A Re-examination of Driving-Related Attitudes and Readiness to Change Driving Behavior in Older Adults

Holly Tuokko[a], Alexandra Jouk[a], Anita Myers[b] Shawn Marshall[c], Malcolm Man-Son-Hing[c], Michelle M Porter[d], Michel Bédard[e], Isabelle Gélinas[fg], Nicol Korner-Bitensky[fg], Barbara Mazer[fg], Gary Naglie[hij], Mark Rapoport[k], Brenda Vrkljan[l] on behalf of the Candrive II Research Team

[a] Centre on Aging, University of Victoria, PO Box 1700 STN CSC, Victoria BC, V8W 2Y2

[b] School of Public Health & Health Systems, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1

[c] Ottawa Hospital Research Institute, University of Ottawa, Ottawa, Ont., Canada

[d] Faculty of Kinesiology and Recreation Management, University of Manitoba, Winnipeg, Man., Canada

[e] Centre for Research on Safe Driving, Lakehead University, Thunder Bay, Ont., Canada

[f] School of Physical & Occupational Therapy, McGill University, Montreal, Que., Canada

[g] Centre de Recherche Interdisciplinaire en Réadaptation du Montréal Métropolitain

[h] Research Department, Toronto Rehabilitation Institute, 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, Toronto, Ont., Canada

[k] Department of Psychiatry, University of Toronto, Toronto, Ont., Canada

[l] School of Rehabilitation Science, McMaster University, Hamilton, Ont., Canada

Address correspondence to: Holly Tuokko, PhD, RPsych, Director, Centre on Aging, University of Victoria, PO Box 1700 STN CSC, Victoria BC, V8W 2Y2. Telephone: 1-250-721-6350; Email: htuokko@uvic.ca

Declaration of Interest

The authors report no declarations of interest.

Abstract

Aims: A detailed, in-depth examination of attitudes relevant to driving restriction practices was examined in 928 active drivers aged 70 and older.

Method: The number of reported *conditions* and *reasons* for restricting driving were examined in relation to theory-based (Transtheoretical Model, Theory of Planned Behavior) attitudinal constructs.

Results: Those more likely to restrict driving consistently showed more negative attitudes toward driving, whereas those less likely to restrict were inconsistent with respect to perceived benefits of driving and social pressure to continue driving. Self-referent attitudes toward driving were more strongly associated with reported restricted driving than attitudes toward driving held in relation to others. Attitudinal constructs from the Transtheoretical Model were more consistently related to driving restriction than those from the Theory of Planned Behavior.

Conclusion: Theory-based attitudinal constructs are strongly related to driving restriction practices, but longitudinal data is needed to examine in more detail the role of attitudes in the behavior change process.

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Keywords: Older driver, behavior change, attitudes, self-regulation, driving restriction, Transtheoretical Model of Behavior Change, Theory of Planned Behavior

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The older adult population, and the number of adults who rely on driving as their primary means of transportation in later life, is increasing (Turcotte 2012). Changes in physical and cognitive functioning related to driving occur with increasing age and in relation to age-related diseases which may increase an individual's risk for crashes and other unsafe driving behaviors (Anstey et al., 2005; Dobbs 2002). However, older adults may voluntarily regulate their driving or strop driving altogether, limiting exposure to risky driving situations (Marottoli et al., 1998; Donorfio et al., 2008). Since mobility is critical for maintaining independence and the quality of life of the older adult, it is important to examine factors that influence driving behaviors and driver behavior change.

Older driver self-regulatory practices have been characterized along a continuum from complete driving independence, through restrictions on driving exposure and conditions (when and where they drive), to driving cessation (e.g., Baldock et al., 2006; Charlton, et al. 2006). Self-regulation can be viewed as the activation of compensatory risk reduction strategies (Donorfio et al., 2009). The activation of such practices is dependent on awareness or perceptions of risk and a number of studies have examined driving behavior change in relation to awareness of, and subsequent compensation for, age-associated physical and cognitive decline (e.g., Gwyther et al., 2012). Driver behavior change may also be influenced by attitudes and beliefs about driving and openness to change. These factors have been proposed to act as the psychological mediators between knowledge and behavior in social sciences theories of behavior change (Tuokko et al., 2006).

Behavior change models such as the Transtheoretical Model of Behavior Change (TM) and the Theory of Planned Behavior (TPB) have been developed to examine the process of behavior change in other contexts (e.g., smoking, exercise). In the TM (Prochaska et al., 1982), stages in the change process are identified, and transitions between stages are explicitly addressed. The TM proposes that behavior change progresses through six stages: pre-contemplation (not planning to change); contemplation (considering changing in the future); preparation (preparing to change in the near future); action (beginning to change); maintenance (behavior has changed); and termination (behavior has stopped). Conditions which promote movement between stages have been identified (Prochaska et al., 1997) and include factors such as attitudes and beliefs about the behavior. Similarly, the TPB (Ajzen 1991) examines how attitudes toward the behavior influence intention to perform the behavior. According to the TPB, intention is determined by favorable or unfavorable views toward the behavior (i.e., Affective Attitude), the importance or salience of the behavior (i.e., Instrumental Attitude), whether other people, important to the individual, think the behavior should be performed (i.e., Subjective Norm), and the perceived ability to perform the behavior (i.e., Perceived Control). Relatively recently, these theories have been applied to driving behavior (e.g., Gwyther et al., 2012; Tuokko et al., 2006; Kowalski et al., 2014).

It has been suggested that driving behavior change observed in older drivers (i.e., from independence through restrictions to driving cessation) can be conceptualized as TM-like stages (Sterns et al., 2001). It has also been noted that constructs derived from the TM and TPB models may provide useful insights into driving behavior change processes of older adults (Tuokko et al., 2006; Lindstrom-Forneri et al., 2007). As yet, very little research has applied constructs derived from these theoretical models and the studies that have are limited by differences in

samples (e.g., small size, ages of participants), the detail and depth with which the constructs have been operationalized, and, to our knowledge, no studies have examined constructs derived from different theories in relation to one another in the same sample.

The purpose of the present study was to examine, in a large sample of older drivers (n=928) aged 70 and older, the relations between driving-related attitudes and readiness to change driving behavior observed previously in smaller, younger samples. Although the constructs derived from different theories are similar, they are not identical and we sought to examine both sets of constructs (i.e., TM, TPB) in relation to readiness to change driving behavior within a single sample. Based on the findings from the pilot study examining decisional balance constructs (Tuokko et al., 2006), it was hypothesized that: (1) those more likely to be restricting their driving would show more negative attitudes toward driving (Con-self) and, (2) the driving of those less likely to be restricting would be reported as more positively affecting others (Pro-other). In addition, based on findings from the study examining TPB constructs (Lindstrom-Forneri et al., 2007), it was hypothesized that: (3) those less likely to be restricting their driving would report perceiving greater benefits of driving (i.e., Instrumental Attitude), and (4) and those less likely to be restricting their driving would perceive greater social pressure to drive (i.e., Subjective Norm). It was anticipated that this examination would provide a more detailed and in-depth examination of attitudes relevant to older driver behavior and decision-making.

Method

Participants

All participants were taking part in the Canadian Driving Research Initiative for Vehicular Safety in the Elderly (Candrive II) common cohort prospective study (see Marshall et al., 2013,

for more details). At baseline, 928 active drivers, 70 years of age and older, were enrolled through media outlets (e.g., newspapers, radio and television coverage) in seven Canadian cities (i.e., Ottawa, Toronto, Hamilton, Thunder Bay, Montreal, Winnipeg and Victoria). Those volunteers aged 70 years or older, with a valid driver's license, who were driving one vehicle 70% of the time when recruited, and who intended to continue driving for at least five years, were eligible to take part. Those with medical contraindications for driving and those with a progressive condition that would affect their driving (e.g., Parkinson's disease) were excluded from participation. The study received ethical approval by the human research ethics board at each participating institution and each participant provided written informed consent. Participants underwent a comprehensive baseline assessment that included demographic measures as well as measures of driving behaviors and driving-related attitudes and measures of driving behaviors.

Procedure

Once enrolled in the Candrive II common cohort study, participants underwent a comprehensive assessment, including a battery of psychological, health and functional measures, at baseline and yearly thereafter (see Marshall et al., 2013, for more details). Only data from the baseline survey was used in the current analyses.

Measures

As part of the baseline data collection for the Candrive II common cohort, drivers completed questionnaires concerning their attitudes toward driving (e.g., Decisional Balance Plus; Tuokko et al., 2006; Lindstrom-Forneri et al., 2007) and a questionnaire concerning their driving habits and intentions (i.e., Driving Habits and Intentions; Kowalski et al., 2011). The 36 items on the Decision Balance Plus scale reflect attitudes toward driving and intention to

continue driving. The items examined positive aspects of driving relevant for the individual (Pro-self; e.g., driving a vehicle is pleasurable; nine items), positive aspects of driving relevant for others (Pro-other; e.g., others count on me being able to drive; seven items), negative aspects of driving relevant for the individual (Con-self; e.g., the financial cost of maintaining a vehicle is an increasing concern of mine; nine items), and negative aspects of driving relevant to others (Con-other; e.g., my driving bothers other people; six items). In addition, the items can be recombined to reflect the TPB constructs (Lindstrom-Forneri et al., 2007) of Affective Attitude (e.g., driving is pleasurable; three items), Instrumental Attitude (e.g., driving is important; three items), Subjective Norm (e.g., my friends drive their vehicles regularly; three items) and Perceived Control (e.g., physical demands of driving; three items). One item on each of the Affective Attitude and Subjective Norm subscales was reverse coded so all responses were framed in the negative. Two additional items addressed intention towards driving (e.g., I plan to continue driving in the foreseeable future; two items). A five-point Likert-type scale, with responses ranging from 1 (Strongly Agree) to 5 (Strongly Disagree), was used for all 36 questions. Low scores reflect more positive attitudes toward driving for the Pro-self, Pro-other, Instrumental Attitude, and Intention subscales. Low scores reflect more negative attitudes toward driving for the Con-self, Con-other, Affective Attitude, Subjective Norm, and Perceived Control subscales.

On the Driving Habits and Intentions questionnaire (Kowalski et al., 2011), participants were asked if they prefer to NOT drive under certain *conditions* (i.e., restrict their driving) and the *reasons* for restricting their driving. Respondents who indicated they were restricting their driving could endorse up to 17 different *conditions* under which they preferred to NOT drive (Table 1) including space to indicate *other* conditions. For the 66 people who provided *other* responses, a decision was made as to whether to include the response if: (1) it fit with existing

categories (*n* = 52) or (2) it fit within the *reasons* question (and, if so, was removed as a *condition*; *n* = 4). Once these corrections to the *other* category were made, a total of 10 *other* conditions remained. Respondents could endorse up to 18 different *reasons* for restricting their driving (Table 1). Of those restricting their driving, 146 indicated *other* reasons. Each of the *other* responses was examined and a decision was made as to whether: (1) it fit within existing categories (*n* = 28), (2) the *reason* fit within the *conditions* question (and, if so, was removed as a *reason*, *n* = 67), or (3) another category was required (i.e., environmental concerns, *n* = 7). Once these corrections to *other* category were made, a total of 44 *other* reasons remained.

[Insert Table 1 about here]

Respondents who indicated they were NOT restricting their driving, and did not intend to restrict their driving within the next 6 months, were asked about reasons why they might consider restricting their driving in the future. The response options paralleled the *reasons* provided for those currently restricting their driving (see Table 1), with the additional of one item (i.e., specific age). Of those NOT restricting their driving but who endorsed reasons why they might consider restricting their driving in the future (*n* = 533), 26 indicated *other* reasons. Each of the *other* responses was examined and 12 fit within existing categories. After corrections to the *other* category were made, a total of 10 *other* reasons remained.

Analyses

To address the specific hypotheses, comparisons were made between: (1) those restricting their driving and those who were not; (2) those restricting their driving who differed with respect to the number of *conditions* and *reasons* identified; and (3) those not restricting their driving who differed with respect to the number of identified *reasons* why they might restrict their driving in the future. Table 2 illustrates this analytic framework in relation to the TM stages of change.

Gender and age were examined in each set of analyses, as it is known that driving-related attitudes may differ in relation to these factors (Donorfio et al., 2008).

[Insert Table 2 about here]

Restricting versus not restricting. Those presently restricting (n = 366) and those not restricting, who indicated they would consider restricting in the future (n = 533) were compared with respect to demographic characteristics and their responses on each of the DB and TPB subscale scores. Chi-square tests were used to compare groups on age categories and gender. ANOVAs were used to compare the groups on each subscale score from each theoretical position (four subscales within the TM, four subscales within the TPB), and Bonferroni's correction for multiple comparisons was applied to adjust for the inflation of Type I errors in group-level comparisons (i.e., $0.05/4 = \alpha < 0.01$) within the TM and the TPB.

Restricting. For those restricting their driving, frequencies were tabulated for: (1) reported *conditions* under which driving was being restricted, and (2) reported *reasons* for restricting driving. The *conditions* and *reasons* were summed separately including the *other* responses and the distributions divided into approximately equal thirds to reflect those identifying fewer or more *conditions* or *reasons* for restricting driving. This was done based on the assumption that those restricting driving under more *conditions* or identifying more *reasons* to restrict their driving may be further along in the change process. That is, it may be that these groupings reflect different stages in the change process. The resulting groups were compared on the DB and TPB subscale scores using the methods noted above (i.e., ANOVAs).

Not restricting. For those not currently restricting their driving, the number of *reasons* for which they would consider restricting their driving in the future was tabulated. The distribution was divided into approximately equal thirds to reflect those identifying fewer or

more reasons why they would consider restricting driving. Once again, this was done based on the assumption that those identifying more *reasons* why they would consider restricting their driving may be further along in the change process. That is, it may be that these groupings reflect different stages within the contemplative stage of the change process. The resulting groups were compared on the DB and TPB subscale scores using the methods noted above (i.e., ANOVAs).

Results

A summary of the results by hypothesis is shown in Table 3.

[Insert Table 3 about here]

Restricting versus Not Restricting

Descriptive data for age and gender are shown in Table 4. The group currently restricting driving (n = 366) differed from the group not currently restricting their driving (n = 533) with respect to gender, $p < .001$, but not age, $p < .095$. A larger proportion of women (51.8% = 175/338) were restricting their driving than men (34% = 191/561). Each DB and TPB subtest score was analyzed with separate 2 (groups) x 2 (gender) ANOVAs. The means and standard deviations for the DB and TPB scores by gender are shown in Table 5 as are the ANOVA results. Main effects of group were observed for all 4 DB subscale scores: Pro-self, $p < .001$; Con-self, $p < .001$; Pro-other, $p < .001$; and, Con-other, $p < .001$. Those restricting driving were less positive and more negative about their own driving, and perceived others as viewing their driving negatively. In addition, a main effect of gender was observed for Con-other, $p < .001$, with men perceiving others as viewing their driving more negatively than women. No interaction effects reached statistical significance. For the TPB subscale scores, main effects of group were observed for Affective Attitude, $p < .001$, Subjective Norm, $p < .001$, and Perceived Control, $p < .001$. Those restricting driving were more negative about driving and more negative about their

abilities to drive than those not restricting. A main effect of gender was observed for Instrumental Attitude, $p < .001$, with women reporting driving as more important to their daily lives than men. No interaction effects reached statistical significance.

[Insert Table 4 about here]

[Insert Table 5 about here]

Restricting. For the group currently restricting, the frequencies of reported conditions under which they restrict their driving and the reasons for restricting their driving are shown in Table 1. Groups based on the distributions of *conditions* under which driving was restricted (Group 1 = 0 or 1 condition, Group 2 = 2 or 3 conditions, Group 3 = 4 or more conditions), did not differ by gender, χ^2 (2, $N = 366$) = 4.99, $p < .08$ or age, χ^2 (6, $N = 366$) = 10.86, $p < .09$. Each DB and TPB subtest score was analyzed with one-way ANOVAs (see Table 6). The groups differed significantly on all four DB subscale scores, Pro-self, $p < .001$; Con-self $p < .001$; Pro-other, $p < .001$; and, Con-other, $p < .004$. Significant differences (Tukey HSD, $p < .001$) between all three groups were apparent for the Pro-self and Con-self subscales, indicating that those restricting under more conditions were less positive and more negative about their own driving. The Pro-other and Con-other scores only differed between the groups with the fewest and most reported conditions under which they restricted their driving. These groups also differed significantly on the TPB constructs (see Table 6) of Affective Attitude, $p < .001$, Instrumental Attitude, $p < .001$, and Perceived Control, $p < .001$. Significant differences (Tukey HSD, $p < .001$) between all three groups were apparent for the Affective and Instrumental Attitude subscales, with those restricting under more conditions evaluating their driving less favorably and viewing driving as more challenging than those restricting their driving under fewer conditions. The Perceived Control scores only differed between the groups with the fewest and

most reported conditions under which they restricted their driving, with the difference between these groups and the middle group approaching significance ($p < .003$).

Groups based on the distributions of *reasons* for restricting driving (Group 1= no reasons reported; Group 2 = 1 reason reported; Group 3 = 2 or more reasons reported) did not differ by gender, χ^2 (2, $N = 366$) = 1.92, $p < .384$ or age, χ^2 (6, $N = 366$) = 6.47, $p < .373$. Each DB and TPB subtest score was analyzed with one-way ANOVAs (see Table 7). The groups only differed for two of the DB subscale scores: Con-self, $p <.001$; and Con-other, $p <.006$. Significant differences (Tukey HSD, <.001) were apparent only between the groups with the fewest and most reported reasons for restricting their driving, with those reporting more reasons for restricting being more negative about their own driving and perceiving others as viewing their driving negatively. The groups did not differ significantly on any of the TPB subscale scores (see Table 7), although Affective Attitude approached significance, with those reporting more *reasons* under which they were restricting driving being more negative toward driving than those reporting fewer *reasons*.

[Insert Table 6 about here]

[Insert Table 7 about here]

Not restricting. Groups based on the distributions of reasons why those NOT currently restricting would consider doing so in the future (Group 1 = 1-9 reasons; Group 2 = 10-12 reasons ; Group 3 = 13 or more reasons) did not differ by gender, χ^2 (2, $N = 533$) = 2.48, $p < .289$ or age, χ^2 (6, $N = 533$) = 9.844, $p < .131$. When each DB and TPB subtest scores were analyzed with one-way ANOVAs, the groups did not differ on any of the DB or TPB subscale scores (see Table 8).

[Insert Table 8 about here]

Discussion

When examining decisional balance constructs in relation to readiness to change driving behavior defined in a number of different ways (i.e., TM stages; see Table 2 and Table 3) in a large sample of drivers aged 70 years and over, the results typically substantiated previous findings observed in a smaller, younger sample (Tuokko, et al., 2006). More negative attitudes toward driving (i.e., Hypothesis 1; Con-self) were seen for those restricting their driving in relation to those not restricting driving, between all three groups differing on number of *conditions* under which they were restricting, and between those reporting the fewest and most *reasons* for restricting their driving (i.e., in the action through maintenance stages from Table 2). No differences were observed for groups who reported they would consider restricting driving for fewer or more reasons (i.e., in the pre-contemplative through preparation stages, see Table 3).

In support of Hypothesis 2 (Pro-other), those who were not restricting their driving in relation to those restricting, and those who were restricting driving under the fewest *conditions* in relation to those reporting the most *conditions*, reported that their driving more positively affected others. However, reports that their driving more positively affected others did not differ between those reporting fewer or more *reasons* for restricting their driving. No differences were observed for groups who reported they would consider restricting driving for fewer or more reasons (i.e., in the pre-contemplative through preparation stages, see Table 3).

In addition to these hypothesized differences on measures of Decisional Balance constructs, it was observed that perceptions that others viewed their driving more negatively (i.e., Con-other) were apparent for those who were restricting their driving in relation to those not restricting driving, and those reporting the fewest and most *conditions* and *reasons* for restricting their driving. Moreover, more positive attitudes toward driving (i.e. Pro-self) were seen for those

who were not restricting driving in relation to those who were, and between all three groups differing with respect to the number of *conditions* under which driving was restricted. As seen in relation to Pro-other, positive attitudes toward driving did not differ for those differing with respect to the number of *reasons* for restricting their driving. As was apparent for Con-self and Pro-other, no differences were observed for groups who reported they would consider restricting driving for fewer or more *reasons* for Con-other or Pro-self (i.e., in the pre-contemplative through preparation stages, see Table 3).

The findings (see Table 3) that all three groups based on the number of self-imposed *conditions* under which driving was restricted differed with respect to both positive and negative attitudes held in relation to oneself (Pro-self and Con-self), whereas only those with the fewest and greatest number of *conditions* differed with respect to positive and negative attitudes held in relation to others (Pro-other and Con-other) suggests that the self-referent attitudes toward driving may be stronger influences for behavior change (or not) than attitudes toward driving held in relation to others. In addition, the findings that those with the fewest and greatest number of *reasons* for restricting driving differed with respect to both negative attitudes held in relation to oneself (Con-self) and others (Con-other), but no differences were seen in relation to positive attitudes held in relation to oneself (Pro-self) or others (Pro-other), suggests that negative attitudes may be stronger influences for behavior change than positive ones. These apparent differences in the findings for groups based on number of reported *conditions* under which driving was restricted versus number of identified *reasons* for restricting driving may relate to difference as to points in time when *conditions* or *reasons* are identified in relation to behavior change. As this data is cross-sectional in nature, it is not possible to address the sequence in which the conditions or reasons were identified. However, it was apparent that most of those

who reported restricting driving reported one or more *conditions* under which they were restricting whereas approximately 38% (139/366) of this sample did not indicate any *reasons* why they were restricting their driving. Thus, it appears that these drivers were able to articulate *conditions* (i.e., driving situations where they restrict driving) but often were not able to attribute these changes to specific *reasons*. In future longitudinal research, it will be important to determine the nature of sequential changes in reporting of *conditions* under which driving behavior is changed and identified *reasons* for changing.

Although it was apparent that attitudes toward driving, as measured by all four Decisional Balance subscales, were related to readiness to change as conceptualized along the TM spectrum, these relations only emerged once behavior change had occurred (i.e., action, maintenance). No relations between the Decisional Balance subscales were seen for those participants who were not restricting their driving, even though they endorsed many *reasons* why they may consider restricting their driving in the future. It is important to note that the number of *reasons* under which driving restriction might be considered in the future was far greater than the number of *reasons* given by those currently restricting. This speculation on the part of the participants who were not restricting may simply indicate that they are aware of the many *reasons* why a person may consider changing driving and that they report that they would be open changing their behavior, should such events occur. Differences in the number of *reasons* endorsed may be a function of their perceived probability that a specific *reason* would be pertinent to their own life circumstances.

When examining the relations among TPB constructs and readiness to change driving behavior (i.e., TM stages; see Table 2 and Table 3) in our sample of drivers, mixed results emerged in relation to findings from previous research (Lindstrom-Forneri et al., 2007). In

relation to Hypothesis 3 (see Table 3), differences in perceived benefits of driving (i.e., TPB subscale of Instrumental Attitude) were seen between all three groups differing on number of *conditions* under which they were restricting (i.e., in the action through maintenance stages). However, no differences were observed for those restricting their driving in relation to those not restricting driving, among groups based on the number of *reasons* identified in relation to driving restriction, or for groups who reported they would consider restricting driving for fewer or more *reasons* (i.e., in the pre-contemplative through preparation stages, see Table 3). Moreover, an unexpected main effect of gender emerged with women perceiving more benefit to driving than men when those restricting driving were compared with those who were not restricting. Given the age of our sample, it may be that women from this cohort who are driving are more likely to be doing so by necessity (e.g., no other driver available) than in younger samples. Other studies have noted that women who lived alone were less likely to self-regulate their driving compared to women with at least one other member in their household (D'Ambrosio et al., 2008) whereas those from a two-person household were more willing to rely on their partner to drive or share in driving (Donorfio et al., 2009). It is possible that lack of access to social support may have played a role in the valuation of the benefits of driving made by women in our study.

In relation to Hypothesis 4 (i.e., Subjective Norm, see Table 3) only those who were not restricting their driving perceived less pressure to stop driving than those who were restricting their driving. There were no differences between those restricting under greater or fewer *conditions* or reporting different numbers of *reasons* for restricting their driving. In addition, no differences were observed for groups who reported fewer or more *reason*s they would consider restricting driving in the future (i.e., in the pre-contemplative through preparation stages, see Table 3).

In addition to these hypothesized differences, greater positive feelings toward driving (i.e., Affective Attitude) were observed for those who were not restricting their driving in relation to those restricting driving, and between all three groups differing in the number of *conditions* under which driving was being restricted. The similarity in pattern of results for Pro-self and Affective Attitude is not surprising as they share some of the same items. In addition, greater perceived difficulty driving (i.e., Perceived Control) was observed for those who were restricting driving in relation to those who were not, and between those who reported the fewest and greatest number of *conditions* under which driving was restricted.

Overall, relations among TPB constructs and various groupings reflecting readiness to change driving behavior (i.e., TM stages; see Table 2 and Table 3) were less consistent than those seen for the Decisional Balance constructs. Perhaps this is to be expected as the TPB constructs were designed in relation to intention to perform a behavior, whereas decisional balance was conceptualized as contributing to movement along through the stages of the TM. Thus, the constructs captured by the Decisional Balance subscales may be more relevant to the driving behavior change process than those captured by the TPB. Alternatively, the relative weakness of the TPB constructs may be a function of the number of items in each scale (TPB subscales each with three items only). The only research other than Lindstrom-Forneri et al. (2007) to examine TPB constructs in relation to driving was conducted by Gwyther et al., (2012), in a sample of 395 drivers between the ages of 18 and 78 years. They noted that the women in their sample tended to restrict driving more and be more negatively influenced by Affective Attitude (Gwyther et al., 2012). In our sample, a greater percentage of women were restricting their driving than men, but regardless of whether they were restricting driving or not, women reported perceiving greater benefits to driving (i.e., Instrumental Attitude) and no gender

differences were observed in Affective Attitude. Differences in findings between our study and Gwyther et al., (2012) may relate to the ages of the samples or the number and types of items included in the measures of Instrumental and Affective Attitudes.

Some features of this study limit its generalizability and need to be taken into consideration when extrapolating the results to other contexts. First, a sample of convenience was recruited via media attention through newspaper (community and city), television and radio interviews during which contact information for the study was included; as well, newsletters, posters and presentations to various seniors' associations. The characteristics of older drivers willing to take part in a large, nationwide (Canada), longitudinal study may differ from the general population of drivers from the same age strata. For example, it is possible that those choosing to take part may have had a special interest in older driver issues, or may have been more (or less) assured of their driving performance than others. Moreover, as the present study focuses on data from the baseline survey, all participants were relatively healthy, active drivers. In addition, this examination of the data is limited to only a few measures and does not take into consideration other possible important demographic characteristics or variables. Finally, all measures were derived from self-reports and so may be incomplete or inaccurate even though all attempts were made to ensure completion of all measures by all participants.

This work extends the existing literature by revisiting findings on the driving restriction practices of older drivers within the context of two behavior change models (i.e., TM and TPB) using a single large sample. Self-reports of restricted driving, *conditions* under which driving was restricted, *reasons* for restricting driving, and *reasons* why those not restricting would consider restricting driving in the future were all used to operationalize and reflect the proposed process of driving behavior change from complete driving independence through increasing

amounts of self-restriction. Although some limited research has begun to address the self-regulatory behavior of older drivers in this way, we extend this literature by including detailed attitude measures derived from both the TM (i.e., decisional balance) and TPB theories. To our knowledge, no other study has examined both types of measures in a single study. Together, these instruments provided a more detailed and in-depth examination of attitudes relevant to driving behavior change and decision-making and serve as a comprehensive basis for future work.

The application of theories of behavior change within the context of older driver decision-making provides clinicians with a conceptual framework from which to approach assessment and intervention (Dickerson et al., 2007). As yet, little is known about the processes involved and the factors that will facilitate a smooth and safe transition from complete driving independence toward driving retirement. As longitudinal data becomes available, it will be possible to extend our current understanding of factors affecting driver behavior change. Prospective data will allow us to examine how self-reported driving behavior changes over time, with some participants beginning to restrict their driving while others stop driving. In addition, it will be possible to examine the temporal sequencing among reported *conditions* under which driving is restricted and *reasons* for restricting driving. Changes in actual driving patterns from baseline (both restrictions and cessation) can then be examined in relation to attitudinal changes and other explanatory factors such as the emergence of new medical conditions or changes in living circumstances. This additional information will allow us to better understand and address the process of behavior change in older drivers.

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References

Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes 50, 179-211.

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.

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

Charlton, J., Oxley, J., Fildes, B., Oxley, P., Newstead, S., Koppel, S., O'Hare, M. (2006). Characteristics of older drivers who adopt self-regulatory driving behaviours. *Transportation Research Part F: Traffic Psychology and Behavior 9*(5), 363-373.

D'Ambrosio, L. A., Donorfio, L., Coughlin, J., Mohyde, M., & Meyer, J. (2008). Gender differences in self-regulation patterns and attitudes toward driving among older adults. *Journal of Women & Aging, 20*(3-4), 265-282.

Dickerson, A. E., Molnar, L.J., Eby, D.W., Adler, G., Bédard, M., Berg-Weger, M., et al. (2007). Transportation and Aging: A research agenda for advancing safe mobility. *The Gerontologist, 47*(5), 578-590.

Dobbs, B. (2002). Medical conditions and driving: Current knowledge. (Report No. DTNH22-94-G-05297) U.S. Department of Transportation, National Highway Traffic Safety Administration, Washington, DC.

Donorfio, L., D'Ambrosio, L., Coughlin, J., & Mohyde, M. (2008). Health, safety, self-regulation and the older driver: It's not just a matter of age. *Journal of Safety Research, 39*(6), 555-561.

Donorfio, L., D'Ambrosio, L., Coughlin, J., & Mohyde, M. (2009). To drive or not to drive, that isn't the question—the meaning of self-regulation among older drivers. *Journal of Safety Research, 40*(3), 221-226.

Gwyther, H., & Holland, C. (2012). The effect of age, gender and attitudes on self-regulation in driving. *Accident Analysis & Prevention, 45*, 19-28.

Kowalski, K, Jeznach, A., & Tuokko, H. (2014). Stages of driving behavior changes within the Transtheoretical Model (TM). *Journal of Safety Research, 50,* 17-25.

Kowalski, K., Love, J., Tuokko, H., MacDonald, S., Hultsch, D., & Strauss, E. (2011). The influence of cognitive impairment with no dementia on driving restriction and cessation in older adults. *Accident Analysis and Prevention, 49*, 308-315.

Lindstrom-Forneri, W., Tuokko, H., & Rhodes, R. (2007). "Getting Around Town": A preliminary investigation of the theory of planned behavior and intent to change driving behaviors among older adults. *Applied Gerontology, 26*(4), 385-398.

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

Marshall, S., Man-Son-Hing, M., Charlton, J., Koppel, S., Langford, J., Tuokko, H., et al. (2013). Protocol for Candrive II/Ozcandrive, a multicentre prospective older driver cohort study. Accident Analysis and Prevention. Epub ahead of print: http://www.sciencedirect.com/science/article/pii/S000145751300081X

Prochaska, J. O., & DiClemente, C. C. (1982). Transtheoretical therapy: Toward a more integrative model of change. *Psychotherapy: Theory, Research & Practice, 19*, 276-288.

Prochaska, J. O., & Velicer, W. F. (1997). The transtheoretical model of health behavior change. *American Journal of Health Promotion, 12*(1), 38-48.

Sterns, H. L., Sterns, R., Aizenberg, R., & Anapole, J. (2001). Family and friends concerned about an older driver: Final report, National Highway Traffic Safety Administration. Available from http://www.nhtsa.gov/people/injury/olddrive/FamilynFriends/faf_index.htm

Tuokko, H., McGee, P., & Rhodes, R. E. (2006). Decisional balance and readiness to change driving behavior in older adults: A pilot study. *Physical & Occupational Therapy in Geriatrics, 24*(3), 1-12.

Turcotte, M. (2012). Profile of seniors' transportation habits. *Canadian Social Trends, 93*, 1-16.

Table 1. Reported conditions under which driving is restricted and the reasons for restricting

Conditions	***N*=366**	**Current reasons for restricting**	***N*=366**	**Reasons for restricting in the future**	***N* = 533**
Bad weather	292	No longer need to drive as much	83	Advised by doctor	505
Night	154	Vision deteriorated	82	Danger to others	497
Heavy traffic on highway	125	Feeling unsafe or nervous	63	Stroke or serious illness	492
Long distances	113	Other	44	Vision deteriorated	486
Park in tight spaces	110	Deteriorated or learning or mental abilities	35	Medications interfering	481
Heavy traffic in town	105	Cost of gas and vehicle upkeep	35	Feeling unsafe or nervous	469
Unfamiliar areas	60	Stroke or serious illness	34	Deteriorated or learning or mental abilities	466
Parallel park	43	General Health deteriorated	34	Government agency advised to	428
Back up	34	Danger to others	32	General Health deteriorated	394
Left turn at intersections	27	Difficulty with activities of daily living	31	Difficulty with activities of daily living	340
Highway	24	Advised by doctor	31	Someone else (not doctor) advised to	280
Parking lots	17	Government agency advised to	29	Hearing deteriorated	279
Change lanes or merge	16	Medications interfering	29	No longer enjoy driving	220
Other	10	No longer enjoy driving	25	At-fault crash	196
Alone	8	Hearing deteriorated	23	Cost of gas and vehicle upkeep	112
With passengers	7	At-fault crash	20	No longer need to drive as much	93
Maintain speed limit	5	Someone else (not doctor) advised to	19	Specific Age	61
		Near miss	17	Near miss	60
		Environmental concerns	7	Other	10

Table 2. Stages of change framework for analyses

Precontemplation	**Contemplation**	**Preparation**	**Action**	**Maintenance**		**Termination**
No change to driving behavior	Would consider changing driving behavior in the future	Planning to change driving behavior in the near future	Changing driving behavior	Driving behavior change has been successfully attained and being maintained		Driving has ceased
Not restricting			**Restricting**			**Stopped driving**
1-9 reasons given	10-12 reasons given	13-18 reasons given	0 or 1 condition	2 or 3 conditions	4 or more conditions	No one in baseline dataset
			0 reasons given	1 reason given	1 + reason given	

Table 3. Summary of support for hypotheses

Hypothesis 1: those more likely to be restricting will hold more negative attitudes toward driving (con-self)			
Restrict or Not[a]	*Restrict – Conditions*[b]	*Restrict – Reasons*[c]	*Would Restrict – Reasons*[d]
Supported	Supported	Supported	Not Supported
Hypothesis 2: those less likely to be restricting will report that their driving more positively affects others (pro-other)			
Restrict or Not[a]	*Restrict – Conditions*[b]	*Restrict-Reasons*[c]	*Would Restrict – Reasons*[d]
Supported	Supported	Not Supported	Not supported
Hypothesis 3:those less likely to be restricting will perceive greater benefits of driving (Instrumental Attitude)			
Restrict or Not[a]	*Restrict – Conditions*[b]	*Restrict-Reasons*[c]	*Would Restrict – Reasons*[d]
Not Supported	Supported	Not Supported	Not supported
Hypothesis 4: those less likely to be restricting will perceive less pressure to stop driving (Subjective Norm)			
Restrict or Not[a]	*Restrict – Conditions*[b]	*Restrict-Reasons*[c]	*Would Restrict – Reasons*[d]
Supported	Not Supported	Not Supported	Not supported
Additional findings (not hypothesized)			
Those more likely to be restricting will perceive others as holding more negative attitudes toward their driving (con-other)			
Restrict or Not[a]	*Restrict – Conditions*[b]	*Restrict – Reasons*[c]	*Would Restrict – Reasons*[d]
Emerged	Emerged	Emerged	Did not emerge
Those less likely to be restricting will show more positive attitudes toward driving (pro-self)			
Restrict or Not[a]	*Restrict – Conditions*[b]	*Restrict-Reasons*[c]	*Would Restrict – Reasons*[d]
Emerged	Emerged	Did not emerge	Did not Emerge
Those less likely to be restricting will show more positive affect toward driving (Affective Attitude)			
Restrict or Not[a]	*Restrict – Conditions*[b]	*Restrict-Reasons*[c]	*Would Restrict – Reasons*[d]
Emerged	Emerged	Did not Emerge	Did not emerge
Those more likely to be restricting will perceive more difficulty driving (Perceived control)			
Restrict or Not[a]	*Restrict – Conditions*[b]	*Restrict-Reasons*[c]	*Would restrict – Reasons*[d]
Emerged	Emerged	Did not Emerge	Did not emerge

Note: [a] comparison of those restricting driving versus those not restricting driving

[b] comparison of groups based on the distributions of *conditions* under which driving was restricted

[c] comparison of groups based on the distributions of *reasons* for restricting

[d] comparison of groups based on distributions of *reasons* why those NOT currently restricting would consider doing so in the future

Table 4. Age and gender distributions for those currently restricting and not restricting

	Currently restricting	**Not restricting**	**Total**
Total Number	366	533	899
Age categories	*% (n)*	*% (n)*	*% (n)*
70-74	39.9 (146)	46.5 (248)	43.8 (394/899)
75-79	32.0 (117)	30.6 (163)	31.1 (280/899)
80-84	21.3 (78)	15.6 (83)	17.9 (161/899)
85+	6.8 (25)	7.3 (39/)	7.1 (161/899)
Gender *n* (% female)	175 women 47.8%	163 women 30.6%	338 women 37.6 %

Note: Valid % reported

[a] χ^2 (3, N = 899) = 6.38, p < .095

[b] χ^2 (1, N = 899) = 27.47, p < .001

Table 5. Subscale scores on constructs for those currently restricting driving or not by gender.

Measure	***Gender***	**Not Restricting (0, N=533); Restricting (1, N=366)**	**Mean (SD)**
Pro self	*Male*	*0*	21.36 (5.97)
		1	22.82 (6.02)
	Female	*0*	20.82 (6.11)
		1	22.22 (6.16)
Pro other	*Male*	0	14.45 (3.71)
		1	15.34 (3.70)
	Female	0	13.71 (3.77)
		1	14.89 (3.75)
Con self	*Male*	0	36.02 (5.61)
		1	32.65 (4.90)
	Female	0	36.28 (4.26)
		1	32.84 (5.04)
Con other	*Male***	0	31.31 (4.24)
		1	30.02 (3.42)
	Female	0	32.07 (2.82)
		1	30.89 (3.32)
Affective attitude	*Male*	0	11.77 (1.53)
		1	10.68 (1.74)
	Female	0	11.98 (1.50)
		1	10.77 (1.75)
Instrumental attitude	*Male***	0	5.90 (2.53)
		1	6.30 (2.29)
	Female	0	5.29 (2.11)
		1	5.59 (2.30)
Subjective norm	*Male*	0	13.29 (1.47)
		1	12.88 (1.56)
	Female	0	13.40 (1.45)
		1	13.02 (1.52)
Perceived control	*Male*	0	13.25 (1.70)
		1	12.41 (1.83)
	Female	0	13.46 (1.54)
		1	12.52 (1.90)

Note: [a] Main effect of group, $F(1, 897) = 11.37$, $p < .001$
[b] Main effect of group, $F(1, 897) = 15.58$, $p < .001$
[c] Main effect of group, $F(1, 897) = 105.86$, $p < .001$
[d] Main effect of group, $F(1, 897) = 29.73$, $p < .001$
[e] Main effect of gender, $F(1, 896) = 12.88$, $p < .001$
[f] Main effect of group, $F(1, 897) = 102.06$, $p < .001$

[g] Main effect of group, $F(1, 897) = 13.87$, $p < .001$
[h] Main effect of group, $F(1, 895) = 52.6$, $p < .001$
[i] Main effect of gender, $F(1, 896) = 17.5$, $p < .001$

Table 6. Comparison based on number of conditions for current restrictions

Measure	Condition Group	N	Mean (SD)	F-value (df)	p-value
*Decisional Balance – Pro-self**	0 or 1	90	21.29 (6.08)	8.28	<.001
	2 or 3	138	21.74 (5.79)	(2, 362)	
	4 +	137	24.16 (6.06)		
*Decisional Balance – Con-self**	0 or 1	90	35.40 (4.45)	34.12	<.001
	2 or 3	138	33.32 (4.74)	(2, 362)	
	4 +	137	30.42 (4.46)		
*Decisional Balance – Pro-other***	0 or 1	90	14.14 (3.52)	7.00	<.001
	2 or 3	138	14.93 (3.68)	(2, 362)	
	4 +	137	15.96 (3.74)		
*Decisional Balance – Con-other***	0 or 1	90	31.27 (3.03)	5.63	<.004
	2 or 3	138	30.56 (3.39)	(2, 362)	
	4 +	137	29.76 (3.53)		
*TPB – Affective Attitude**	0 or 1	90	11.34 (1.65)	20.79	<.001
	2 or 3	138	11.01 (1.82)		
	4 +	137	10.02 (1.48)	(2, 362)	
*TPB – Instrumental Attitude**	0 or 1	90	5.56 (2.14)	8.66	<.001
	2 or 3	138	5.59 (2.03)	(2, 362)	
	4 +	137	6.59 (2.51)		
TPB – Subjective Norm	0 or 1	90	13.19 (1.48)	2.30	<.102
	2 or 3	138	12.99 (1.60)	(2, 362)	
	4 +	137	12.75 (1.49)		
*TPB – Perceived Control***	0 or 1	90	13.17 (1.39)	14.59	<.001
	2 or 3	138	12.59 (2.03)	(2, 362)	
	4 +	137	11.88 (1.95)		

*Tukey post hoc analyses show differences between all three groups

**Tukey post hoc analyses show differences between groups with fewest and most conditions

Table 7. Comparison of groups based on number of reasons for restricting driving.

Measure	**Condition Group**	**N**	**Mean (SD)**	**F-value (df)**	**p-value**
Decisional Balance – Pro-self	0	68	21.76 (6.03)	28.11	<.469
	1	177	22.59 (6.30)	(2, 362)	
	2	120	22.89 (5.79)		
*Decisional Balance – Con-self***	0	68	34.26 (4.89))	6.77	<.001
	1	177	32.94 (4.63)	(2, 362)	
	2	120	31.59 (5.25)		
Decisional Balance – Pro-other	0	68	14.13 (3.41)	2.99	<.052
	1	177	15.34 (3.86)	(2, 362)	
	2	120	15.37 (3.64)		
*Decisional Balance – Con-other***	0	68	31.35 (3.29)	5.12	<.006
	1	177	30.564(3.23)	(2, 362)	
	2	120	29.75 (3.59)		
TPB – Affective Attitude	0	68	11.13 (1.81)	4.54	<.011
	1	177	10.80 (1.66)	(2, 362)	
	2	120	10.38 (1.77)		
TPB – Instrumental Attitude	0	68	5.72 (2.32)	7.22	<.486
	1	177	5.93 (2.23)	(2, 362)	
	2	120	6.13 (2.38)		
TPB – Subjective Norm	0	68	13.30 (1.31)	3.79	<.023
	1	177	12.99 (1.49)	(2, 362)	
	2	120	12.68 (1.68)		
TPB – Perceived Control	0	68	12.91 (1.71)	3.14	<.044
	1	177	12.46 (1.89)	(2, 362)	
	2	120	12.21 (1.86)		

**Tukey post hoc analyses show differences between groups with fewest and most conditions

Table 8. Comparison of groups based on number of reported reasons that those not restricting driving would consider restricting.

Measure	Reason Group	*N*	Mean (SD)	F-value (df)	*p*-value
Decisional Balance – Pro-self	0	158	20.06 (6.06)	4.04	<.018
	1	192	21.61 (5.86)	(2, 362)	
	2	183	21.73 (6.03)		
Decisional Balance – Con-self	0	158	36.39 (4.50))	1.87	<.155
	1	192	36.36 (4.42)	(2, 362)	
	2	183	35.58 (4.56)		
Decisional Balance – Pro-other	0	158	13.94 (3.64)	1.14	<.320
	1	192	14.45 (3.60)	(2, 362)	
	2	183	14.14 (3.97)		
Decisional Balance – Con-other	0	158	31.77 (3.15)	1.03	<.358
	1	192	31.60 (3.00)	(2, 362)	
	2	183	31.29 (3.25)		
TPB – Affective Attitude	0	158	11.94 (1.62)	.597	<.551
	1	192	11.80 (1.54)	(2, 362)	
	2	183	11.77 (1.40)		
TPB – Instrumental Attitude	0	158	5.35 (2.11)	3.12	<.045
	1	192	5.80 (2.26)	(2, 362)	
	2	183	5.93 (2.26)		
TPB – Subjective Norm	0	158	13.30 (1.57)	2.69	<.069
	1	192	13.50 (1.35)	(2, 362)	
	2	183	13.16 (1.46)		
TPB – Perceived Control	0	158	13.27 (1.66)	1.13	<.324
	1	192	13.46 (1.68)	(2, 362)	
	2	183	13.21 (1.63)		