell whether the presence of sleep problems in a larger sample influences on-road driving outcomes. However, the findings at this stage strongly suggest that the risk of crash should not be elevated in drivers having subclinical sleep problems.

Our findings demonstrate the importance of considering the impact of other variables that relate to sleep and self-reported driving factors and perceptions. Of all the variables examined, age consistently predicted scores on all three self-report driving measures used in this study, while gender predicted scores on both SDF and SDA. The contribution of the number of medical conditions was a significant predictor of PDA and SDF, albeit small. We included BMI as a covariate considering the known association between obesity and sleep problems (Foley et al., 2004). BMI scores made a positive contribution to both SDF and PDA, however, for SDA, BMI scores made a negative contribution. These results should be interpreted with caution. In one large study on the relationship with sleep and obesity, BMI did not contribute to the statistical model. Instead, waist circumference was the reliable obesity variable (Fogelholm et al., 2007). Finally, cognitive decline as estimated by the MoCA was found to be significantly related to SDA. However, the contribution was minimal (.5% of the variance) and should be interpreted in light of previous findings that suggest that cognitive impairment scores were not related to either self-reported driving restrictions (Crizzle et al., 2012; Kowalski et al., 2012) or objectively measured driving exposure (Crizzle et al., 2012).

5. Conclusion

The results of the present study suggest that self-reported subclinical sleep problems and the severity of sleep problems, as assessed through a standardized and validated measure (SII), do not influence driving patterns or perceptions when other factors, such as age, gender, BMI, MoCA score, the number of medical conditions, anticholinergic and benzodiazepine use, and depression, have been controlled for. Instead, several of these confounding factors were significantly associated with situational driving frequency and avoidance, as well as perceived driving abilities. Overall, these findings support the idea that self-reported subclinical sleep problems in older adults are not a reliable indicator of perceived driving patterns and abilities. Future studies should explore the relationship between on-road driving outcomes and sleep problems in order to provide further support for the lack of association between sleep problems and driving performance in older drivers.

Acknowledgements

This study was funded by a Team Grant from the Canadian Institutes of Health Research (CIHR) entitled “The CIHR Team in Driving in Older Persons (Candrive II) Research Program (grant 90429). Candrive researchers are Shawn C. Marshall, Malcolm Man-Son-Hing, Paul Boase, Michel Bédard, Anna Byszewski, Ann B. Cranney, Hillel M. Finestone, Sylvain Gagnon, Isabelle Gélinas, Michel J, Johnson, Nicol Korner-Bitensky, Linda C. Li, Barbara L, Mazer, Frank J. Molnar, Jeannette Montufar, Anita M. Myers, Gary Naglie, Jan A Polgar, Michelle M. Porter, Mark J. Rapoport, Ian G. Stiell, Holly A. Tuokko, Brenda H. Vrkljan, George A. Wells.

References

Abe, T., Komada, Y., Nishida, Y., Hayashida, K., & Inoue, Y. (2010). Short sleep duration and long spells of driving are associated with the occurrence of Japanese drivers' rear-end collisions and single-car accidents. *Journal of Sleep Research, 19*(2), 310-316.

Anstey, K. J., Wood, J., Lord, S., & Walker, J. G. (2005). Cognitive, sensory and physical factors enabling driving safety in older adults. *Clinical Psychology Review, 25*(1), 45-65.

Ball K, Owsley C, Stalvey B, et al. (1998). Driving avoidance and functional impairment in older drivers. *Accident Analysis & Prevention*, *30*, 313–322.

Barrash J., Stillman A., Anderson, S. W., Uc, E. Y., Dawson, J. D., & Rizzo, M. (2010). Prediction of driving ability with neuropsychological tests: demographic adjustments diminish accuracy. *Journal of International Neuropsychological Society*, *16*(4), 679–686.

Bastien, C. H., Vallieres, A., & Morin, C. M. (2001). Validation of the insomnia severity index as an outcome measure for insomnia research. *Sleep Medicine*, *2*, 297–307.

Beebe, D. W., Lewin, D., Zeller, M., et al. (2006). Sleep in overweight adolescents: shorter sleep, poorer sleep quality, sleepiness, and sleep-disordered breathing. *Journal of Pediatric Psychology*, *104*, 1– 11.

Bjorngaard, J. H., Bjerkeset, O., Romundstad, P., & Gunnell, D. (2011). Sleeping problems and suicide in 75,000 Norwegian adults: A 20 year follow-up of the HUNT I study. *Sleep, 34*(9), 1155-1159.

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

Blanchard, R. A., Myers, A. M., & Porter, M. M. (2010). Correspondence between self-reported and objective measures of driving exposure and patterns in older drivers. *Accident Analysis & Prevention*, *42*, 523e9.

Carskadon, M. A., Acebo, C., Wolfson, A., Tzischinsky, O., & Darley, C. (1997). REM sleep on MSLTS in high school students is related to circadian phase. *Sleep Research, 26*, 705.

Chen, Q., Hayman, L. L., Shmerling, R. H., Bean, J. F., & Leveille, S. G. (2011). Characteristics of chronic pain associated with sleep difficulty in older adults: The maintenance of balance, independent living, intellect, and zest in the elderly (MOBILIZE) Boston study. *Journal of the American Geriatrics Society, 59*(8), 1385-1392.

Cohen, D. A., Wang, W., Wyatt, J. K., Kronauer, R. E., Dijk, D. J., Czeisler, C. A., & Klerman, E. B. (2010). Uncovering residual effects of chronic sleep loss on human performance. *Science Translational Medicine, 2*(14), 14ra3.

Connor, J., Norton, R., Ameratunga, S., Robinson, E., Civil, I., Dunn, R., & Jackson, R. (2002). Driver sleepiness and risk of serious injury to car occupants: Population based case control study. *British Medical Journal (Clinical Research Ed.), 324*(7346), 1125.

Crizzle, A. M. & Myers, A.M. (2012). Examination of naturalistic driving practices in drivers with Parkinson's disease compared to age and gender-matched controls. *Accident Analysis & Prev*ention, http://dx.doi.org/10.1016/j.aap.2012.06.025.

Crizzle, A. M., Myers, A. M., & Almeida, Q. J. (2012). Self-regulatory practices of drivers with Parkinson's disease: Accuracy of patient reports. *Parkinsonism and Related Disorders*, http://dx.doi.org/10.1016/j.parkreldis.2012.09.003.

Czeisler, C. A. (2011). Impact of sleepiness and sleep deficiency on public health--utility of biomarkers. *Journal of Clinical Sleep Medicine : JCSM : Official Publication of the American Academy of Sleep Medicine, 7*(5 Suppl), S6-8.

Dennis, M., Kadri, A., & Coffey, J. (2012). Depression in older people in the general hospital: A systematic review of screening instruments. *Age and Ageing, 41*(2), 148-154.

Dubois, S., Bedard, M., & Weaver, B. (2008). The impact of benzodiazepines on safe driving. *Traffic Injury Prevention, 9*(5), 404-413.

Ellen, R. L., Marshall, S. C., Palayew, M., Molnar, F. J., Wilson, K. G., & Man-Son-Hing, M. (2006). Systematic review of motor vehicle crash risk in persons with sleep apnea. *Journal of Clinical Sleep Medicine, 2*(2), 193-200.

Filtness, A. J., Reyner, L. A., & Horne, J. A. (2011). Moderate sleep restriction in treated older male OSA participants: greater impairment during monotonous driving compared with controls. Sleep Medicine, 12(9), 838-843.

Fogelholm, M., Kronholm, E., Kukkonen-Harjula, K., Partonen, T., Partinen, M., & Harma, M. (2007). Sleep-related disturbances and physical inactivity are independently associated with obesity in adults. *International Journal of Obesity, 31*, 1712-1721.

Foley, D., Ancoli-Israel, S., Britz, P., & Walsh, J. (2004). Sleep disturbances and chronic disease in older adults: Results of the 2003 national sleep foundation sleep in America survey. *Journal of Psychosomatic Research, 56*(5), 497-502.

Foley, D. J., Monjan, A. A., Brown, S. L., Simonsick, E. M., Wallace, R. B., & Blazer, D. G. (1995). Sleep complaints among elderly persons: An epidemiologic study of three communities. *Sleep, 18*(6), 425-432.

Garbarino, S., Nobili, L., Beelke, M., et al. (2001). The contributing role of sleepiness in highway vehicle accidents. *Sleep*, *24*, 203–206.

Howard, M. E., Desai, A. V., Grunstein, R. R., Hukins, C., Armstrong, J. G., Joffe, D., & Pierce, R. J. (2004). Sleepiness, sleep-disordered breathing, and accident risk factors in commercial vehicle drivers. *American Journal of Respiratory and Critical Care Medicine, 170*(9), 1014-1021.

Hunt, L. A., Morris, J. C., Edwards, D., & Wilson, B. S. (1993). Driving performance in persons with mild SDAT. *Journal of the American Geriatrics Society*, *41*, 747–753.

Johns, M. (1991). Sleepiness in different situations measured by the Epworth sleepiness scale. *Sleep*, *14*, 540–545.

Koppel, S., Bohensky, M., Langford, J., & Taranto, D. (2011). Older drivers, crashes and injuries. *Traffic Injury Prevention, 12*(5), 459-467.

Kowalski, K., Love, J., Tuokko, H., MacDonald, S., Hultsch, D., & Strauss, E. (2012). The influence of cognitive impairment with no dementia on driving restriction and cessation in older adults. *Accidents Analysis and Prevention*, *49*, 308-315.

Langford, J., & Koppel, S. (2006). Epidemiology of older driver crashes - identifying older driver risk factors and exposure patterns. *Transportation Research Part F: Psychology and Behavior, 9*(5), 309-321.

Lauderdale, D. S., Knutson, K. L., Yan, L. L., Liu, K., & Rathouz, P. J. (2008). Self-reported and measured sleep duration: how similar are they? *Epidemiology*, *19*, 838-845.

Leproust, S., Lagarde, E., & Salmi, L. R. (2008). Systematic screening for unsafe driving due to medical conditions: Still debatable. *BMC Public Health*, *8*, 27.

Lopez-Torres Hidalgo, J., Navarro Bravo, B., Parraga Martinez, I., Andres Pretel, F., Tellez Lapeira, J., & Boix Gras, C. (2011). Understanding insomnia in older adults. *International Journal of Geriatric Psychiatry,* doi: 10.1002/gps.2834; 10.1002/gps.2834

Lyman, J. M., McGwin, G., & Sims, R. V. (2001). Factors related to driving difficulty and habits in older drivers. *Accident Analysis & Prevention*, *33*, 413–421.

Lyznicki, J. M., Doege, T. C., Davis, R. M., Williams, M. A. (1998). Sleepiness, driving, and motor vehicle crashes. *Journal of the American Medical Association*, 279, 1908–1913.

MacDonald, L. M., Myers, A. M., & Blanchard, R. A. (2008). Correspondence between older drivers' perceptions, abilities and driving behavior. *Topics in Geriatric Rehabilitation, 24*, 239-252.

Marshall, S. C. (2008). The role of reduced fitness to drive due to medical impairments in explaining crashes involving older drivers. *Traffic Injury Prevention, 9*(4), 291-298.

Marshall, S., Man-Son-Hing[a], M., Bédard, M., Charlton, J.L. Gagnon, S. et al. , (Under review). Protocol for Candrive II/Ozcandrive, a multicentre prospective older driver cohort study.

McGwin, G. Jr, Sims, R. V., Pulley, L., & Roseman, J. M. (2000). Relations among chronic medical conditions, medications, and automobile crashes in the elderly: A population-based case-control study. *American Journal of Epidemiology, 152*(5), 424-431.

Morin, C. M. (1993). *Insomnia. Psychological assessment and management.* New York: Guilford Press.

Morin, C. M., & Azrin, N. H. (1988). Behavioral and cognitive treatments of geriatric insomnia. *Journal of Consulting and Clinical Psychology*, *56*, 137–146.

Morin, C., Stone, J., McDonald, K., & Jones, S. (1994). Psychological management of insomnia: A clinical replication series with 100 patients. *Behavior Therapy*, *25*(2), 291-309.

Nabi, H., Gueguen, A., Chiron, M., Lafont, S., Zins, M., & Lagarde, E. (2006). Awareness of driving while sleepy and road traffic accidents: Prospective study in GAZEL cohort. *British Medical Journal (Clinical Research Ed.), 333*(7558), 75.

Nasreddine, Z. S., Phillips, N. A., Bedirian, V., Charbonneau, S., Whitehead, V., Collin, I., & Chertkow, H. (2005). The Montreal cognitive assessment, MoCA: A brief screening tool for mild cognitive impairment. *Journal of the American Geriatrics Society, 53*(4), 695-699.

Ohayon, M. M. (2002). Epidemiology of insomnia: What we know and what we still need to learn. *Sleep Medicine Reviews, 6*(2), 97-111.

Peppard, P. E., Young, T., Palta, M., & Skatrud, J. (2000). Prospective study of the association between sleep-disordered breathing and hypertension. *The New England Journal of Medicine, 342*(19), 1378-1384.

Philip, P., Sagaspe, P., Moore, N., Taillard, J., Charles, A., Guilleminault, C., & Bioulac, B. (2005). Fatigue, sleep restriction and driving performance. *Accident; Analysis and Prevention, 37*(3), 473-478.

Philip, P., Sagaspe, P., Taillard, J., Moore, N., Guilleminault, C., Sanchez-Ortuno, M., Bioulac, B. (2003). Fatigue, sleep restriction, and performance in automobile drivers: A controlled study in a natural environment. *Sleep, 26*(3), 277-280.

Powell, N. B., Schechtman, K. B., Riley, R. W., Li, K., Troell, R., & Guilleminault, C. (2001). The road to danger: The comparative risks of driving while sleepy. *The Laryngoscope, 111*(5), 887-893.

Rapoport, M. J., Zagorski, B., Seitz, D., Herrmann, N., Molnar, F., & Redelmeier, D. A. (2011). At-fault motor vehicle crash risk in elderly patients treated with antidepressants. *The American Journal of Geriatric Psychiatry, 19*(12), 998-1006.

Sagaspe, P., Taillard, J., Bayon, V., Lagarde, E., Moore, N., Boussuge, J., & Philip, P. (2010). Sleepiness, near-misses and driving accidents among a representative population of french drivers. *Journal of Sleep Research, 19*(4), 578-584.

Sagberg, F. (2006). Driver health and crash involvement: A case-control study. *Accident; Analysis and Prevention, 38*(1), 28-34.

Sleep in america poll. (2012). Retrieved from www.sleepfoundation.org.

Stranges, S,Tigbe, W., Gómez-Olivé, F. X., Thorogood, M., & Kandala, N. B. (2012). Sleep Problems: An Emerging Global Epidemic? Findings From the INDEPTH WHO-SAGE Study Among More Than 40,000 Older Adults From 8 Countries Across Africa and Asia. *Sleep*, *35*(8), 1173–1181.

Ting, P. H., Hwang, J. R., Doong, J. L., & Jeng, M. C. (2008). Driver fatigue and highway driving: A simulator study. *Physiology & Behavior, 94*(3), 448-453.

Vanlaar, W., Simpson, H., Mayhew, D., & Robertson, R. (2008). Fatigued and drowsy driving: A survey of attitudes, opinions and behaviors. *Journal of Safety Research, 39*(3), 303-309.

Vaz Fragoso, C. A., Araujo, K. L. B., Van Ness, P. H., & Marottoli, R. A. (2008). Prevalence of sleep disturbances in a cohort of older drivers. *The Journals of Gerontology: Series A: Biological Sciences and Medical Sciences, 63A*(7), 715-723.

Verster, J. C., Veldhuijzen, D. S., & Volkerts, E. R. (2004). Residual effects of sleep medication on driving ability. *Sleep Med Rev*, *892* (4), 309-325.

Vitiello, M. V. (1997). Sleep disorders and aging: Understanding the causes. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 52*(4), M189-91.

Yesavage, J. A., Brink, T. L., Rose, T. L., Lum, O., Huang, V., Adey, M., & Leirer, V. O. (1982). Development and validation of a geriatric depression screening scale: A preliminary report. *Journal of Psychiatric Research, 17*(1), 37-49.

Table 1. Demographics, health, and cognitive functioning of older drivers with/without sleep problems based on self-reporting (yes/no).

	No Sleep Problems (Self-reported)			Sleep Problems (Self-reported)				
Variables	N	Participant N (%)	*M* (SD)	N	Participant N (%)	*M* (SD)	*t*	χ^2
Age	668		76.4 (4.9)	194		76.02 (4.8)	.90	
Gender	668			194				10.57^{***}
Male		424 (63.5)			98 (50.5)			
Female		244 (36.5)			96 (49.5)			
Number of Chronic Conditions	668		7.0 (3.3)	194		8.5 (3.6)	5.52^{***}	
Body Mass Index (BMI)	665		27.2 (4.9)	194		26.9 (4.1)	0.82	
Montreal Cognitive Assessment (MoCA) Score	666		25.9(2.5)	194		26.2(2.2)	1.61	
>26		286(2.9)			91(46.9)			
<26		380(57.1)			103(53.1)			
Medication Use								
Anticholinergics	668			194				4.23*
Yes		7 (1.0)			6 (3.1)			
No		661 (99.0)			188 (96.9)			
Benzodiazepines	668			194				3.20^{***}
Yes		43 (6.4)			39 (20.1)			
No		625 (93.6)			155 (79.7)			
Geriatric Depression Scale (GDS)	668			194				6.10^{*}
GDS Score ≤ 5		659 (98.7)			186 (95.9)			
GDS Score > 5		9 (1.3)			8 (4.1)			
Situational Driving Frequency (SDF) Score	656		35.57(7.47)	190		33.80(7.08)	2.90**	
Situational Driving Avoidance (SDA) Score	657		5.26(4.11)	191		5.71(4.15)	1.33	
Perceived Driving Abilities (PDA) Score	657		36.34(6.01)	191		34.21(6.27)	4.26***	

Note. * $p < 0.05$; ** $p < 0.01$; *** $p \leq 0.001$; M = Mean; SD = Standard Deviation.

Table 2. Self-reported sleep problems (yes/no), driving patterns and perceived driving abilities. Results of the regression analysis with self-declared sleep problems as a predictor.

Subjective Sleep Problems		Situational Driving Frequency n = 840[a]		Situational Driving Avoidance n = 842[a]		Perceived Driving Abilities n = 842[a]	
		β	t	β	t	β	t
Control Variables	Age	-.17**	5.03	.18**	5.16	-.13**	3.87
	Gender	-.23**	6.71	.18**	5.36	-0.02	0.51
	BMI	.15**	4.33	-.09**	2.48	0.11**	3.17
	MoCA	.06	1.84	-.07*	2.01	-0.01	0.15
	Number of Medical Conditions	-.13**	3.74	0.07	1.87	-.18**	4.98
	Anticholinergics Use	-.02	.54	0.00	0.05	0.01	0.37
	Benzodiazepine Use	.02	.70	0.05	1.49	0.04	1.26
	Depression	-.04	1.36	0.04	1.26	-0.04	1.08

[a] Totals vary owing to missing variables. β = Standardized Beta; * p <.05 **; p < .01

Table 3. Sleep Impairment Index, driving patterns and perceived driving abilities.

Results of the regression analysis with Sleep Impairment Index score as a predictor.

Sleep Impairment Index Score		Situational Driving Frequency n = 190[a]		Situational Driving Avoidance n = 191[a]		Perceived Driving Abilities n = 191[a]	
		β	t	β	t	β	t
Control Variables	Age	-.24**	3.40	.22**	3.02	-.21**	2.88
	Gender	-0.23**	3.22	.16*	2.12	-0.02	0.23
	BMI	0.12	1.61	-.15*	1.97	.17*	2.24
	MoCA	0.09	1.18	-.02	.26	.07	0.99
	Number of Medical Conditions	-0.08	1.08	0.03	.33	-.21**	2.86
	Anticholinergic Use	-0.02	0.32	-.03	0.37	0.01	0.18
	Benzodiazepine Use	0.11	1.59	0.02	.26	0.09	1.25
	Depression	-0.01	.14	.02	.31	-0.04	.58

[a] Totals vary owing to missing variables. β = Standardized Beta; * p <.05 **; p < .01