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Project Title: **Validity and Usability of a Safe Driving Behaviors Measure for Older Adults: Strategy for Congestion Mitigation**

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CHAPTER 1 INTRODUCTION

Statistics project that crash/injury/fatality rates of older drivers will increase with the future growth of this population. Accurate and precise measurement of older driver behaviors becomes imperative to curtail these crash trends and resulting congestion. The Comprehensive Driving Evaluation (gold standard test) is highly valid and reliable, but limitations include being time-consuming, providing limited access, and holding an element of threat (mandatory/ ethical reporting upon failing). Self-report is a means to identify older adults' safe driving behaviors, increase driving safety awareness/ knowledge, and promote behavior change and safer driving outcomes. Existing measures are limited in accurately assessing older driver behaviors due to length, respondent burden, and inadequately representing driving constructs (i.e. person, vehicle, environment). Current self-report measures fall short of providing meaningful descriptions of driving ability level, and do not contribute to targeting risk reduction or increasing driving safety strategies. In contrast, item response theory or IRT methods are particularly useful to offer precise measurement of driving behaviors. Understanding a driver's "level" of safe driving behaviors is a critical step towards providing an entry point for logical and effective interventions, identifying optimal training parameters, and predicting future driving ability. To that end we propose the further development of such a measure.

Research Objectives and Scope

Specific Aim 1. Determine the SDBM measurement properties (dimensionality, item/person-level psychometrics, and rater severity) with adequate sample size. **Specific Aim 1(a):** Confirm the factor structure of the SDBM. ***Hypothesis 1 (a):*** The SDBM has a two factor structure: pre-driving skills and driving skills. **This aim was picked up under FDOT funding in spring of 2011 and was not completed under this grant.

Specific Aim 1(b): Describe the item and person level properties of the SDBM. ***Hypothesis 1 (b):*** The SDBM will fit the Rasch measurement model.

Specific Aim 1(c): Determine the rater severity of the three rater groups (older driver, family member/caregiver [F/C], driving evaluator). ***Hypothesis 1(c):*** The evaluator will be the "most severe" rater followed by the F/C and then the older driver.

Specific Aim 2. We will validate the SDBM to the gold standard on-road driving evaluation.

Specific Aim 3: Develop the instructional clinical outputs, or "key forms" to determine if: **Specific Aim 3(a)** driving evaluators and occupational therapists (OTs) understand the results of the SDBM in an interpretable way; and if **Specific Aim 3 (b)** older drivers and F/C understand the results of the SDBM in an interpretable way. ***Hypothesis 3:*** SDBM will be used by (a) clinicians and (b) older drivers and F/C as a clinically useful measure to discern the level of safe driving ability of the older driver, and to identify the next logical steps for intervention to improve safe driving behaviors.

Specific Aim 4: (Revised scope initiated April 2011 following FDOT grant to support Specific Aims 1-3) To develop and implement the computer algorithms for a web-accessible Keyform for the Safe Driving Behavior Measure **and** to enroll subjects for improved representativeness of the sample.

CHAPTER 2 – BACKGROUND

Determine the SDBM measurement properties (dimensionality, item/person-level psychometrics, and rater severity) with adequate sample size.

Specific Aim 1. Determine the SDBM measurement properties (dimensionality, item/person-level psychometrics, and rater severity) with adequate sample size.

Specific Aim 1(b): Describe the item and person level properties of the SDBM.

Focusing on the strengths of self and proxy report measures we developed the Safe Driving Behavior Measure (SDBM) and research findings reflected the face and content validity, rater reliability and rater effects (Classen, Winter, et al., 2010; Winter et al., 2011; Classen et al., 2012). The SDBM consists of three sections: A = Demographic information; B = Driving habits; C = Driving behavior questionnaire with 68 items, and has a proposed hierarchy of driving tasks which increase in complexity. For example, the instrument indicates that item 1 "open car door" is potentially the easiest item and that item 68 "drive on an icy road" is potentially the most difficult item. Based on this principle, one may assume that if a person can drive in "an unfamiliar urban area" without difficulty (item 49), then he/she may also be likely to complete the preceding items without difficulty. Understanding the "level" of safe driving behavior of a participant is a critical step towards providing an entry point for occupational therapists to plan logical and effective interventions, identify optimal training parameters, and to predict future safe driving ability.

The objective of this project was to investigate the item/person-level psychometrics and item hierarchy of three groups -- older drivers, caregivers and driving evaluators who had completed the 68-item SDBM. If the SDBM shows reasonable psychometric properties, it will assist occupational therapy generalists to identify unsafe driving behaviors and provide them with an entry point for delivering preventative services. Psychometrics of the SDBM for this study included i**tem statistics** (i.e. *item difficulty, item fit, item reliability,* and *item separation*), **person statistics** (i.e. *person's ability, person fit, ceiling/floor effects, person reliability* and *person separation*), and **item hierarchy**. *Item difficulty* is an estimate of an item's underlying difficulty calibrated from the total numbers of drivers who succeed on the item. *Item fit* was determined by the fit statistics of each item provided by the Winsteps program. The Winsteps program provides two types of fit statistics: information-weighted mean square (infit MnSq) and outlier-sensitive mean square (outfit MnSq). The ratings of a driver that a rater assigned in the highest and lowest categories of the scale are weighted less heavily on the Infit MnSq. The infit MnSq has an expected value of 1. Values > 1 signal more variation (i.e., unexplained, unmodeled variation) in a driver's ratings on the items than expected; values < 1 signal less variation in a driver's ratings on the items than expected. Generally, infit > 1 is more of a problem than infit < 1, since highly surprising or unexpected ratings that do not "fit" with the other ratings tend to be more difficult to explain and defend than overly predictable ratings. By contrast, the outfit MnSq is more sensitive than the infit MnSq statistic to the occasional highly unexpected and surprising ratings that may occur; therefore we used infit statistics. The criteria of the Infit MnSqs were set from .5 to 1.7 and the standardized fit statistics were set from -2 to 2, (Type 1 error rate = .05) (Wang & Chen, 2005; Wright & Linacre, 1994). *Item reliability* represents how well the estimates of the item measures can be replicated

when another sample with comparable ability are rated using the same set of items. *Item separation* estimates how well the items are separated by the measured variable. *Person's ability* is an estimate of the driver's underlying ability based on the driver's performance on a set of items and it is calibrated from the total number of items to which the driver responded successfully. Similar to item fit, *Person fit* is determined by the fit statistics of persons, with person misfit indicating that one or more of the ratings that the rater assigned to the older driver were surprising or unexpected. *Ceiling effect* is defined as more than 5% of participants rated at the maximal score, while *floor effect* is defined as more than 5% of participants rated at the minimal score. *Person reliability* represents how well the estimate of the driver's ability can be replicated when other sets of items, measuring the same construct, are used to rate the same sample of drivers, and is analogous to Cronbach's alpha with values between 0 and 1. *Person separation* index, measured in standard error units, indicates how well the instrument separates drivers of different levels of safe driving ability. The statistically distinct strata of safe driving ability within the sample of older drivers can be obtained by applying the formula $(4G_p+1)/3$, where G_p represents the person separation index (Wright & Masters, 1982). An assessment needs at least two strata to reliably distinguish between safe and unsafe older drivers. *Item hierarchy* was evaluated based on the item map provided by the Winsteps program. One of the strengths of the Rasch model is that it can readily handle missing data or "Not applicable" answers. That is, the Rasch model does not require a fully crossed rating design; it can easily accommodate partially crossed rating designs that provide sufficient linkage of raters and drivers.

Specific Aim 1(c): Determine the rater severity of the three rater groups (older driver, family member/caregiver, driving evaluator).

In this study we address inter-rater reliability among three groups of raters (older driver, F/C and driving evaluators), and investigate the rater effects among two of the groups (F/C and driving evaluators) on 41 items of the SDBM. We expect that the findings of this study will provide the evidence to use the self/ proxy-report SDBM as a reliable measure of safe driving among older adults, their F/C, and occupational therapists conducting such evaluations.

Understanding the "level" of safe driving behaviors of a participant is a critical step towards providing an entry point for logical and efficient occupational therapy interventions, identifying optimal training parameters, and predicting future safe driving ability. In ongoing work we have developed a self-report Safe Driving Behavior Measure (SDBM) (Classen, Winter et al., 2010; Winter, et al., 2011). We have tested it among 80 older drivers, 80 family members/caregivers (F/C) and two driving evaluators, and conducted psychometric analyses. Findings from the pilot work encouraged us to further refine the SDBM as a precise and accurate measure for detecting safe driving behaviors among older adults. As such, the objective of this study is to quantify the rater reliability and rater effects, by using IRT, among three rater groups (older drivers, F/C, driving evaluator).

SA1c. Inter- rater reliability

Inter-rater reliability is defined as the extent to which different raters agree on the same persons or characteristics. The terms, inter-rater reliability, rater agreement, and rater correlation are often used interchangeably. Two studies investigated the relationship of driving performance rated by evaluators and older drivers (Marottoli & Richardson, 1998; Wild & Cotrell, 2003). Marottoli and Richardson

investigated the relationship between on-road driving performance rated by evaluators and self-reported driving ability rated by older drivers using the Pearson correlation. They did not find a significant association between the ratings of these two groups. Wild and Cotrell investigated the differences between evaluators' ratings and older drivers' ratings on the Driving Safety Evaluation scale using t- test statistic. They found that only 2 of 10 items showed significant differences between the evaluators' ratings and the older drivers' ratings.

Neither the Pearson correlation coefficient nor t-test statistic, can accurately determine the potential rater effects. While the Pearson correlation can provide the strength of the relationship between two sets of data (the concordance of the data), it cannot detect if the value of one set of data is consistently greater than the other one, which might indicate that one rater is more severe/lenient than the other. The t-test statistic detects the significant difference of the means of two sets of data; however, using the "mean" may partial out the individual differences that exist within the rater group. Further, the Pearson correlation and t-test statistic cannot provide information regarding the response pattern; that is, whether someone responds to the items erratically, i.e., rating inconsistently. Thus, although the Pearson correlation and t-test statistics provide necessary methods for assessing rater agreement, it is not sufficient to make an accurate determination of rater effects. It is critical to examine rater effects, especially when individuals will be reporting on safety aspects of driving.

SA1c. Rater Effects

Rater effects is a function of *severity or leniency* defined as the tendency that a rater assign ratings consistently higher or lower than other raters (Myford & Wolfe, 2004). In addition to having tendency to assign higher or lower ratings, raters may also assign ratings erratically (erratic response pattern); that is, the raters assign, inappropriately, low scores (cannot do) to drivers with a higher ability level, or high scores (no difficulty) to drivers of a lower ability level. The Many Facets Rasch Model (MFRM), an extension of the Rasch model, is useful to investigate the rater severity and response patterns (Linacre, 2004). The Rasch model, a one-parameter model IRT converts ordinal scales into interval measures (using logit as its unit) and provides a useful, efficient and objective framework for developing, evaluating, and revising measures. Recently, five published driving studies applied Rasch analysis to develop or evaluate driving scales (Kay, Bundy, & Clemson, 2008; Kay, Bundy, & Clemson, 2009; Myers, Paradis, & Blanchard, 2008; Patomella, Kottorp, & Tham, 2008; Patomella, Tham, & Kottorp, 2006). Patomella and colleagues (2006) first applied Rasch analysis to examine the Performance Analysis of Driving Ability (P-Drive), in a driving simulator, with 31 persons with brain injury; and later (2008) they used Rasch analysis to evaluate the P-Drive with 101 individuals with stroke. Kay and colleagues (2008) applied Rasch analysis on a standard on-road test to transform the on-road test into a linear interval measure with hierarchical ordered tasks. Myers and colleagues (2008) also examined the structure of a scale assessing driving confidence using Rasch model. Most recently, Kay and colleagues applied Rasch analysis on a simulated test rated by trained professionals, and an awareness test, to investigate the construct validity and internal reliability of the two scales (Kay et al., 2009). While we are seeing an increased application of Rasch analysis in developing and evaluating assessments, no driving-related published study has yet applied the Rasch model to assess rater effects.

Beyond estimating item difficulties and person abilities, the Many Facets Rasch Model (MFRM) includes an additional parameter, the rater to detect whether the response differences are caused by systematic rater severity/ leniency. Moreover, by fitting data to the Rasch model, the MFRM can detect the erratic raters. Rater effect is particularly important in our field of study where we are developing an older driver and proxy self-report tool: the Safe Driving Behavior Measure (SDBM). When comparing older driver self-reports with F/C reports or driver evaluator reports, we anticipate a discrepancy. That is, we expect that older drivers may be the least severe in their self-ratings (e.g., not wanting to lose their license) and the evaluators may be the most severe in their ratings (e.g., their training is to focus on deficits); the F/C may be somewhat in the middle with their ratings as some may be overly severe (i.e., really want the driver to stop driving) and some less severe (i.e., not wanting to lose their means of transportation) with the driving safety of their loved one.

Specific Aim 2. We will validate the SDBM to the gold standard on-road driving evaluation.
The on-road test is considered the industry gold-standard but due to its characterisitcs (expensive, time consuming, risky, not accessible to all), efficient screening tests, predictive of actual on-road outcomes, must be developed and tested. The SDBM has promise to be used as a screening tool for family members/caregivers and potentially the older drivers, but the criterion validity for each of these two groups has not yet been established. Thus, the purpose of this study was to determine the concurrent criterion validity of the SDBM, as completed by older drivers and their family members/caregivers, against the on-road test conducted by trained driving evaluators.
Existing self-report/screening tools with criterion validity to driving performance (passing/failing an on-road test), are limited in the driving literature. In addition to self-reports, proxy or caregiver reports may serve as a useful source of driving behaviors in older adults. Caregiver opinions have been sought in several driving studies. For example, Wild and Cotrell (2003) found that caregivers had insight into the driving errors (e.g., managing intersections, managing lane changes) of care recipients with Alzheimer's disease who still drove. However, they underreported some driving errors of the care recipients when compared to a standardized road test. Cronston et al., 2009 reported that family members could provide adequate information on some driving behaviors (e.g., monitoring traffic, maintaining speed) of drivers with dementia (Alzheimer's type). In our previous work, we found that family members/caregivers were more reliable than healthy community dwelling licensed drivers to report on driving behaviors (e.g., come to a dead stop or maintain lane while driving); but they were not as accurate as the driving evaluator reports which were based on standardized on-road tests (Classen, et al., 2012, Classen, Wang et al., in press).
Recognizing that caregivers make an important contribution in identifying driving errors or driving behaviors, we have used their input in determining the psychometrics of the SDBM. As such family members/caregivers were involved in establishing face and content validity (Classen, Winter et al., 2010; Winter et al., 2011); and their ratings were used to determine construct validity (Classen, Wen et al., in press), rater reliability, and rater effects (leniency vs. severity) among three rater groups (older drivers, family members/caregivers, driving evaluators) (Classen, et al., 2012). Our preliminary data (from the cited studies above) points to the potential usefulness of the SDBM as a screening measure

used by family members/caregivers to rate the driving behaviors of older drivers, but concurrent criterion validity has not yet been determined.

SA2. Measure of validity testing: ROC Curves

Receiver operating characteristic (ROC) curves provide a methodology to determine the criterion validity of a screening tool as measured against a gold-standard outcome. Essentially, the ROC curve is a plot of the rate of true positives (true hits or sensitivity) against the rate of false positives (true misses or 1- specificity) resulting from application of many arbitrarily chosen cut-off points of the predictor test (Portney & Watkins, 2000). The ROC curve demonstrates the effectiveness of using different cut-off values and reveals the optimal cut-off value for the predictor test. If the *area under the curve*, an index of discriminability, is statistically significant and at least .70 in magnitude, then further attention must be paid to the other ROC attributes, such as *sensitivity, specificity, positive predictive value* and *negative predictive value* (Portney & Watkins, 2000).

Sensitivity is the predictor test's ability to obtain a positive test when the condition really exists (a true positive); here it means that the predictor test would suggest the participant will fail the on-road test, and the participant actually fails it. *Specificity* is the predictor test's ability to obtain a negative result when the condition is really absent (a true negative), here the predictor test would suggest the participant will pass an on-road test, and the participant actually passes it (Portney & Watkins, 2000). *Positive predictive value (PPV)* is the probability that the participant will, given a certain cut-point on the predictor test suggesting a fail the on-road test, actually fail the on-road test. *Negative predictive value (NPV)* is the probability that the participant will, given a cut-point on the predictor test suggesting a pass for the on-road test, actually pass the on-road test. It is important to note that the number of *false positives* (those who receive a failing score but pass the road test), and *false negatives* (those who receive a passing score but fail the road test) and thus the sensitivity and specificity values, change with the cut-off value. Ultimately one wants the false positives and false negatives to be as close to 0 as possible. For an example of ROC curves using error scores to determine passing/ failing an on-road test see (Shechtman, Classen, Awadzi, & Mann, 2009), and for using ROC to determine the sensitivity of predictor tests of on-road outcomes see (Classen, et al., 2009).

Specific Aim 3: Develop the instructional clinical outputs, or "key forms" to determine if driving evaluators and occupational therapists (OTs) understand the results of the SDBM in an interpretable way; and if older drivers and their family/caregivers understand the results of the SDBM in an interpretable way.

This study illustrates the contributions of three stakeholder groups: occupational therapy practitioners, expert CDRSs, and family members/ caregivers (F/C). Specifically, we conducted three focus groups, one with each stakeholder group, to learn their needs, perspectives, and suggestions for refining the web-based SDBM and keyform. Our research question is: *What is the input (needs, perspectives, and suggestions) of stakeholders (occupational therapy practitioners, CDRSs, and family members/caregivers) in the process of developing a "keyform" for the SDBM?*

Stakeholders, i.e., occupational therapy (OT) practitioners, expert raters, or family members/caregivers, may contribute to developing measures for clients. For example, the OT may acquire knowledge on habits of a driver during the interview (American Occupational Therapy Association, 2010); an expert rater, such as a certified driving rehabilitation specialist (CDRS) may interpret the drivers' on-road performance to reveal errors or violations (Classen, Shechtman, Awadzi, Joo, & Lanford, 2010); or a family member riding with the driver may observe lapses or near misses (Wild & Cotrell, 2003). In fact, a renowned methodologist suggested that the development of a measure starts by understanding the qualitative experiences shared by the stakeholders (Thurstone, 1925). Such qualitative experiences are best captured by soliciting the perceptions of stakeholders who have real life experiences with the client (Magasi & Heinemann, 2009). The qualitative features of the stakeholder-client interaction therefore constitutes a real-time interpretation of the driver's abilities, and subsequent formulation of the needs, perceptions or suggestions pertaining to the driver in his or her context. This interaction, between stakeholder and client, is essential to capture in the development of outcome measures.

Driving is an instrumental activity of daily living (IADL) and a key area needing to be addressed by all occupational therapy practitioners (American Occupational Therapy Association, 2010). Both generalists and those who specialize in the assessment and rehabilitation of driving (or community mobility) may contribute to measurement development. Failing to include these practitioners, with their understanding of the background, clinical utility and application of the measurement tool, may lead to measures which lack essential information critical to clinical decision making. Thus, without practitioner input, a gap may continue to exist between measurement tool development and the *translation of the measurement tool* to clinical practice.

Experts are recognized persons whose skill, knowledge, or judgment in a specific well-distinguished domain is widely recognized by their peers and/or the public. In the practice area of driving, persons designated as either Certified Driving Rehabilitation Specialist (CDRS) or having the Specialty Certification in Driving and Community Mobility (SCDCM) are considered experts (American Occupational Therapy Association, 2010). Given their extended involvement in assessing driving and remediating driving performance issues (and community mobility), CDRSs and SCDCMs can make important contributions to measure development and refinement in at least three ways. First, by nature of their prolonged or intense experience through practice and education they bring depth to the meaning of items measuring driving performance. Next, they may identify gaps or particular strengths in the measurement instrument. Finally, using their clinical reasoning and critical thinking skills, they can help with the interpretation of data and make useful recommendations for intervention. Although experts in occupational therapy are used widely to provide "expert witness testimonies", they are not regularly included in the development of measurement tools. Such inclusion can bring domain and content specific knowledge not otherwise obtained through contributions of generalists.

Our prior SDBM work included F/C in: establishing face and content validity (Classen, Winter et al., 2010; Winter, et al., 2011); determining construct validity (Classen, Wen, et al., in press); determining

rater reliability and rater effects (leniency vs. severity) among three rater groups (older drivers, family members/caregivers, driving evaluators) (Classen et al., 2012); and determining criterion validity of the SDBM to on-road outcomes (Classen, Wang, et al., in press). In fact, we found that family members/caregivers were more reliable than healthy licensed older drivers to report on driving behaviors, yet not as accurate as the CDRS reports which were based on standardized on-road tests (Classen, Wen, et al., in press). The family members/caregivers also demonstrated acceptable accuracy in their SDBM ratings to predict on-road outcomes among older drivers (Classen, Wang, et al., in press).

A keyform is a clinical outcome form that illustrates the relationship client performance on the items of an instrument. This form is generated from the "General Keyforms" output table produced from Rasch analysis using the Winsteps software program (Winsteps; Chicago, Illinois) (Linacre, 2010). A core feature of the keyform is that it provides immediate and useful information to the stakeholder. For example, with a glance, the OT practitioner may observe the client's profile, including tasks (expressed as items) that are "easy" to perform and tasks that are "hard" to perform. A major benefit of the keyform is that it provides an entry point for OT interventions (Kielhofner, Dobria, Forsyth, & Basu, 2005). However, by incorporating the perspectives of caregivers/family members in keyform development, it may provide an entry point for further family conversations, or decision making relevant to the independence or safety of their loved one. The overarching objective of this study is to illustrate how stakeholders, as defined above, make a significant contribution to the development of a web-based SDBM and "keyform."

Specific Aim 4: To develop and implement the computer algorithms for a web-accessible Keyform for the Safe Driving Behavior Measure.

As part of refining the SDBM, we will address a computerized format and development of clinically relevant outputs that indicate the type and severity of driving difficulty as well as recommendations. These outputs would be used by older adults, their significant others, and clinicians in decision-making. Recommendations would cover a continuum of driver needs from continued driving through driving rehabilitation, driving cessation, and the use of other mobility options when driving is no longer a viable option. We expect that such safe driving decisions will lead to safe driving behaviors, which will in turn reduce crashes, injuries, fatalities and congestion.

CHAPTER 3 - METHODS

Specific Aim 1. Determine the SDBM measurement properties (dimensionality, item/person-level psychometrics, and rater severity) with adequate sample size.

Specific Aim 1(b): Describe the item and person level properties of the SDBM

SA 1b. Participants

This study included older drivers and F/C, our age range of 65-85 years of age for drivers was based on the driving literature, which typically defines older drivers as age 65 and over. Due to IRB concerns of high on-road test failure rate, our top age for drivers was 85. We recruited participants in North Florida and Ontario, Canada by advertisements in newspapers, word-of-mouth referrals, and flyers distributed to local community facilities (e.g., retirement communities). A convenience sample of older community dwelling licensed drivers were included if they: were between 65-85 years of age, had a valid driver's license, were driving at the time of recruitment, had the cognitive ability to complete the SDBM, and had the cognitive and physical ability to participate in an on-road driving test. Participants were excluded if they: had been medically advised not to drive, experienced uncontrolled seizures in the last year, or took medications that caused central nervous system impairment. Caregivers (18-85 years of age) were included if they: were able to report (based on observation) on the older adult's driving behavior and excluded if they showed presence of physical or mental conditions that impaired the ability to make an active contribution. At the primary site, an occupational therapist / certified driving rehabilitation specialist (OT/CDRS) with seven years clinical practice experience collected the data; at the Canadian site, the driving evaluator, an accredited driving instructor by the Province of Ontario with over 10 years of experience, collected the SDBM driving and data.

SA 1b. Procedure

Clinical tests and on-road driving evaluation were conducted by trained staff including the OT/CDRS, Accredited driving instructor, and graduate level research assistants. The SDBM and clinical test administration, as well as the on-road driving evaluation test, were standardized across sites by: (1) using a set testing protocol for the two sites; (2) conducting a 3 day training, led by the OT/CDRS of the primary site (Florida) with all research staff at the Canadian site; (3) assess inter-rater reliability and ensuring 100% congruence between the two on-road driving evaluators by using a four-point scale to rate the driving of three healthy volunteers. All older drivers and their F/C were consented in a private research office before completing demographic information and the SDBM, older drivers also completed a battery of clinical tests and an on-road assessment (Classen, et al., 2008; Stav et al., 2008). The two evaluators (one per site) were blinded to the participants' SDBM self-ratings or proxy ratings and also completed a SDBM on each driver after the on-road test. Participants received $50 to $100 for their study participation based on whether they were a driver or F/C and when they participated.

Instrument

The SDBM is a 68-item self-report or proxy measure to assess safe driving behaviors (Classen, Winter et al., 2010; Winter, et al., 2011). The SDBM is available for drivers, family members/caregivers, and professionals (e.g. driving rehabilitation specialists, driving evaluators and therapists). The driver SDBM has three sections. Section A: Demographic profile (gender, race, education level, etc); Section B: Driving history profile (days per week of driving, crashes or violations numbers, etc); Section C:

Driving behaviors, a 68-item questionnaire to determine the level of difficulty a driver experienced in the last three months when executing driving behaviors. Difficulty with the driving task was rated via a 5-point adjectival scale ranging from 1 = Cannot do, to 5 = Not difficult (Classen, Winter et al., 2010). The family member/caregiver's SDBM only has section A (Demographics) and C (Driving behaviors). The response option of "Not applicable" was used for conditions that some participants may not experience, e.g., driving in snow. Completion of all sections of the SDBM, whether using paper version or web-based, takes approximately 20 minutes. A copy of the SDBM is included with this report.

SA1b. Measures and Study Variables

Demographics and health-related characteristics

For the *drivers*, we reported the following *demographic variables*: age, gender, race (Caucasians vs. others), education (high school graduation, some training after high school graduation, and college graduation), and living status (live with others vs. live alone). We also analyzed number of days driving per week and *health-related characteristics*, such as self-reported numbers of medication, self-reported health conditions, and co-morbidities.

For the *family members/caregivers*, we reported age, gender, race, education, relationship with driver (family member vs. caregiver), days per week riding with the driver, and lifestyle impact (a self-reported appraisal of how much the caregiver's lifestyle would be impacted if the driver stopped driving).

SDBM measure

In this study, we used the SDBM measure (interval data derived from Rasch analysis) of section C, not the total of the raw scores (ordinal data) as documented in detail in a prior publication (Classen, Wen, et al., in press). We used the SDBM measure as the independent predictor of on-road outcomes.

Clinical tests

The validated clinical test battery, with reported psychometrics, included tests of vision, vision-cognition, cognition and motor performance and is fully documented in previous studies. For the purposes of this study we are only including information on the abilities described below (Stav, et al., 2008).

Vision. Visual acuity and contrast sensitivity were tested using the Optec® 2500 visual analyzer (Stereo Optical Company Inc., 2007). We categorized the binocular (both eye open) visual acuity as "20/20 to 20/40" and "20/50 or poorer (e.g., $\geq$20/70). We dichotomized contrast sensitivity as *intact* (all 5 Optec ® 2500 contrast sensitivity slides are intact) and *impaired* (any of the five contrast sensitivity slides is impaired).

Visual-cognition. We reported the Useful Field of View (UFOV) risk index (1 = very low risk, 2 = low risk, 3 = low-moderate risk, 4 = moderate-high risk, and 5 = high risk) and three UFOV subsets (UFOV 1 = visual search and visual processing; UFOV 2 = divided attention; and UFOV 3 = selective attention) (Ball & Owsley, 1993; Edwards, et al., 2006). The cut-point for each one of the sub-tests is 500 milliseconds, meaning that if a person exceeds this score per subtest, he/she will not be able to continue the proceeding sections and may have impaired visual processing speed.

Cognition. We used Mini Mental State Examination (MMSE, maximum score = 30) as an indicator of baseline cognitive functioning (Folstein, Folstein, & McHugh, 1975).

Motor performance. We used the Rapid Pace Walk (RPW) (in seconds) to test the motor performance (gait, postural control, balance and speed of walking) of older drivers. The RPW when executed for longer than 7 seconds is predictive of adverse driving events (accidents, violations, being stopped by the police, violation, or traffic accident) (Marottoli, Cooney, Wagner, Doucette, & Tinetti, 1994); and this test is statistically significantly correlated to on-road driving performance (Stav, et al., 2008).

On-road test

The Florida on-road tests consisted of driving a standardized road course with demonstrated reliability (ICC= .94, $p<0.05$) and validity (driving performance score was correlated to the Global rating score, $r=.84$, $p<0.001$) for older drivers (Justiss et al., 2006; Posse, McCarthy, & Mann, 2006; Bédard, et al., 2008). The Canadian site used a demerit point system consistent with the method used by their licensing authority. The outcome of the road-tests included a pass/fail measure of driving: 3 = Pass, 2 = Pass with restrictions or recommendations, 1 = Fail with remediation, 0 = Fail not remediable. Both UF and Lakehead used a dichotomized pass/fail outcome.

SA 1b. Data Collection

All the participant data were collected and entered into a central secure and password protected data repository at the primary site (the University of Florida). Data entry was monitored by the principal investigator and quality control spot checks and corrections were made, intermittently during data entry, to ensure data completion and accuracy. Missing data were reported to the driving evaluators, obtained from participants via phone calls, or reported as "missing" when data were not available.

SA 1b. Data Analysis

We managed the participant demographic data using SPSS (Version 17), and we used the rating scale model implemented through the Winsteps computer program (Version 3.57) to conduct Rasch analyses of the rating data. In using the rating scale model, we assumed that the rating scale structure was similar across the 68 items on our instrument. That is, we assumed that the raters used each of the categories of the rating scale in a similar fashion when rating each item (i.e., a "1" on item 1 was equivalent to a "1" on each of the other items; a "2" on item 1 was equivalent to a "2" on each of the other items, etc.).

We reported *only* on older drivers and family members/ caregivers' demographic information, and psychometric properties of the SDBM across the three rater groups. Rasch analysis is a one-parameter logistic model (1-PL) which assumes all items have a constant item discrimination parameter. Because of its simplicity, the Rasch model, unlike 2-PL or 3-PL models, does not require large sample sizes to obtain stable estimates and is preferred in the rehabilitation field (Jette & Haley, 2005). For polytomous scales (such as the SDBM), the rating scale model of Rasch analysis that calibrates the rating scale across all items using the same rating scale structure, is a preferable model for small samples; hence adequate to perform data analyses on our sample (N=80 for each rater group) (Linacre, 2000). The measurement model we employed is presented below:

$$\text{Log}\,[P_{nik} / P_{ni(k-1)}] = B_n - D_i - F_k$$

Where P_{nik} = probability of driver n receiving a rating of k on item i,

$P_{ni(k-1)}$ = the probability of driver n receiving a rating of k-1 on item i
D_i = the difficulty of item i, and
F_k = the difficulty of receiving a rating of k, relative to receiving a rating of k-1.

First, we used the **Principal Component Analysis of Rasch generated residuals** (PCAr) to investigate the assumptions of unidimensionality, and **the correlations of the Rasch generated residuals** to examine the assumption of the local independence. We inspected **unidimensionality** based on the eigenvalues and the amount of variance explained by the first component of PCAr. We examined the **local dependency** based on the strength and the pattern of the correlations of the Rasch generated residuals, and evaluated the SDBM rating scale structure, item statistics, and person statistics, and item hierarchy**. The rating scale structure** was investigated according to three essential criteria: 1) there must be at least 10 observations per rating category; 2: the average measures (mean of each category) should be advanced which indicates that if "cannot do" is -2 logits, the average measure of "a lot of difficulty" should be larger than -2 logits; and 3) outlier-sensitive mean square fit statistic for each rating scale category should be bigger than 2.0 (Linacre, 2002). **Item statistics** including *item difficulty, item fit, item reliability,* and *item separation,* and **person statistics** including *person's ability, person fit, ceiling/floor effects, person reliability* and *person separation,* were evaluated. In this paper, "person" was referred to "older driver". *Item difficulty* is an estimate of an item's underlying difficulty calibrated from the total numbers of drivers who succeed on the item. *Item fit* was determined by the fit statistics of each item provided by the Winsteps program. The Winsteps program provides two types of fit statistics: information-weighted mean square (infit MnSq) and outlier-sensitive mean square (outfit MnSq). The ratings of a driver that a rater assigned in the highest and lowest categories of the scale are weighted less heavily on the Infit MnSq. The infit MnSq has an expected value of 1. Values > 1 signal more variation (i.e., unexplained, unmodeled variation) in a driver's ratings on the items than expected; values < 1 signal less variation in a driver's ratings on the items than expected. Generally, infit > 1 is more of a problem than infit < 1, since highly surprising or unexpected ratings that do not "fit" with the other ratings tend to be more difficult to explain and defend than overly predictable ratings. By contrast, the outfit MnSq is more sensitive than the infit MnSq statistic to the occasional highly unexpected and surprising ratings that may occur; therefore we used infit statistics. The criteria of the Infit MnSqs were set from .5 to 1.7 and the standardized fit statistics were set from -2 to 2, (Type 1 error rate = .05) (Wang & Chen, 2005; Wright & Linacre, 1994). *Item reliability* represents how well the estimates of the item measures can be replicated when another sample with comparable ability are rated using the same set of items. *Item separation* estimates how well the items are separated by the measured variable. *Person's ability* is an estimate of the driver's underlying ability based on the driver's performance on a set of items and it is calibrated from the total number of items to which the driver responded successfully. Similar to item fit, *Person fit* is determined by the fit statistics of persons, with person misfit indicating that one or more of the ratings that the rater assigned to the older driver were surprising or unexpected. *Ceiling effect* is defined as more than 5% of participants rated at the maximal score, while *floor effect* is defined as more than 5% of participants rated at the minimal score. *Person reliability* represents how well the estimate of the driver's ability can be replicated when other sets of items, measuring the same

construct, are used to rate the same sample of drivers, and is analogous to Cronbach's alpha with values between 0 and 1. *Person separation* index, measured in standard error units, indicates how well the instrument separates drivers of different levels of safe driving ability. The statistically distinct strata of safe driving ability within the sample of older drivers can be obtained by applying the formula $(4G_p+1)/3$, where G_p represents the person separation index (Wright & Masters, 1982). An assessment needs at least two strata to reliably distinguish between safe and unsafe older drivers. **Item hierarchy** was evaluated based on the item map provided by the Winsteps program. One of the strengths of the Rasch model is that it can readily handle missing data or "Not applicable" answers. That is, the Rasch model does not require a fully crossed rating design; it can easily accommodate partially crossed rating designs that provide sufficient linkage of raters and drivers.

Specific Aim 1(c): Determine the rater severity of the three rater groups (older driver, family member/caregiver, driving evaluator).
** For details on the participants, procedure and data collection see the descriptions listed under Specific Aim 1b on pages 12 and 13.

SA1c. Data Analysis
Item inclusion/exclusion: We excluded 27 items from the analysis. These items included 22 items that were not observable by the driving evaluator at the time of testing (e.g., driving in snow), and 5 items that added little or no variance to the responses. For example, > 95% of respondents used the same rating category, i.e., "not difficult" for 5 items.
Inter-rater reliability: We conducted an intra-class correlation (ICC) to examine the rater reliability on the 41 remaining items. We used SPSS version 17.0 for the analyses and a p-value less or equal to 0.05 was considered significant for the correlations.
Rater effects: We conducted the Many-Facet Rasch Model (MFRM) to analyze rater effects using the Facets software version 3.57 (Linacre, 2004). The MFRM extends the rating scale Rasch model by adding one component/facet (Cj) to calibrate rater severity:

Log[Pnik /(Pni(k-1))]=Bn - Dgi - Fgk - Cj
Where Pnik =probability of observing category k for person n who answers item i;
Pni(k-1) =probability of observing category k-1;
Bn =person ability;
Dgi =item difficulty for item i in group g;
Fgk =the difficulty of being observed in category k relative to category k-1 for an item in group g; and
Cj= severity of judge j, who gives rating k to person n on item i

Facet ruler, fit statistics, fixed chi-square, and paired comparisons were used to investigate the rater effects. *Facet ruler*, displaying three Facets (rater, item difficulty, person ability) in the same linear continuum, provides a visual map to compare the relative hierarchy within and between Facets. To illustrate the relative distribution of the drivers' abilities and item difficulties simultaneously, we

anchored the mean of the rater severity to 0. *Fit statistics* (Infit MnSqs and Outfit MnSqs) were used to detect erratic raters; that is, raters who assign high scores to drivers from a low ability level, and low scores to those drivers with a high ability level. Infit statistics is more responsive to the variance of those well-targeted observations, while outfit statistics is sensitive to the variance of outliers or extreme observations. Ideal fit is when the observed response patterns exactly match the predicted pattern (MnSq=1) of the model. Infit MnSq and Outfit MnSq ranging from 0.6 to 1.4 were considered adequate fit for survey data (Bond & Fox, 2001). The measure represents the average ratings of the rater in logits with higher scores indicative of greater severity in rating. *The fixed chi-square* was used to examine whether at least one rater group, on the overall scale level, consistently used the ratings differently from other rater groups. Should the fixed chi-square test be significant, then *paired comparisons* are performed to identify item level rater effects. For example, if three rater groups are tested, a significant fixed chi- square statistic means that at least one of these three rater groups is more severe/ lenient in their ratings on the overall scale. *Paired comparisons* are then performed to identify which rater group is significantly more severe / lenient in their ratings, or to show where (which items) the raters rate significantly more severe/lenient. We used an alpha level of 0.05 to determine a significant rater effect.

Specific Aim 2. We will validate the SDBM to the gold standard on-road driving evaluation.
** For details on the participants, procedure and data collection see the descriptions listed under Specific Aim 1b on pages 12 and 13.

SA2. Data Analysis

We used PASW Statistics 18 (SPSS Inc., 2009) and WINSTEPS 3.70.0 (http://www.winsteps.com/winsteps.htm) to perform the analyses.

Descriptive statistics

For the drivers, we conducted a descriptive analysis and included demographic, driving history, health-related characteristics, clinical tests and on-road test data. For family members/caregivers the descriptive analysis included their demographics, their history as a passenger, and how their lifestyle would be impacted if the driver reduced or stopped driving.

Bivariate analysis

We conducted the Chi-square test (Fisher's Exact test was used when there were cells with expected counts of less than 5 in the 2×2 contingency table) to compare the difference between family members and caregivers for " lifestyle impact"; that is determining if the lifestyle will be impacted (yes/no), if the driver reduce or stop driving. A p-value ≤ 0.05 was considered significant.

ROC curve analysis

We determined the concurrent criterion validity of the SDBM using the ROC curve. In this study we viewed an AUC between 0.7 and 0.9 as having an acceptable magnitude (Streiner & Cairney, 2007). Most important for the SDBM, to be used as a potential screening tool to accurately classify the drivers who fail the on-road test, we wanted sensitivity to be high (>.70). Generally, we wanted to minimize misclassification of drivers, or false positives and false negatives. We generated the ROC curve and AUC estimates with PASW Statistics 18 (SPSS Inc., 2009) using measures. The measures were derived from the raw scores of the SDBM via Rasch analysis and are presented as logits (Bond & Fox, 2007;

Classen, Wen, et al., in press). Using the measure (logits) we present the ROC curves demonstrating five of these potential SDBM cut-point measures. Based on the cut-points we also calculated the associated specificity, sensitivity, error, PPV and NPV. The AUC of the ROC curve was based on a 95% confident interval (CI) and p-value ≤ 0.05 to indicate statistical significance.

Specific Aim 3: Develop the instructional clinical outputs, or "key forms" to determine if driving evaluators and occupational therapists (OTs) understand the results of the SDBM in an interpretable way; and if older drivers and their family/caregivers understand the results of the SDBM in an interpretable way.

SA3. Methods

Institutional review board approval was granted for this project. Participants provided written informed consent prior to focus group involvement and were paid $50 for participation.

SA3. Design

During initial development of the SDBM from we held focus groups with stakeholders including older drivers and F/C to select and refine the SDBM items (CITE). As we prepared the web-based SDBM and keyform we again sought stakeholder input via three focus groups, with each group addressing specific goals. The groups are listed below by stakeholder and purpose: *Focus Group 1*: Occupational therapy practitioners: To address keyform understandability and utility, and to obtain feedback on improving clarity. *Focus Group 2*: Expert Panel of CDRSs: To develop, from expert opinion, clinical recommendations for the caregiver/family members and to obtain feedback on the web-based keyform. *Focus Group 3*: Family members/ caregivers: To obtain feedback on the understandability and ease-of-use of the web-based SDBM and keyform.

SA3. Participants

We recruited participants by purposive sampling for all stakeholder groups (Morse, 1994). Sample size for the groups was set between 5 and 12 depending on the purpose and degree to which we required in-depth responses (Krueger, 2009). Specific criteria were: *Focus Group 1*, we recruited 12 OT practitioners via our networking with the AOTA Older Driver Group. Driving evaluators and occupational therapists with at least 2 years of clinical practice experience, who have completed driving screenings/ assessments/ evaluations, and who have worked with older adults $\geq$ 65 years. *Focus Group 2:* included an expert panel of five CDRSs, with at least 10 years of experience in driving evaluation and rehabilitation, and who have worked with older adults $\geq$ 65 years. *Focus Group 3:* included eight family members/caregivers, all previous participants who were selected based on gender, rural or urban residence, race (Caucasian, Asian or African-American), and relationship to the driver (spouse, adult child or friend).

SA3. Data Collection

We used set questions (focus group guide) to moderate the group and direct participant feedback. We asked participants about aspects of keyform utility, i.e., ease of use, time to complete, training required, format, interpretation, meaning, and relevance (Smart, 2006). Specific group content are next discussed.

Focus Group 1 (OT Practitioners): The setting was a private hotel conference room in Philadelphia, during the 2011 AOTA annual conference**.** The research team (SC, CV, SW, and DL) presented the development of the SDBM using the focus group guide and illustrated the keyform (see Figure 3-1). Moderated discussions were led by core research personnel, with participants divided into two groups. Designated research personnel took notes, and a representative from each group reported feedback which was audio-recorded and later transcribed.

Focus Group 2 (Expert Panel): The setting was at Adaptive Mobility Services, Orlando, FL. During the four hour expert panel meeting, members were oriented to the development and functionality of the keyform, and our goal to develop clinical recommendations. The use of the keyform was illustrated with three case study examples who had various outcomes following the on-road test (one fail, one was borderline, and one passed). The experts provided oral feedback, and completed 11 questions on keyform usability (overall ease of use of the keyform) via a visual analogue scale (VAS) (Streiner & Norman, 2008). We video recorded the panel discussion, for vivid retrieval of content during data analysis.

Focus Group 3 (Family members/Caregivers): The setting was a private conference room at the University of Florida, Gainesville, FL. The duration was approximately two hours and included an introduction to the web-based SDBM and keyform, a discussion, and structured respondent feedback. Respondents had experience completing the proxy version SDBM in a previous study session. To orient them and introduce new developments, we described the web-based SDBM and keyform, including the on-line scripts, instructions for administration and guidelines for interpretation. We presented a case study of a driver who failed, showed the recommendation and solicited feedback. We also discussed the recommendations for the two higher level drivers ("passed" and "borderline"). We created a focus group guide with questions targeted to family members and caregivers. In addition to answering the focus group guide questions, respondents were asked to suggest revisions and general feedback on the SDBM, keyform, and web-based functions. Verbal feedback was audio-recorded for transcription and respondents provided written feedback on a VAS. Assigned research personnel took field notes, which were integrated with the verbal and written responses for data analysis.

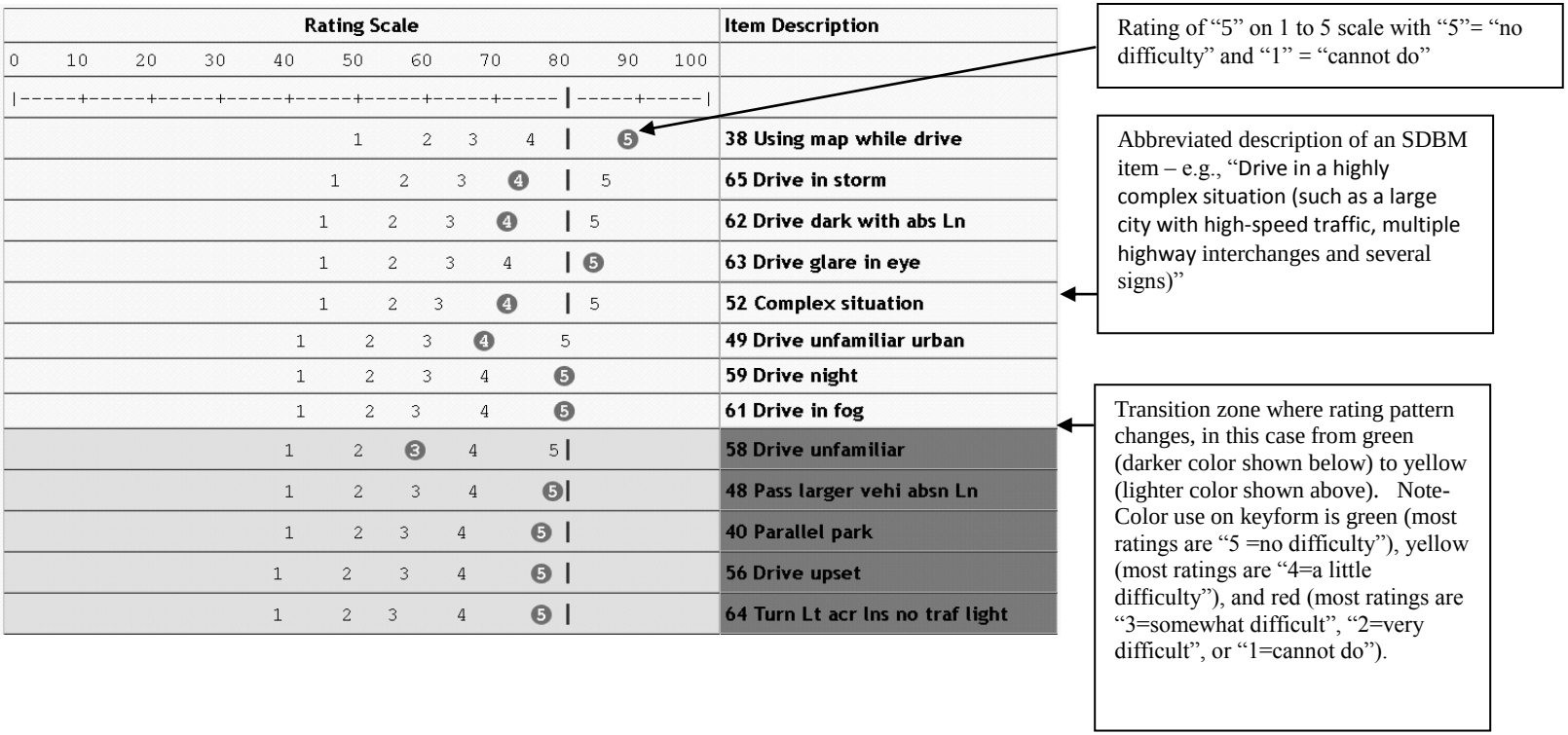


Figure 3-1. Example keyform of a driver who "passed" the on-road test. Rating is by his/her family member/ caregiver. Ratings are mostly 4's (a little difficult) or 5's (no difficulty) with only one 3 (somewhat difficult). Note: In the web-based version items are fully displayed when the cursor points to the items as listed in the "item description". Legend for abbreviations: vehi= vehicle; absn= absence; Ln= lane; Lt= left; acr= across; lns= lanes; traf= traffic

SA3. Coding and Data Analysis

Focus Group 1 (OT Practitioners): We transcribed the focus group data and hand-written comments, verbatim, into Microsoft Word® documents and imported the documents into QSR International's NVivo 8 software (NVivo qualitative data analysis software, 2008) for coding. We used a directed content analysis approach (Hsieh & Shannon, 2005), a deductive approach to identify initial constructs for use as coding categories. We identified these initial constructs by, first, coding the questions posed to Focus Group members, and then coding the remaining data according to four broad themes that emerged from the data, i.e., *Face Validity*, *Appearance and Wording*, *Usability*, and *Recommendations for Improvement*. To ensure rigor, coding and results were reviewed by a primary and secondary analyst. Coding and results were reviewed in-depth, for rigor, by a primary and secondary analyst. Results were further refined by the research team. *Face Validity* refers to whether, in the respondent's judgment, the measure and items measure what they report to (e.g. driving behavior). Face validity for our study is the ability of the keyform or items to (1) discriminate between levels of driving ability, (2) highlight a driver's challenges, and (3) capture a driver's strengths and abilities. *Appearance and Wording* refers to the readability and visual appeal of the keyform (layout, font, spacing etc.), and whether or not the item language is clear. *Usability* refers to the overall ease-of-use of the keyform. Recommendations for *Improvement,* included suggestions for revisions, additions, and improved user friendliness for the OT practitioners.

Focus Group 2 (Expert Panel): We transcribed the respondents' discussion and their hand-written comments. Using the directed content analysis approach (Hsieh & Shannon, 2005) we coded data to address the focus group discussions. From the data (VAS, video-taped materials and field notes) we synopsized changes to be made to the web-based keyform (layout and descriptions), and we constructed texts for the clinical recommendations of the keyforms.

Focus Group 3 (Family members/Caregivers): We integrated the field notes, VAS responses, transcript and coded data to summarize responses using a directed content analysis approach (Hsieh & Shannon, 2005). From these responses, we identified recommendations to clarify wording, revise instructions, enhance usability of features (e.g., data entry via drop-down boxes rather than the type in method), improve the introductory script, and modify the presentation of the keyform. We also received feedback on the implications of the recommendations, such as need for follow-up conversations with the physician, or conflict arising between the driver and family based on ratings.

Specific Aim 4: To develop and implement the computer algorithms for a web-accessible Keyform for the Safe Driving Behavior Measure.

SA4. A primary task for the web-based SDBM and keyform was to determine an appropriate classification of drivers based on the ratings. This would enable us to make user specific recommendations for steps to assess or address identified driving safety concerns.

As part of setting the thresholds, we used three exemplar cases, choosing one for each category that was most representative based on F/C ratings and on-road test results (pass or fail). The research team looked at the rating patterns to determine the "transition zone boundary" where the F/C rating started changing from one category of difficulty to the next category (e.g., from rating of "No difficulty" to rating of "A little difficulty") as these items provide information for setting category thresholds. Items were calibrated based on Rasch analyses and charted to demonstrate the item hierarchy (easy to difficult) and the pattern of difficulty ratings (from not difficult to very difficult). Using the functional stages method (Jette, Tao, Norweg & Haley, 2007), we identified difficulty patterns associated with each driver category. For example, a basic driver may be rated "not difficult" for the easiest (basic) driving skills, but rated as "somewhat difficult" or "very difficult" for routine driving skills indicating a high level of overall driving difficulty. In contrast, the routine driver is rated "not difficult" for the basic driving but ratings for the routine driving items indicate moderate difficulty and ratings for the accomplished (hardest) items indicate moderate to severe difficulty. Lastly, the accomplished drivers are rated "not difficult" for both the basic and routine driving items, but may be rated as having slight to moderate difficulty with the most challenging driving skills.
To further identify and classify at-risk drivers across the groups, the team identified 7 critical items (see Figure 2). If a F/C gave a rating of "somewhat difficult" or "very difficult" for one or more critical items, the driver was labeled as having made a critical error

CHAPTER 4 – RESULTS

Demographics of the Overall Sample

The analyses for study aims 1,2, and 4 used a sample of older driver and F/C dyads whose key characteristics are described below. While the final sample under the CMS study was 168 dyads, analyses completed in earlier stages used fewer dyads as indicated in the results for each aim.

Descriptive statistics

Driver: Table 4.1 presents the demographics, health-related, and driving habits for 168 drivers. The mean age of the drivers was 72.96 years (standard deviation (SD) = 5.28, range = 65-85). The majority of the drivers was Caucasian (91.7%), educated beyond high school (80.4%) and lived with others (73.8%). The self-reported average number of medications was 6.95 (SD ± 4.48). Only 4.8% of the drivers reported having health conditions, which limited their driving abilities. Although the secondary site did not collect data on contrast sensitivity, 33.1% of the drivers (n=49) from the primary site (n= 148) had impaired contrast sensitivity. Across all sites, 10.1% had the binocular visual acuity of 20/50 or less, or cannot be tested, and 11.9% had the UFOV risk index of moderate to high, or high to very high. The mean MMSE was 27.98 (range = 22-30; SD = 1.82), and the mean RPW was 5.71 seconds (SD = 1.66).

Table 4-1. Characteristics of the drivers (N = 168)

Driver Characteristics *Mean (SD) / Frequency (Percentage)*	***N = 168***
Age	72.96 (5.28)
Gender	
Female	77(45.8%)
Male	91(54.2%)
Race	
Caucasian	154(91.7%)
Other	12(7.1%)
Missing	2 (1.2%)
Education	
< = High School	33(19.6%)
Training after high school	36(21.4%)
>=College	99 (58.9%)
Dichotomized Live Alone	
Live alone	44 (26.2%)
Live with others	124 (73.8%)
Driving days per week	5.71 (1.66)
Number of medications	7.01 (4.54)
Self-report Health Condition	
Having limitation on driving	8 (4.8%)
No limitation on driving	160 (95.2%)

Driver Characteristics *Mean (SD) / Frequency (Percentage)*	***N = 168***
Visual acuity	
Vision 20/20 - 20/40	143 (85.1%)
Vision 20/50 or less & NT	16 (9.5%)
Missing	9 (5.4%)
Contrast sensitivity	
Impaired	49 (29.2%)
Intact	99 (58.9%)
Missing [d]	20 (11.9%)
Useful Field of View (UFOV)	
UFOV1 (ms)	27.20 (25.49)
UFOV2 (ms)	118.03 (109.97)
UFOV3 (ms)	273.27 (120.55)
Risk index Very low	84 (50.0%)
Low	42 (25.0%)
Low to moderate	22 (13.1%)
Moderate to high	16 (9.5%)
High to very high	4 (2.4%)
MMSE total	27.96 (1.82)
Rapid Pace Walk (second) [b]	5.72 (1.53)
On-road driving test	
Failing	29 (17.3%)
Passing	139 (82.7%)

SD = standard deviation; ms= milliseconds; NT = cannot be tested;
[a]: sample size = 164; [b] : sample size = 167 [c]: sample size = 161;
[d]: The Canada site didn't test the contrast sensitivity.

Family member/caregiver

One hundred and sixty-eight family members/caregivers completed the study. Table 4.2 shows that the majority of the family members/caregivers were female (72.0%), Caucasian (92.9%), family members of the drivers (79.8%), and received further education after high school graduation (83.9%). They were aged 19 to 85 with the median age of 67.5 (25^{th} percentile = 56.3, 75^{th} percentile = 74.0), and were a passenger of the driver an average of 2.77 days (SD = 2.42) a week. The family members were more likely to report that their lifestyle would be impacted if the driver reduced or stopped driving than caregivers (35.1% of the family members vs. 8.8% caregivers, $p < 0.05$; results are not shown in Table 4-2).

Table 4-2. Characteristics of the family members/caregivers (N = 168)

Family member/caregiver Characteristics *Mean (SD) / Frequency (Percentage)*	*N = 168*
Age [a]	63.52 (14.38)
Gender	
Male	47(28.0%)
Female	121 (72.0%)
Race	
Caucasian	157(93.5%)
Other	11(6.5%)
Education	
< = High school	27 (16.1%)
Training after high school	61 (36.3%)
>=College	80 (47.6%)
Relationship with driver	
Family Member	134 (79.8%)
Other	34(20.2%)
How many days a week do you ride with the driver	2.77 (2.42)
Lifestyle Impact [b]	
No	110 (67.9%)
Yes	52 (32.1%)

SD = standard deviation
[a]: 25th percentile = 56.3, 50th percentile = 67.5, 75th percentile = 74.0
[b]: If the driver reduced or stopped driving would it significantly impact your current lifestyle?

Interestingly, although 100% of the caregivers were licensed drivers, only 50% of them drove 7 days per week and 31.3% stated that their independence would be impacted if their spouse/ partner—the older driver - stopped driving.

Specific Aim 1. Determine the SDBM measurement properties (dimensionality, item/person-level psychometrics, and rater severity) with adequate sample size.
Specific Aim 1(b): Describe the item and person level properties of the SDBM.
SA1b.

SA1b. ***Unidimensionality and local independency***
The PCAr showed the second component had eigenvalues of 4.6, 5.3, and 10.4 for the ratings of the driver, caregiver and evaluator groups, respectively. In contrast to the total variances explained by the measure (92.4%, 86.1% and 90.3%), the second component only accounted for

0.6%, 1.1% and 1.5% of the total variance for the ratings of the driver, caregiver and evaluator groups. The evidence suggested our measure is unidimensional (Linacre, 2010). For local dependency, Table 4-3 shows items with high correlations of the Rasch generated residuals ($r \geq .7$). Several pairs of items, those hypothesized "easy items", showed local dependency.

Table 4-3. Items with High Correlations from Rasch Generated Residuals for Driver, Caregiver and Evaluator

	Item	*Item*	*Residual correlations*
Driver	9. Stay in lane	41. Stay in the lane markings	0.73
Caregiver	4. Adjust the car mirrors	11. Turn on light before dark	.93
	47. Pass car in absence of passing lane	48. Pass larger vehicle in absence of passing lane	.79
	27. Change lanes in traffic	37. Merge onto highway	.76
	24. Drive on highway with two or more lanes	37. Merge onto highway	.71
	24. Drive on highway with two or more lanes	27. Change lanes in traffic	.70
Evaluator	5. Stay awake	8. Drive in good weather	1.00
	5. Stay awake	10. Drive during daylight	1.00
	5. Stay awake	7. Stop for pedestrians	.99
	7. Stop for pedestrians	8. Drive in good weather	.99
	7. Stop for pedestrians	10. Drive during daylight	.99
	1. Open the car door	5. Stay awake while driving	.99
	1. Open the car door	8. Drive in good weather	.99
	1. Open the car door	10. Drive during daylight	.99
	1. Open the car door	7. Stop for pedestrians	.97
	1. Open the car door	3. Turn the steeling wheel	.97

SA1b. ***Rasch Analysis***

Rating scale structure

Results of rating scale structure indicated the under use of category 1 "Cannot Do". The observed counts of category 1 were 26 (driver group), 19 (caregiver group), and 3 (evaluator group). The Outfit MnSq (perfect Outfit MnSq = 1) for category 2 "Very Difficult" was 4.86 for the evaluators, indicating that one or more of the ratings that the evaluators assigned in category 2, for one or more of the items, were quite surprising or unexpected.

Item and Person Statistics

We performed three separate Rasch analyses on the SDBM: for the older drivers, for the caregivers, and for the driving evaluators (Table 4-4). In general, the item statistics of Rasch

analysis showed 1-13 (1%-19%) misfitting items across three groups of raters, with the evaluator group having the highest number of misfitting items. One item showed high infit statistics (misfit) on both ratings of driver group and caregivers group: item 38 "Use a map while driving". However, it did not show misfit on the ratings of the evaluator group. Instead, the misfitting items on the ratings of evaluator group were items 1-8 and 10 (hypothesized easiest items), items 14 "Press gas/brake", 17 "Emergency brake", 19 "Read sign to react", and 44 "Look before cross" (see Appendix A). In addition, good item reliability (>0.93) and good item separation (>3.6) were found across three rater groups. For person (driver) statistics the results showed 6 (8%) misfitting drivers across the three groups of raters. Good person reliability (>0.92), and good person separation (>3.49) were found across three rater groups. Person means (average of older drivers' abilities) were about 2 standard deviations higher than the item means across three groups. Additionally, the ratings of the caregiver group showed a slight ceiling effect, as 11% of the drivers rated by their caregivers obtained the maximum score.

Table 4-4. Rasch Analysis of the 68-item SDBM for the Driver, Caregiver and Evaluator

	68-item SDBM			
Rater	Driver (N=80)	Caregiver (N=80)	Evaluator (N=80)	Evaluator (N=79)
Item Misfittting	2 (3%)	1 (1%)	13 (19%)	8 (12%)
Item with minimum estimate value	8 (12%)	1 (1%)	0	3 (4%)
Item Reliability	0.95	0.93	0.95	0.96
Item Separation	4.23	3.6	4.19	4.99
Person Misfitting	6 (8%)	6 (8%)	6 (8%)	6 (8%)
Person Reliability	0.93	0.92	0.93	0.96
Person Separation	3.54	3.49	3.54	4.64
Person Strata	5.05	4.99	5.05	6.52
Cronbach's Alpha	0.96	0.99	0.96	0.97
Person Mean	3.80	4.30	3.80	4.84
Standard Deviation (logits)	1.42	1.58	1.42	1.41
Ceiling/Floor	2 (3%)/0	9 (11%)/0	0/0	0/0

Item Hierarchy

We presented the item maps rated by evaluator and older driver groups in Figure 4-1 and Figure 4-2. These figures demonstrated the older drivers' abilities and item difficulties on a single linear continuum with equal intervals or logits. In these figures, each older driver was indicated by a "x" (two drivers were indicated by "#") on the left side of the continuum according to the older drivers' abilities ascending from low, at the bottom, to high at the top. The items were located on the right side of the continuum based on their difficulty levels ascending from easy, on the

bottom, to the most challenging at the top. The mean, one standard deviation (SD) and two SD of the older drivers' abilities were indicated by "M", "S", and "T" respectively on the left side of the continuum. The mean, one SD and two SD of the item difficulties were indicated by "M", "S", and "T" on the right side of the continuum. The Winsteps program anchors the item mean to zero by default. In comparing the left side (people ability) to the right side (item difficulty), person's ability level can be expressed not only by a number but also by a descriptive activity depicted by the paralleled item.

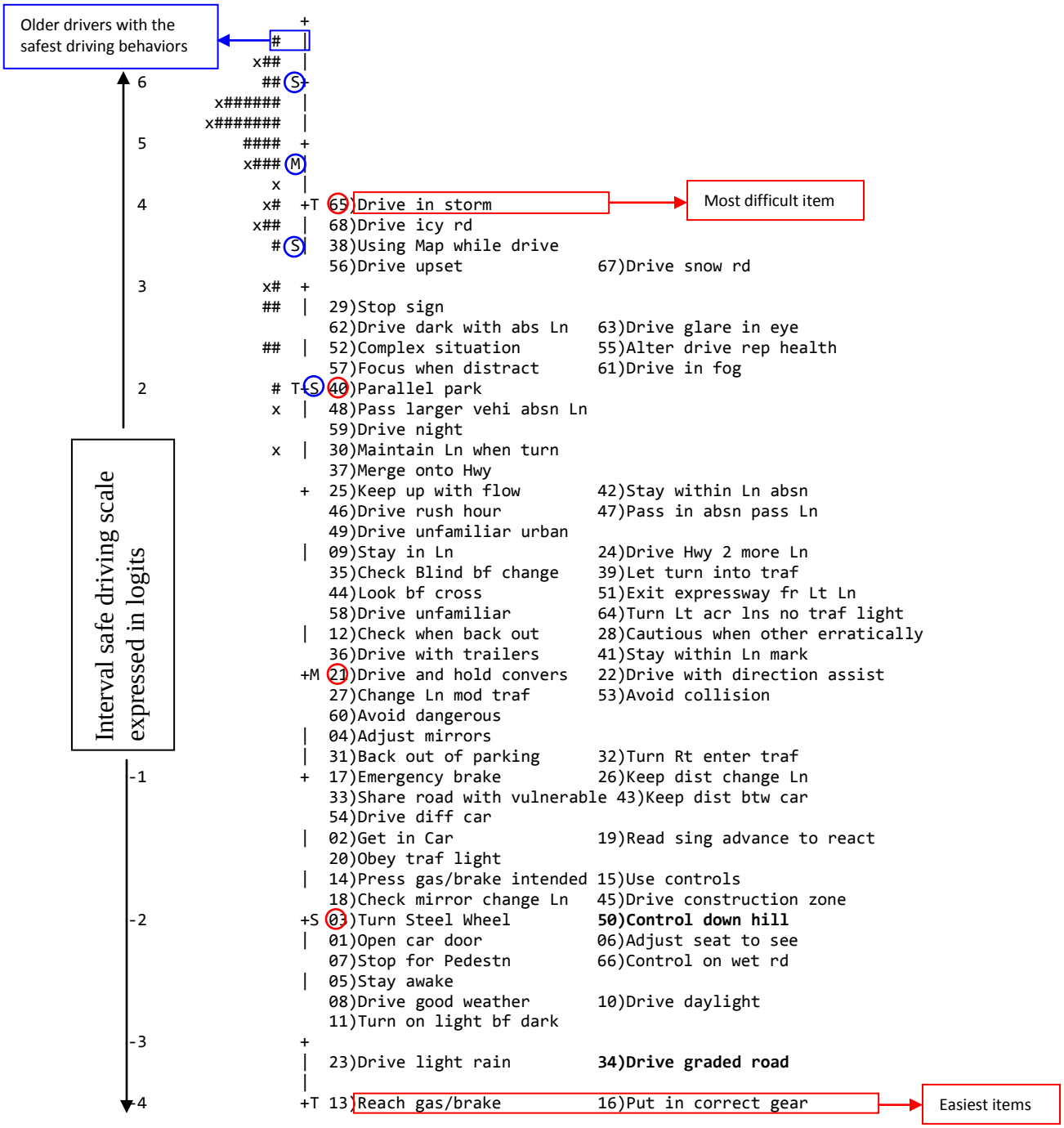


Figure 4-1: Evaluators' ratings of drivers' ability vs. item difficulty. Note: Each "x" Represents 1 driver and each '#' represents 2 drivers.
Abbreviations. Rd: road; Ln: lane; vehi: vehicle; absn: absence; acr: across; Rt: right; Pedestn: pedestrian; raf: traffic; convers: conversation; fr: from; Lt: left; bf: before

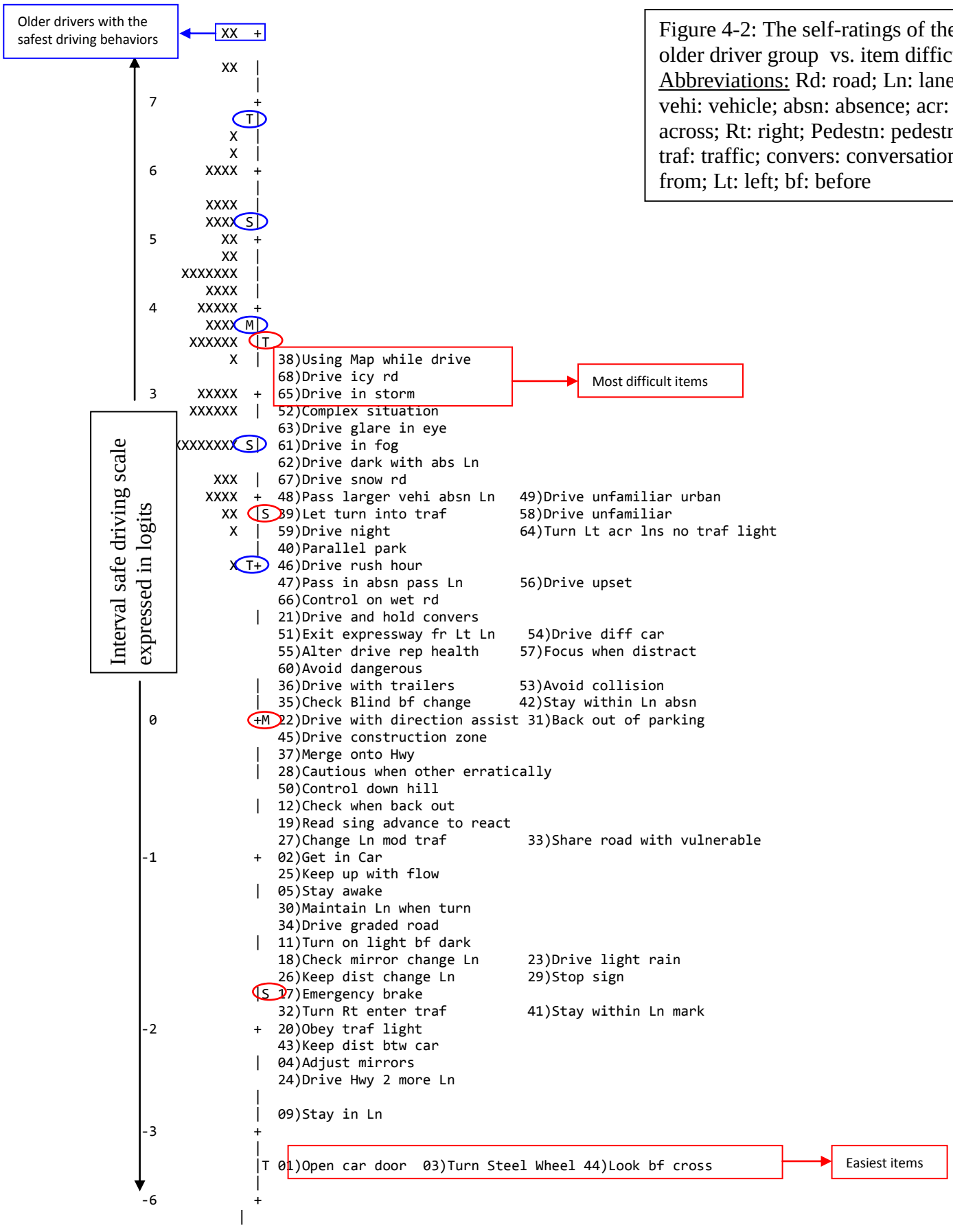


Figure 4-2: The self-ratings of the older driver group vs. item difficulty. Abbreviations: Rd: road; Ln: lane; vehi: vehicle; absn: absence; acr: across; Rt: right; Pedestn: pedestrian; traf: traffic; convers: conversation; fr: from; Lt: left; bf: before

Figures 4-1 (evaluator group) and 4-2 (older driver group) showed that the average of older drivers' abilities was more than two SD higher than the average of item difficulties. The distribution of the older drivers (left side) and items (right side) indicated that this sample had relative high ability in terms of safe driving behaviors. On the evaluator group's item map (Figure 4-1), ratings showed that item 65 "Drive in a thunderstorm" was the most challenging item and items 13 "Reach gas/brake" and 16 "Put in correct gear" were the easiest items. In comparison, item maps based on the ratings of the driver group (Figure 4-2) and the caregiver group (map not shown) both showed item 38 "Use a map while driving", item 65 "Drive in a thunderstorm" as the most difficult items, and item 13 "Reach gas/brake" as one of the easiest items. Note that the metrics of the item difficulties were different and the mid-points of the scale (zero) and were not directly comparable between Figure 4-1 and 4-2.

Specific Aim 1(c): Determine the rater severity of the three rater groups (older driver, family member/caregiver, driving evaluator).

Demographics - same as for Specific Aim 1b

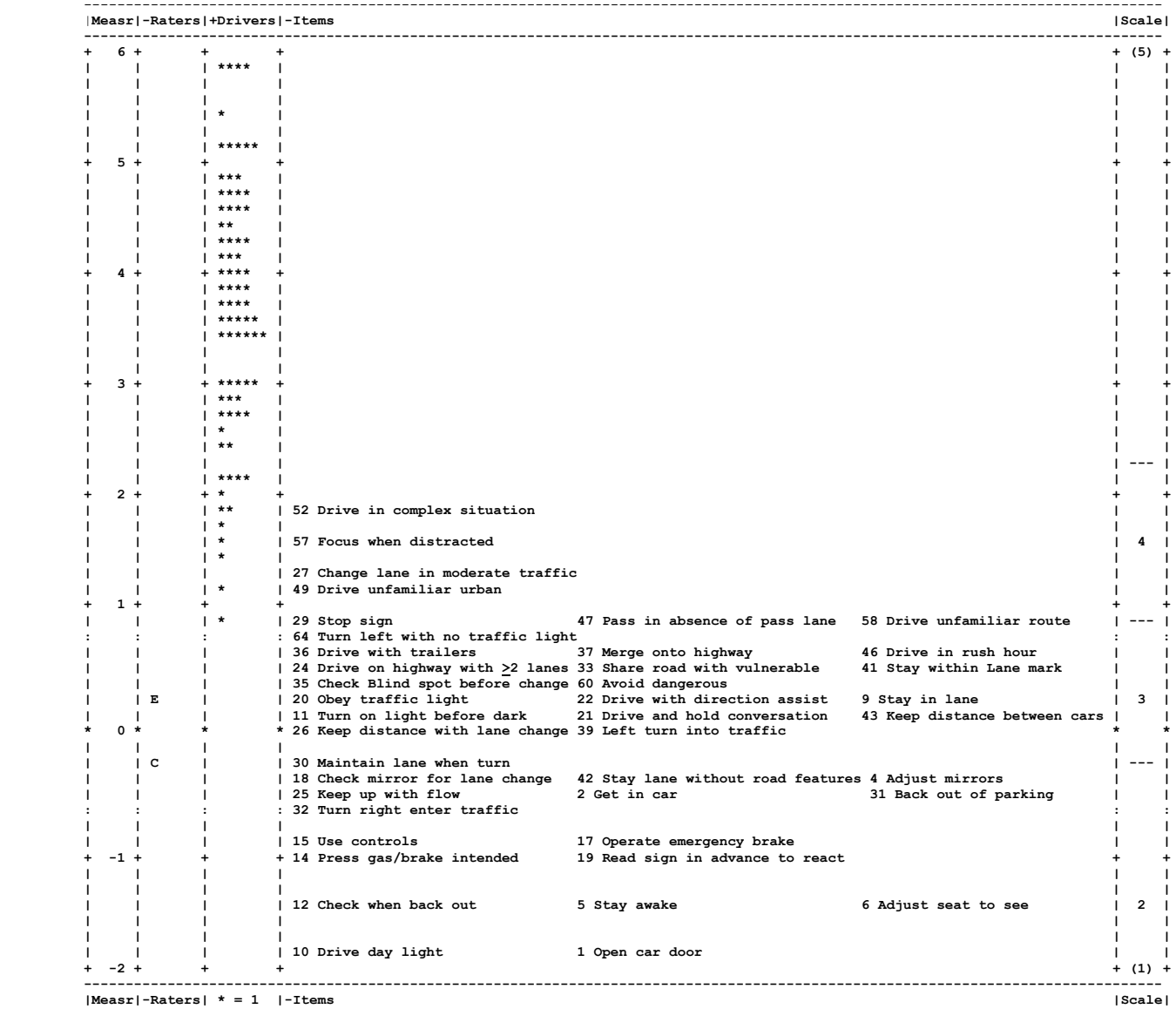
SA1c.Inter-rater reliability

The ICC among the ratings of three rater groups was significant but weak (ICC=0.256, p<0.001, 95% CI =0.118, 0.403). The significant correlation on the 41 items was between the ratings of the evaluator and the F/C groups (ICC= 0.462, p < 0.001, 95% CI = 0.271, 0.618). No significant correlations were observed between the ratings of the older driver and the F/C groups (ICC=0.127, p=0.129; nor between the older driver and the evaluator groups (ICC=0.088, p=0.217).

SA1c. Rater Effects

Facet ruler of the SDBM. Figure 4-3 depicts three Facets (raters, drivers, items) on the linear interval scale for the SDBM. The first column, titled measure, is the interval scale expressed as a logit unit. The second column displays the severity of raters, from bottom to top, representing lenient to severe raters. The third column shows the distribution of the safe driving ability of the drivers, from bottom to top representing the drivers with poor safe driving abilities to good driving abilities. The fourth column displays item difficulties, from bottom to top representing that the items were essentially easy and then progress to levels of increasing difficulty. The fifth column shows the likelihood of applying the rating scale in relation to the raters' abilities; that is, when a driver's estimated ability is between 1 and 2 logits, he/she will likely receive a rating of 4 on this measure. In the second column, the driving evaluator is located above the caregiver, indicating that driving evaluator is the more severe rater. The distribution of the drivers' abilities was on the upper part of the ruler as displayed in the third column; while the distribution of the item difficulties were on the lower part of the ruler as displayed in the fourth column. This indicated that the drivers had, generally speaking, high safe driving abilities as measured with this 41-item scale.

Figure 4-3. Facet Ruler of the 41-item SDBM



Legend: Measr= measure; C= family member/caregiver; E=driving evaluator; Each number represents an item; Appendix A contains each item by item number.

Fit statistics of the rater groups. The infit MnSqs and the outfit MnSqs for both rater groups were between 0.97 and 1.05, well within the defined criteria of 0.6 and 1.4 (Bond & Fox, 2001; Linacre, 2002; Wright & Linacre, 1994).

The fixed chi-square. The *fixed chi-square* value, 166.9 with 1 degree of freedom, was statistically significant ($p<0.001$). The overall ratings between F/C group and evaluator group showed significant rater effects with the evaluator being overall more severe when considering the measure of the evaluator group is higher (-3.32 ± 0.03) than the F/C group (-3.98 ± 0.04).

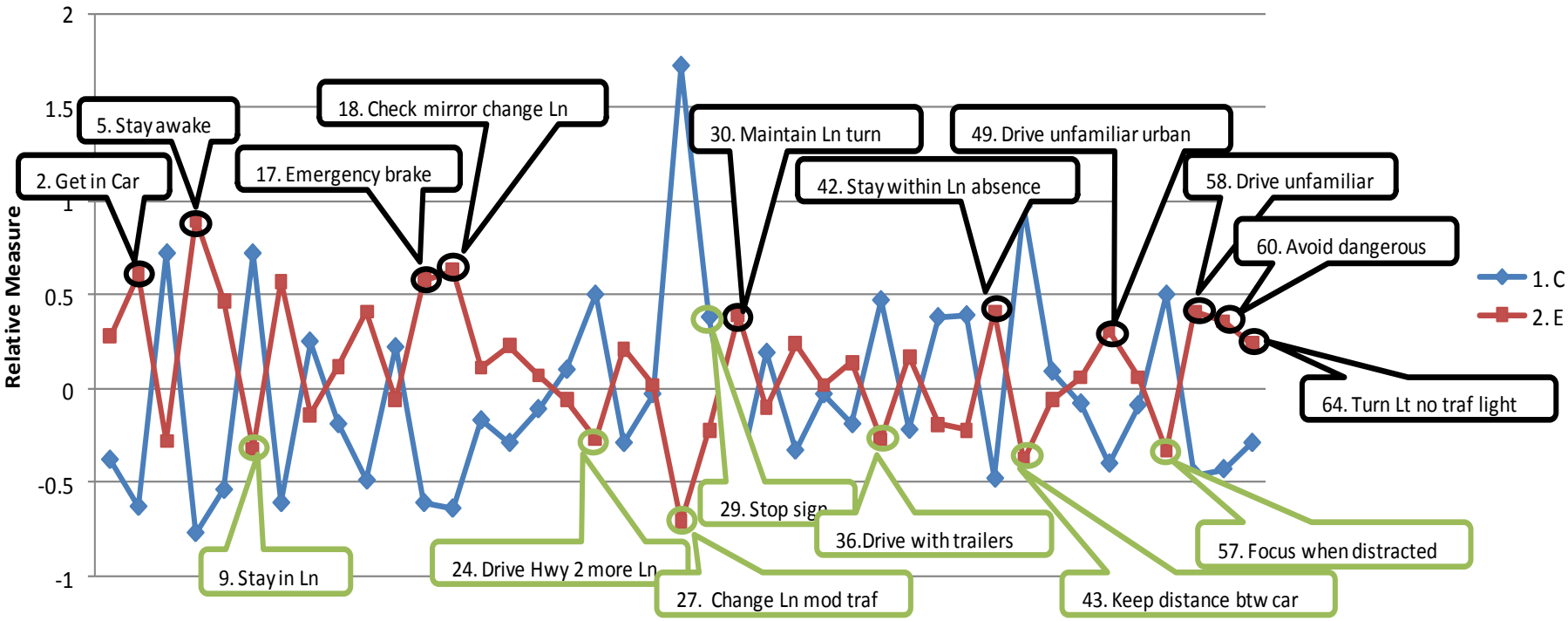
Paired comparisons. The results of the *paired comparisons* showed significant rater effects on 17 items (Table 4-5 and Figure 4-4). Although the ratings of the evaluators were more severe on overall scale, the F/C group rated 10/17 items more severe than the evaluator group.

Table 4-5. SDBM Items with Significant Rater Effects

F/C Group is more severe raters than Evaluator Group on ten items:	***Measure of Caregiver***	***Measure of Evaluator***	***Contrast***	***Joint S.E.***	***T***	***P-value***
2.Get in his/her car	-0.12	-1.13	1.25	0.42	2.99	0.003
5. Stay awake while driving	-0.7	-2.38	1.68	0.69	2.44	0.016
17. Operate the emergency brake	-0.18	-1.35	1.19	0.47	2.55	0.012
18. Check car mirrors when changing lanes	-0.25	-1.02	1.27	0.40	3.19	0.002
30.Maintain lane when turning	0.25	-0.51	0.86	0.36	2.37	0.019
42. Stay within proper lane in the absence of road features	0.05	-0.84	0.89	0.39	2.27	0.024
49. Drive in an unfamiliar urban area	1.56	0.85	0.71	0.25	2.87	0.005
58. Drive in an unfamiliar area	1.31	0.44	0.86	0.26	3.34	0.001
60. Avoid dangerous situations	0.88	0.09	0.79	0.29	2.74	0.007
64. Turn left across multiple lanes when no traffic light	1.11	0.58	0.53	0.26	2.03	0.044
Evaluator Group is more severe raters than F/C Group on seven items:	**Measure of Caregiver**	**Measure of Evaluator**	**Contrast**	**Joint S.E.**	**T**	**P-value**
9.Stay in the proper lane	-0.46	0.58	-1.04	0.37	-2.78	0.006
24. Drive on a highway with ≥ 2 lanes in each direction	0.05	0.82	-0.77	0.32	-2.44	0.016
27. Change lanes in moderate traffic	-0.46	1.97	-2.43	0.36	-6.81	<0.001
29. Brake at a stop sign so car stops before the marked line	0.42	1.02	-0.6	0.28	-2.11	0.037
36. Drive with surrounding tractor trailers	0.31	1.04	-0.74	0.29	-2.53	0.012
43. Keep distance between his or her car and others	-0.84	0.51	-1.35	0.43	-3.15	0.002
57. Stay focused on driving when there are distractions	1.03	1.87	-0.83	0.24	-3.49	0.001

Legend: SE= Standard Error; F/C = family member/caregiver

Figure 4-4. Bias Analysis Map for the Evaluator and Family Member/Caregiver Rater Groups



Legend: C=Family member/caregiver; E=Driving evaluator. The map shows significant rater effects on 17 items: #2, #5, #9, #17, #18, #24, #27, #29, #30, #36, #42, #43, #49, #57, #58 #60 and #64. The ratings of the F/C group were significantly more severe than the ratings of the evaluator group on 10 items #2, #5, #17, #18, #30, #42, #49, #58, #60, #64, while the ratings of the evaluator group were significantly more severe than the F/C group on item 7 items: #9, #24, #27, #29, #36, #43, and #57 Please see Appendix A for a detailed description of the items by item number.

Specific Aim 2. We will validate the SDBM to the gold standard on-road driving evaluation.

SA2. ROC curves

Driver: Figure 4-5 shows the ROC curve and the AUC based on drivers' responses. The AUC based on drivers' responses = 0.620, 95% CI = (0.514, 0.725), $p = 0.043$. Five SDBM measure cut-points and the associated specificity, sensitivity, error, PPV and NPV are reported with the ROC curve. As an example, a cut-off point of 4 on the ROC curve, a value of 4.55 logits (converting raw scores to interval measures based on Rasch analysis), yields sensitivity of 0.79, specificity of 0.46, error of 0.74, PPV of 0.23, and NPV of 0.91.

Family member/caregiver: Figure 4-6 shows the ROC curve and the AUC based on family members/caregivers' responses. The AUC is 0.726 (95% CI = [0.622, 0.829], $p < 0.001$). Five SDBM measures and the associated specificity, sensitivity PPV and NPV are reported with the ROC curve. The AUC of 0.726 is above the acceptable AUC level of 0.7. As an example, a cut-off point of 4 on the ROC curve (a value of 4.57 logits), yields an associated sensitivity of 0.79, specificity of 0.59, error of 0.62, PPV of 0.29, and NPV of 0.93.

Figure 4-5. ROC curve with cut-points based on the drivers' ratings.
AUC = 0.620 (0.514, 0.725), p = 0.04

Cut-point	*1*	*2*	*3*	*4*	*5*
Measure	3.29	3.74	4.06	4.55	5.62
Sensitivity	0.38	0.55	0.62	0.79	0.93
Specificity	0.72	0.63	0.55	0.46	0.26
Error	0.90	0.82	0.83	0.75	0.81
PPV	0.22	0.24	0.23	0.24	0.21
NPV	0.85	0.87	0.88	0.91	0.95

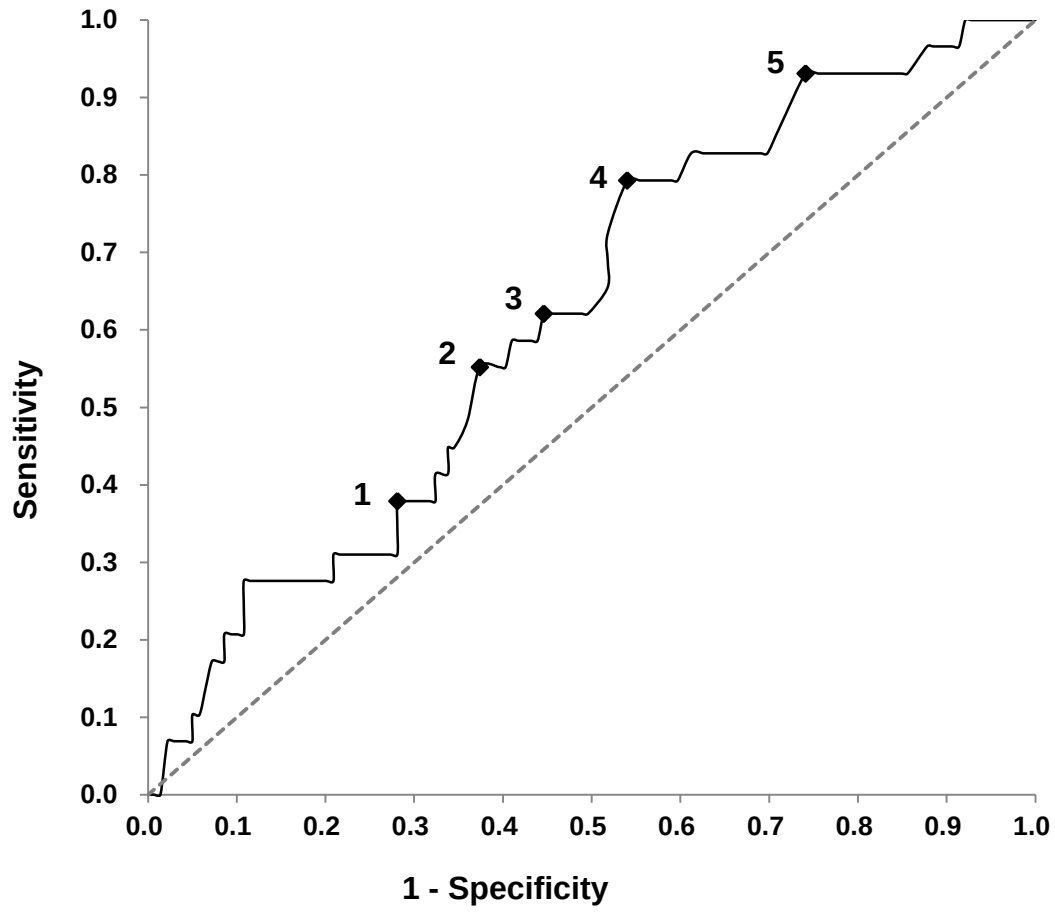
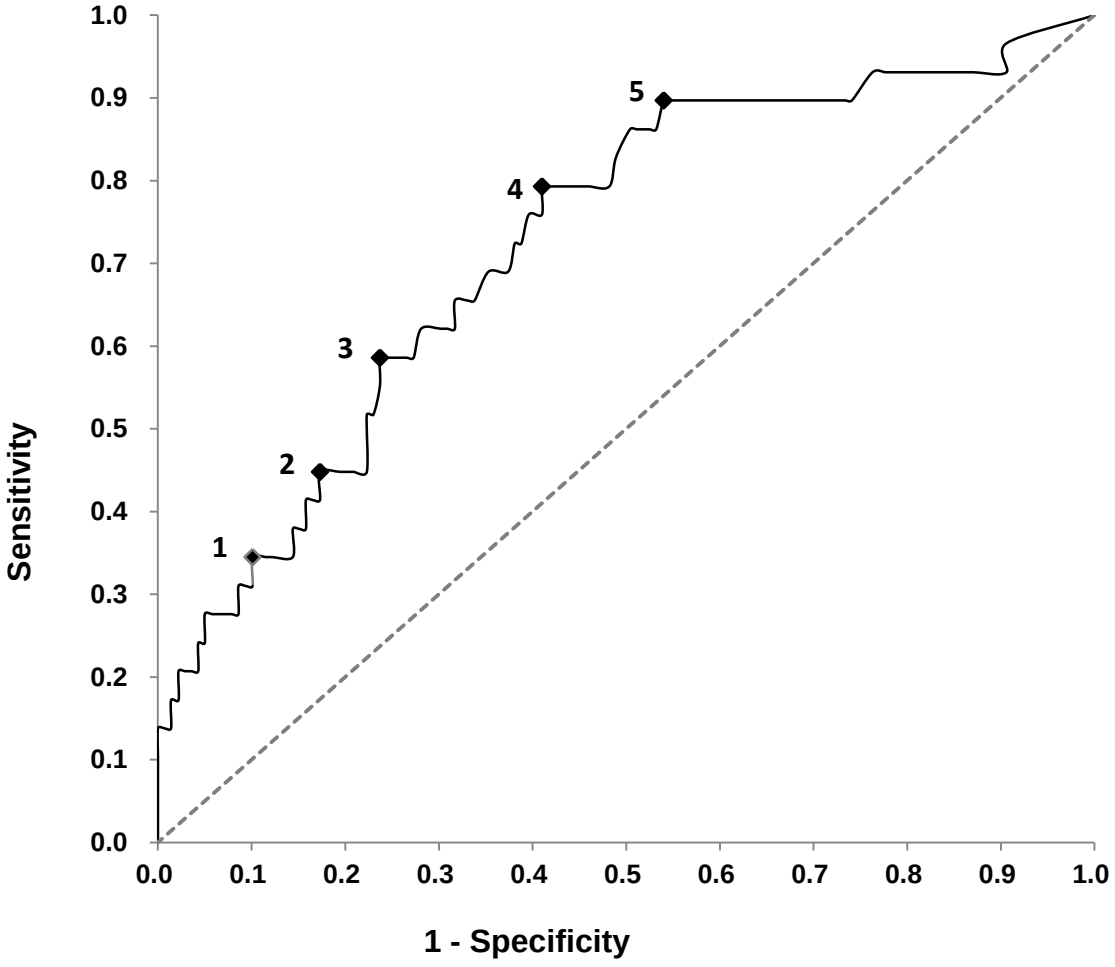


Figure 4-6. ROC curve with cut-points based on the family members/caregivers' ratings. AUC = 0.726(0.622, 0.829), $p \leq 0.01$

Cut-off	*1*	*2*	*3*	*4*	*5*
Measure	2.93	3.52	3.94	4.57	5.16
Sensitivity	0.35	0.45	0.59	0.79	0.90
Specificity	0.90	0.83	0.76	0.59	0.46
Error	0.76	0.72	0.65	0.62	0.64
PPV	0.42	0.35	0.34	0.29	0.26
NPV	0.87	0.88	0.77	0.93	0.96



Specific Aim 3: Develop the instructional clinical outputs, or "key forms" to determine if driving evaluators and occupational therapists (OTs) understand the results of the SDBM in an interpretable way; and if older drivers and F/C understand the results of the SDBM in an interpretable way.

SA3. Focus Group 1 (OT Practitioners)

Demographics. Twelve participants, 10 women and 2 men, 5 being occupational therapists and 7 being occupational therapists/certified driving rehabilitation specialists (OT/CDRSs), participated. Job classifications were OT/CDRS in either community (n= 4) or academic setting (n=3), OT/Researcher (n=3), and OT/Administrative or Management (n=2).

Results. Data from the focus group questions were coded according to three themes: (1) Face Validity, (2) Appearance and Wording, and (3) Usability.

- Face Validity: Respondents said listing items hierarchically (easy to hard) by difficulty level improved face validity as did use of color coding to illustrate ratings and item hierarchy. They suggested we emphasize the area on the keyform where ratings change (e.g., transition zone where overall ratings shift from "a little difficulty" to "a moderate level of difficulty");
- Appearance and Wording: Formatting comments included that the keyform was too "busy" and "difficult to read". They suggested using a legend to clarify terms like "cautiously" or "dense traffic", using full items versus abbreviating, and increasing font size for "elder friendliness". Additionally, on results summary, show items without item number (in results they are listed by difficulty, not numerical order)
- Usability: Respondents said identifying the key domains where difficulty occurs (e.g., motor coordination) would help them match client deficits with OT interventions (e.g., vehicle modifications). The keyform may help identify driver limitations with potential to be addressed by the OT generalist, before pursuing referral to a CDRS. The keyform could also help justify referral to and intervention by a CDRS. Suggestions for *revisions* were to allow space for the users to include comments, enable creation of reports comparing the different raters (e.g., driver vs. caregiver); and to incorporate training in use of the SDBM (e.g., case study), so users would better understand the results, driver profiles and recommendations.

SA3. Focus Group 2 (Expert Panel)

Demographics. Five occupational therapists, all CDRSs, each with more than 10 years experience, participated. They were from four states representing the Southeast, Northeast and Midwest. Four attended on-site and one via telephone conference.

Results. As illustrated in Table 1, the CDRSs perceived the SDBM as "a screening tool that can trigger conversations and broad decisions about driving", one that "measures behavior in such a

way as to give caregivers a structured method of rating driving difficulty" and "allows information to be shared with the driver, and professionals such as a doctor or a CDRS". The keyform recommendations may enhance the clarity of communication about driving concerns, and increase the efficiency of appointment scheduled with the doctor and/or CDRS, to discuss driving-related issues. The CDRSs feedback on the 11 keyform questions (e.g., clarity, ease of use, readability, adequacy, understandability, and acceptability) are listed in Table 4-8 along with the mean VAS ratings of the expert panel members' responses. Using the VAS scale from "0" to "10", "0" was least acceptable while "10" was most acceptable. The overall average of the respondent's keyform ratings was 8.4, SD=0.8. Mean ratings ranged from 7.7-8.9, with the lowest rating given for Q10a – "How would you rate the acceptability of the keyform for drivers?" and the highest rating for Q5 – "Does the keyform adequately illustrate the transition zone, i.e. where the ratings shift from "No Difficulty" to "A Little Difficulty"?"

Table 4-6. Focus Group 2 (Expert Panel): Keyform Questions and Select Respondent Data

Questions	*Mean rating ±SD*	*Respondent comments*
Q1. From the case studies – does the keyform adequately demonstrate the differences in drivers' abilities?	8.1 ±1.8	- caregiver report remarkably in line with the therapist's measure of abilities (R1) - easy to compare good/marginal/bad (R2) - yes, very clear, colors help (R4)
Q2. How would you rate the ease of use of the keyform?	8.3 ±1.5	- impressed with ease of getting a visible snapshot of the abilities (R1) - shows great promise in ease of use and understandability (R1) - user might not understand how overall score derived from ratings (R2)
Q3. How would you rate the clarity of the item hierarchy?	8.2 ±1.0	- hierarchy helps client / family understand that despite many abilities intact, impaired critical elements lead to results/recommendations (R1)
Q4. Does the keyform adequately illustrate the driver's areas of difficulty?	7.9 ±1.7	- caregiver self-report was impressively consistent to therapist's rating (R1) - yes, the colors are great! (R2) - colored zones are great (R5)
Q5. Does the keyform adequately illustrate the transition zone, i.e. where the ratings shift from "No Difficulty" to "A Little Difficulty"?	9.4±0.7	- Yes, very understandably (R1) - Excellent! (R2) - Colors very helpful (R5)
Q6. How would you rate the readability (font, spacing, orientation) of the keyform?	8.8 ±0.9	- once oriented, I found it clear (R2) - positive value that web-based version will offer further description (R1) - excellent! (R2)
Q7. How would you rate the understandability of the language used to describe the items?	7.9 ±1.7	- clearly seems on the right track (R1) - great (R2) - some items need clarification or specific examples (R4)
Q8. How would you rate the acceptability of the keyform layout?	8.9 ±0.9	- once oriented I found it easier (R1) - great (R2) - the hierarchy is ideal and enables someone to educate on driving environment and driving situations (R3) - excellent (R5)
Q9. How would you rate the acceptability of the keyform for occupational therapists?	8.8 ±1.2	- once understood by OTs would be very eagerly accepted (R1) - great visual when talking to patients/family (R3) - provide instructions prior to using (R4) - useful (R5)
Q10a. How would you rate the acceptability of the keyform for drivers?	7.7 ±1.5	- builds self-awareness of deficits (R1) - might only relate to colors and average score especially if they have rated themselves 5s (not difficult) (R2) - provide instructions (R4) - explain the layout / meaning (R4)
Q10b. How would you rate the acceptability of the keyform for caregivers?	8.2 ±1.2	- could strongly enhance the therapeutic discussion(R1) - provides rationale for restriction or cessation (R1) - should definitely trigger conversation (R2) - provide instructions (R4) - explain the layout / meaning (R4)
Overall mean and SD	8.4 ±0.8	

Legend: Q= Question; R= Respondent; Not all raters provided written responses for feedback, SD= Standard deviation

Note: * Numerical data derived from the Visual Analogue Scale are used as continuous data.

The expert panel helped us operationalize three driver types or profiles ("pass, borderline, fail"), and for each profile identify specific safety needs for continued driving (or driving cessation) and the logical next steps for family members/caregivers. Panelists discussed the clinical, ethical, and legal implications of making recommendations, and sought the "just right fit recommendation" for each driver profile ("pass, borderline, fail").

For the most impaired driver groups ("borderline" or "fail"), they were concerned that an overly severe rating may lead to caregiver-driver conflict, that the caregiver would unnecessarily "take the driver off the road", or "reject the screening results". On the other hand, they felt lenient recommendations may prevent family members/caregivers of at-risk drivers from taking appropriate steps to improve safety. Respondents suggested recommendation language that would facilitate action while minimizing negative impact of words pertaining to "threat" "risk" and "concern", which resulted in much debate. One respondent suggested easing the negative impact of a recommendation by "starting with the good", and highlighting items (driving behaviors) that the driver was able to perform, and not just pointing out areas of difficulty.

For the best driver in the group ("passed") the expert panel members developed the following description, refined by the research team, to be shared with the caregivers/family members: *Category: Accomplished Driver- Driving is overall good, but difficulty is experienced with some challenging driving situation, e.g., (examples are selected from the driver's profile). Recommendation: It may be helpful to avoid or limit the challenging driving situations (described in the example). Based on your ratings, we do not think that a comprehensive driving evaluation is critical at this time; but we recommend completing this screening at least annually or if there are any changes in the driver's status.*

The expert panel members also suggested specific recommendations for the "borderline" or "fail" driver profiles including recommendation to have a comprehensive driving evaluation by an OT with specialty certification. They also suggested general recommendations for all groups such as: "as suggested by the American Geriatrics Society seek a physical and eye exam annually, or earlier" or "take a mature drivers class offered by AAA or AARP".

SA3. Focus Group 3 (Family Members/Caregivers)

Demographics. Seven respondents constitute five spouses (71.4%), one adult child (14.3%), and one friend (14.3%). Age range was 46-77 years (median age= 65); most were females (57.1%); 42.9% Caucasian (n=3), 28.6% African-American (n=2), and 28.6% Asian (n=2); all had at least high school graduation, with most having a Bachelor's or higher degree (57.1%).

Results. Changes were recommended for both the web-based SDBM and the keyform. Changes included: to rename "caregiver" as "proxy" which indicated (more accurately) a family member, friend or caregiver with sufficient knowledge to rate the driver's ability; revise instructional

scripts for the web-based SDBM; and incorporate "drop down boxes" to document numerical values e.g., birth year. They suggested clarify the race question (SDBM Section A-demographics); create a proxy version of the driving history (SDBM Section B); and consider use of "not applicable" versus forced response for the driving behavior questions (68 items of SDBM Section C). Respondents also requested a customer satisfaction survey be included with the web-based SDBM and keyform. Table 4-7 presents the family members/caregivers VAS ratings on the six questions regarding purpose, clarity, understandability and meaningfulness of the web-based keyform. The mean VAS score across raters was 9.01/10 and the SD=1.02.

Table 4-7. Focus Group 3: Family Members/ Caregivers Visual Analogue Scale Ratings*

	Rater A	*Rater B*	*Rater C*	*Rater D*	*Rater E*	*Rater F*	*Rater G*	*Mean of Sum*	*SD of Sum*
Q1a. How well did we explain the purpose of the questionnaire?	8.4	8.7	8.1	9.8	9.9	9.9	10	9.26	0.82
Q1b. How clear were the instructions of the questionnaire?	6.8	8.4	8.1	9.7	6.3	9.8	7.7	8.11	1.33
Q2a. How well did we explain the purpose of the keyform?	7.6	8.4	9.1	10	9.5	9.8	9.9	9.19	0.89
Q2b. Is the keyform useful, e.g., does it illustrate your areas of concern ?	8.8	8.3	9.4	10	9.7	9.8	9.9	9.41	0.64
Q2c. Is the keyform understandable, e.g., does it reflect the driver's difficulties?	8.3	8.1	7.5	9.9	7.6	9.7	10	8.73	1.10
Q2d. Is the keyform meaningful, e.g., does it provide helpful recommendations regarding follow-up?	7.5	9.1	9.4	9.9	9.7	9.9	10	9.36	0.88
Mean of Sum	7.90	8.50	8.60	9.88	8.78	9.82	9.58	9.01	--
SD of Sum	0.73	0.35	0.80	0.12	1.48	0.08	0.92	--	1.02

Note: * Data derived from the Visual Analogue Scale are used as continuous data.

Specific Aim 4: To develop and implement the computer algorithms for a web-accessible Keyform for the Safe Driving Behavior Measure.

SA4. At this stage we have developed multiple algorithms for the web-based SDBM and keyform and this work will be continued under an FDOT project. As described in methods we developed and refined an algorithm for classification of the drivers which is illustrated in Figure 4-7 below and described.

Procedure for Setting the Cut-Scores

Based on measurement theory, psychometrics of the SDBM, exemplar cases, and team input, three driver classifications were established. The three driver classifications were basic driver, routine driver and accomplished driver as defined below, plus a category for drivers who could not be classified based on the ratings. Two cut scores or thresholds were established using the F/C ratings for the group of 200 drivers. The first threshold separated the lowest rated drivers (basic) from the moderately rated drivers (routine). The second threshold separated the moderately rated drivers (routine) from the highest rated drivers (accomplished). In addition to the three categories based on difficulty ratings, it was necessary to establish a category (Group D-unable to categorize) for drivers whose rating pattern (based on Infit MnSq and Outfit MnSq) did not fit the Rasch model as the F/Cs' ratings showed unexpected or erratic patterns. The driver categories are as follows:

Group A 1 = Accomplished Driver: someone who is able to perform complex driving skills and may only experience difficulty with the most challenging skills.
Group A 2 = Accomplished Driver-Difficulty with one or more critical driving errors: someone who is able to perform complex driving skills, however, one or more critical driving errors were reported indicating a need for intervention.

Group B 1 = Routine Driver: someone showing difficulty with routine driving skills and early signs of needing intervention.
Group B 2 = Routine Driver: Difficulty with one or more critical driving errors: someone showing difficulty with routine driving skills and due to one or more critical driving errors there are critical safety concerns that need immediate attention.

Group C 1= Basic Driver: Although driver can still perform basic driving skills, there are safety concerns that need immediate attention.
Group C 2= Basic Driver: Difficulty with one or more critical driving errors: Although driver can still perform some basic driving skills, there are critical safety concerns that need immediate attention.

Group D1= Unable to classify: this driver's rating pattern could not be matched to a category.
Group D2= Unable to classify: this driver's rating pattern could not be matched to a category, due to one or more critical driving errors there are safety concerns that need immediate attention.

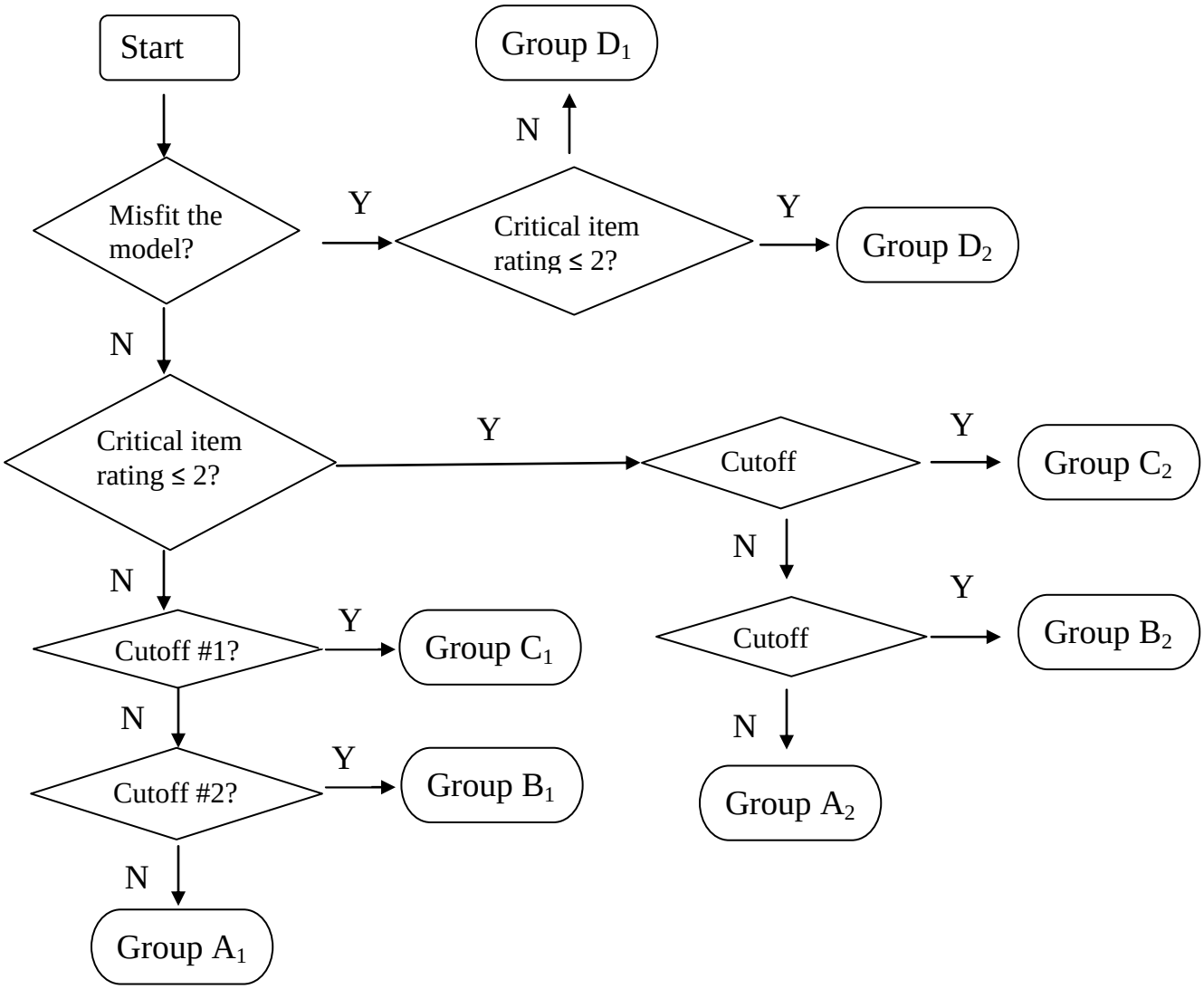
The SDBM output included a driver profile with keyform to illustrate ratings, driver category, examples of difficult items, and category specific safety recommendations. Drivers in Group C and drivers with critical errors received the strongest clinical recommendation to pursue a CDE. The recommendations for the three main groups are:

Basic Driver: Specific Recommendations: We recommend the driver see a doctor for a physical exam as soon as possible, and not drive until he/she is able to undergo a comprehensive driving evaluation conducted by a Certified Driving Rehabilitation Specialist. Information on the use and access to alternative transportation (other than the personal automobile) may be available from the local Area Agency on Aging. **General Recommendations**: Based on guidelines of The American Geriatrics Society, we recommend an eye exam annually, or earlier if there are changes in health or vision.

Routine Driver: Specific Recommendations: We recommend a doctor's appointment to start a conversation about conditions that may impact driving safety. The driver will also benefit from a comprehensive driving evaluation to address safety concerns. We do recommend repeating this self-screening annually, or when the driver experience changes in health or functional status. **General Recommendations**: The American Geriatrics Society recommends a physical and eye exam annually, or earlier, when needed. We recommend taking a class for mature drivers such as those offered by AAA, AARP or a local driving school.

Accomplished Driver: Specific Recommendations: It may be helpful to avoid or limit driving situations that are challenging. Based on your ratings, we do not think that a comprehensive driving evaluation is critical at this time. We do recommend repeating this self-screening annually, or when the driver experiences changes in health or functional status. **General Recommendations**: Additionally, The American Geriatrics Society recommends a physical and eye exam annually, or earlier, when needed. We recommend taking a class for mature drivers such as those offered by AAA, AARP or a local driving school.

4-7. Flowchart for Driver Categorization based on F/Cs' Ratings



- Group D1 – misfit and no critical items
- Group D2 – misfit with critical items
- Group C1 – lowest ability pattern
- Group C2 – lowest ability pattern with critical items
- Group B1 – middle ability pattern
- Group B2 – middle ability pattern with critical items
- Group A1 – highest ability pattern
- Group A2 – highest ability pattern with critical items

Critical items

- 9 Stay in Ln
- 27 Change Ln mod traf
- 30 Maintain Ln when turn
- 32 Turn Rt enter traf
- 39 Let turn into traf
- 41 Stay within Ln mark
- 42 Stay within Ln absn

CHAPTER 5 – DISCUSSION

Participants and Sample Considerations:
Before discussing the findings, it is important to address key characteristics of our sample and related study limitations. Overall our drivers were licensed community-dwelling Caucasians of a high educational level who drove almost daily and who had relatively few self-reported medications. Although the group reported a variety of co-morbidities, only about five percent reported that these conditions affected their driving. Their clinical profiles portrayed that they had adequate visual, vision-cognitive, cognitive and motor performance skills, and as such we surmised that they can be considered a relatively healthy group of older drivers. This group is not representative of the general spectrum of older adults, as our sample had low representation of minorities, low educational status, or those with poor health status. Generalizations can only be made to drivers who fit the above profile.

Overall the family members/caregivers were community dwelling Caucasians, mainly female, with the majority having education beyond high school. About 80% of the group was family members of the drivers. Thirty percent of the group reported that they would have been impacted if the driver reduced or stopped his/her driving. In terms of the general US demographics for caregivers of older adults, our group showed similarities in that they were also mainly female caregivers. One limitation that could be addressed in a future study is that we did not test the cognitive ability of caregivers, a factor which could influence the accuracy of their ratings. Generalizations can only be made to family members/caregivers who fit the above profile.

Specific Aim 1(b): Describe the item and person level properties of the SDBM.
SA1b. We investigated the psychometric properties of the 68-item SDBM by unidimensionality and local independency, rating scale, item/person-level psychometrics, and item hierarchy across three groups (older drivers, caregivers and driving evaluators).

The result of the PCAr was sufficient to assume the SDBM measured a unidimensional construct. The local independency assumption, however, was not held, especially for the evaluator group's ratings. The pattern of the residual correlation of the evaluator group's ratings showed that the hypothesized easy items were highly correlated. This was caused by the low response variances on the easier items on this sample, suggesting that the easier items (pre-driving items) may be excluded in the final version of the SDBM. The rating scale structure suggested that the "Cannot Do" category was under used across three rater groups; although it did not discriminate among the ability levels of drivers, it did provide an anchoring point at one end of the rating scale. When we test drivers with "lesser" ability levels (than the current sample), they may very well use the "Cannot Do" category. However, if future data still indicate under usage, we may have to collapse the "Cannot Do" and "Very Difficult" categories.

Item/ person-level psychometrics of the SDBM for each of the three groups revealed incongruence pertaining to (mis)fit. This overlapping misfitting item 38 in the driver and caregiver groups may need clarification as group members were not specifically instructed on the *type* of map (Google map, or a geographic positioning system map), which could lead to greater variability in their response choices. Misfitting items (19%) in the evaluator group were problematic. The problem, based on post-hoc inspection, was due to the evaluators rating high ability people as having difficulty with the easiest items. The Rasch model "recognizes" such ratings as inconsistent (misfitting) with the predicted pattern; that is, if people do well on difficult items, they should also do well on easy items. We found one older driver whose response pattern was very different than the rest of the older drivers (person infit statistic was 5, versus the perfect fit which is "1"). When this driver was excluded, post-hoc analyses revealed that the number of misfitting items for the evaluator group reduced from 13 to 8.

Across the three rater groups, these data displayed good *person separation* (>3.49) and *item separation* (>3.6), *good item reliability* (>0.93) and *person reliability* (>0.92) and *Cronbach's alpha* >96%. However, some of the items were not following the hypothesized order of item difficulty. The evaluator group's ratings showed a different item hierarchy compared to the other two rater groups, potentially due to the evaluators wanting to minimize traffic risk and maximize participant safety.

Even though mild ceiling effects existed for the caregivers (11%), and the person mean across the three rater groups was about 2 SD higher than the item mean, given that this sample was high functioning, the SDBM may have a sufficient level of challenging items to measure other older adult groups.

This study has several limitations. Caution needs to be exercised when interpreting the data as we can only generalize results to the sample under this study, i.e., an educated, mainly white, and cognitively intact group of community dwelling licensed older drivers. Additionally, several pairs of easy items showed local dependency and some of them were misfitting as well.

Preliminary findings (N=80) (Classen et al., 2012) indicated significant differences between the ratings of the evaluator and the caregiver on 17 items, where the evaluator rated 7 items more severely compared to the caregiver; and the caregiver rated 10 items more severely compared to the evaluator. There were no significant differences between the ratings of the evaluator and the driver; or the caregiver and the driver. All of these issues must be reconsidered for exclusion if the same pattern holds up after we test drivers with lower ability levels (currently lacking from our sample).

Recently, two driving studies used item response theory (IRT) to develop or evaluate driving scales: one to convert a standard on-road test to a Rasch scale and the other to develop a measure

of driving confidence (Kay, Bundy, Clemson, & Jolly, 2008; Kay, Bundy, & Clemson, 2009; Myers, Paradis, & Blanchard, 2008). Neither one of these studied safe driving from a comprehensive person-vehicle-environment approach, within the driving context, to provide an entry point for occupational therapy intervention. Moreover, the clinical utility of the SDBM is favorable: ≤ 20 minutes to complete; minimal respondent burden; and items reflect person, vehicle, and environment domains, and driving behaviors requiring very basic to very advance maneuvers. The instrument can accurately distinguish the ability level of people into 5-6 strata and its strengths i.e., good person and item separation, good item and person reliability, adequate internal consistency, and good clinical utility motivated us to continue data collection for future analyses.

Specific Aim 1(c): Determine the rater severity of the three rater groups (older driver, F/C, driving evaluator).

For Specific Aim 1c, we addressed inter-rater reliability among three groups of raters (older driver, F/C and driving evaluators), and investigated the rater effects between the evaluators and the F/C to identify erratic responses and to determine the severity/ leniency of the groups' ratings on 41 items of the SBDM.

SA1c. Inter-rater reliability

We found no statistically significant correlation between the ratings of the driver and the evaluator groups, or the driver and the F/C groups. On the other hand a significantly moderate agreement (0.53) was found between the evaluator and F/C groups. Two studies have previously investigated the relationship of driving performance rated by evaluators and older drivers (Marottoli & Richardson, 1998; Wild & Cotrell, 2003), showing no significant correlation between the evaluator and the drivers' rating (Marottoli & Richardson, 1998); and no significance on 8 of 10 items rating the drivers' driving performance (Wild & Cotrell, 2003). Our study's findings are therefore somewhat consistent with these two studies in that the evaluator's ratings are not associated with the driver's ratings, but that they are correlated with the F/C's ratings.

SA1c. Rater Effects

Facet ruler of the SDBM. The distribution of the drivers' ability relative to the distribution of the items' difficulty indicates that the participants in this study performed well on the instrument. As can be seen from Figure 4-3 many of our items are on the same logit level. Taking into account that only the *means* of the items are represented, we have more overlapping among the items, because each item consists of five difficulty levels corresponding to 5-point adjectival scale. Having different items at the same difficulty level in the item pool may be redundant for paper and pencil tests; however that will increase the item pool which will in turn provide more choices for future applications, such as using computer adaptive testing (the next step in the development of our instrument).

Fit statistics of the three rater groups. The fit statistics across the rater groups (evaluators and F/C) showed that there were no erratic rater groups and that the evaluators were overall more *severe* raters (Facets) when compared to the F/C.

Fixed chi-square and paired comparisons. While the evaluator group is a more severe rater group than the F/C group on the overall scale, the F/C group rated 10 items more severely than the evaluator group. On the other hand the evaluator group rated 7 items more severely than the F/C group. Evaluators have formal training to rate driving behaviors according to the standards of regulatory bodies such as the Department of Motor Vehicle and Highway Safety licensure guidelines; and we can therefore expect that they will be more technical and more stringent in their ratings. The F/C group does not have such formal training and are rating the drivers on their perceptions of how they are experiencing the driving safety of their loved ones. The tendency for evaluators to rate more severely (than the F/C), may be influenced by their training to focus on identifying deficits. The F/Cs, on the other hand, may be influenced by showing concern for their loved one's safety, thus rating more stringently; or being concerned with maintaining their own independence in transportation and rating leniently, especially given that 31.3% of F/C stated that their independence will be impacted if the older driver stopped driving. In future studies we may want to control for this variable by means of stratifying F/Cs based on whether their independence will be impacted, or not, if the older driver stopped driving.

The generalizability of our findings are limited due to using only two evaluators, using a convenience sample, and having a sample size of 80 F/C and 80 older drivers. Our driver sample was skewed to include mainly white (97.5%) and educated participants (63.8% had some college education or university degree). The F/C sample were mainly male (22.5%), white (98.8%), and 48.8% of them had completed college or university degrees.

Nevertheless, our findings suggest that, due to the significant relationship between F/C and evaluator findings, that we may train caregivers to recognize older adults' unsafe driving behaviors more precisely. As such, after a short training program to the caregivers, we expect that the paired comparisons of the identified items may show improved congruence between F/C and evaluators.

Specific Aim 2. We will validate the SDBM to the gold standard on-road driving evaluation.

In the study for Specific Aim 2, we examined the concurrent criterion validity of the SDBM to on-road outcomes (passing/ failing the on-road test as determined by a certified driving rehabilitation specialist), among older drivers and their family members/caregivers in Florida and Thunder Bay, Ontario.

The area under the curve (AUC) of the older drivers' self-assessment based on SDBM, although statistically significant, yielded low accuracy in predicting the on-road driving test results. As

such, we conclude that the SDBM, when used by drivers, is not an accurate self-report screening tool to make determinations regarding on-road outcomes. That being said, the driver's ratings may still be used by occupational therapists in discussing differences between drivers' self-ratings and those of the family members/caregivers to increase self-awareness of driving behaviors. Likewise, the driver report may also be used, in combination with the caregiver's report to "start" the conversation about future driving interventions, driving alternatives, or driving cessation.

The family member/caregivers' AUC yielded acceptable accuracy for using the SDBM measure to predict outcomes of the on-road driving test. Several previous studies have used caregivers to provide a proxy report on older drivers' driving errors (Wild & Cotrell, 2003) and behaviors (Croston, Meuser, Berg-Weger, Grant, & Carr, 2009). Similarly in our previous work, we have shown that family members/caregivers' ratings on the SDBM are reliably correlated to SDBM ratings of the driving evaluators (Classen, et al., 2012). We propose that these finding have implications for research and clinical practice:

The first implication for future research is: Even though the family member/caregivers' ROC findings illustrate acceptable AUC, using a cut-off point to achieve good sensitivity, results in a large number of false positives. For example, using a cut-off point of 5 yields a sensitivity of 0.79 and a specificity of 0.59. To improve the accuracy of the SDBM, we are testing the efficacy of a caregiver training program to enhance their accuracy in identifying driving difficulties in the older drivers. While preliminary findings are promising, this approach will have to be tested in multi-site, multi-center settings with representative samples to make population-based generalizations.

The second implication is for clinical practice: This is one of few screening tools for use by family members/caregivers to rate older drivers' behaviors. To our knowledge, this is the first screening tool showing concurrent criterion validity for family members/caregivers report in classifying older drivers who failed an on-road test. As such, occupational therapists may use this screening tool (completed by family members/caregivers) to form a picture of the driver's driving behaviors. This screening tool may also be used to facilitate a conversation about difficulty with driving (from the caregiver and/or client perspective), and help to identify driving problems, which may in turn lay the foundation for intervention planning by a certified driving rehabilitation specialist or evaluator. Moreover, the SDBM operationalizes driving by means of 68 behavioral items. Thus it gives the practitioner, perhaps a generalist who is not extensively familiar with all the underlying driving-related issues, a concrete description of driving abilities that can be viewed as "difficult" to perform, and provide an entry point for clinical decision-making, intervention, adaptation (e.g., suggesting safer strategies, such as not driving on the interstate) or referral to a driving rehabilitation specialist.

Limitations beyond those already mentioned (e.g., race) pertain to the error associated with the family members/caregivers SDBM ratings, as well as the less than desirable specificity and low PPV. Only two sites were involved in the testing of participants. A web-based tool (in development) may enhance our chances of involving more sites in continued research.

Specific Aim 3: Develop the instructional clinical outputs, or "key forms" to determine if driving evaluators and occupational therapists (OTs) understand the results of the SDBM in an interpretable way; and if older drivers and their family/caregivers understand the results of the SDBM in an interpretable way.
In the study for Specific Aim 3, we conducted three focus groups, one with each stakeholder group representing OT practitioners, CDRSs, and family members/caregivers, to learn their needs, perspectives, and suggestions for refining the web-based SDBM and keyform.

The OT practitioners' results supported the web-based SDBM and keyform as a potentially useful tool to provide a profile of the driver for further decision-making. It may facilitate communication about driving difficulties among the stakeholders and the drivers. Velozo & Woodbury (2011) suggested that a major benefit of the keyform is that it can be used as the basis for interventions. In our focus group, the OT practitioners have verified the usefulness of the keyform to "provide a visible snapshot of abilities" from which further interventions could be planned.

Based on the expert panel of CDRSs' specialized knowledge, in-depth understanding and clinical reasoning (American Occupational Therapy Association, 2010), we refined the classifications of drivers. This led to formulating the "just right fit" recommendations for three driver profiles, with wording and action steps to guide family members/caregivers, and potentially promote safety among drivers.

From the family members/caregivers, we obtained feedback that the web-based SDBM and keyform, were useful to rate and share a driver's ability level with the driver, the family doctor, or an occupational therapist. We implemented their suggestions to enhance the functionality, user-friendliness, understandability, and acceptability of the web-based version of these tools.

Limitations of this study pertain to generalizability of the results, which can only be extrapolated to participants fitting the profile of our respondents. However, we used purposive sampling for this study which yielded reasonable representation of participants. For example, we had occupational therapists representing a variety of clinical and academic setting; the experts represented three U.S. states and different practice settings, while family members/caregivers were from different age, gender, and racial groups.

Strengths pertain to the inclusion of three different stakeholder groups to share their specific needs, perspectives and suggestions to enhance the development of the web-based SDBM and

keyforms. Indeed, the respondents' descriptions provided a rich contribution reflecting the many aspects of instrument development to satisfy the needs of different user groups (Thurstone, 1925). To our knowledge, this is the first study to include OT practitioners, CDRSs as experts, and family members/caregivers, in the refinement of a driving outcome measure.

Next steps, in progress, are to launch the web-based version of the SDBM and keyforms for field testing in selected sites. We anticipate receiving further feedback on the adequacy, readability, acceptability, and usability of web-based version. We will also test the SDBM in physician's offices to determine its usability in helping physicians to enhance their decision making related to driving concerns of their patients. As such we are hopeful that each of the stakeholder groups will be able to use the web-based tool in an effective way. In so doing, we will help family members/caregivers to identify older drivers at risk (via keyform output), create an avenue for OT generalists to start conversations about driving safety (via the driver profile of the keyform), and provide an entry point for CDRSs (through the keyform profiles).

Specific Aim 4: (Revised scope initiated April 2011 following FDOT grant to support Specific Aims 1-3) To develop and implement the computer algorithms for a web-accessible Keyform for the Safe Driving Behavior Measure **and** to enroll subjects for improved representativeness of the sample.

SA4 - This work is continuing under the FDOT funding started April 2011 with final results to be attained on that project.

Study Conclusion

Our data reflect the SDBM is efficient and offers the potential to accurately classify a population of older drivers with varying ability levels into distinct groups with more or less of safe driving behaviors; as such, the SDBM, when tested further and calibrated among drivers with a wide spectrum of ability levels, may provide the first step to identify unsafe driving behaviors and provide occupational therapists with an entry point for delivering preventative services. Our findings address an under studied phenomenon in the older driver safety literature: the reliability, leniency and severity of F/C and evaluators ratings of older drivers through the SDBM. This study makes clear that: a correlation exists between the evaluator and the F/C ratings, that neither of these groups is erratic in their rating responses, that the driving evaluator is the most severe rater; but that the F/C show potential to be trained to increase the accuracy of their ratings. A future implication is to devise, implement and test a F/C training protocol to enhance the accuracy and reliability of their ratings. Testing may also include looking at alternate ways of rating, such as rating whether ability for a behavior has declined over time, to see if this o Occupational therapists may play a critical role in interpreting the findings of such proxy reports, and identifying entry points for logical and efficient driver safety interventions. Our study of concurrent criterion validity established that the SDBM, when used by family members/caregivers to rate the driving behaviors of older drivers has an acceptable level of validity in relation to on-road outcomes but requires further validation (larger research study

with a more representative sample). From the focus groups, stakeholders (OT practitioners, CDRS experts, family members /caregivers) contributed to the formatting of a web-based SDBM and keyform. Based on their responses, we propose the web-based SDBM and keyform may be useful for family members/caregivers to identify at-risk older drivers, occupational therapy practitioners to start conversations about general driving safety and CDRSs in providing them an entry point for interventions. Further testing could be used to indicate the Generalizability of the SDBM for other populations including those from the general population experiencing driver disability, beyond the older adult population.

Through the studies addressing the four aims, we specifically addressed ***CMS Research Priority 1: Recurrent congestion as it pertains to prevention of crashes among older drivers as a congestion mitigation strategy.*** Building on our NIH funded pilot work, we have refined a theory-driven instrument that measure the level of safe driving ability among older drivers; and which produces clinically relevant outputs to guide older adults and significant others in making safer decisions for continued driving when it is possible, or suggest driving cessation and the use of other mobility options when driving is no longer a viable option. We expect that these decisions will lead to safe driving behaviors, which will in turn reduce crashes, injuries, fatalities and congestion. However, we will have to test this assumption through longitudinal studies.

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APPENDICES

A. SAFE DRIVING BEHAVIOR MEASURE

For Office Use Only
Date: _____
Participant ID: _____

SDBM Version 1/29/09

Safe Driving Behavior Measure

A. Demographic Profile

Instructions:
1. **Please answer all 9 questions to the best of your ability.**
2. **Answer by checking the box or filling in the blank.**

1. What is your birth year? _____

2. What is your gender?
   - ☐ Male
   - ☐ Female

3. What is your ethnicity? Do you consider yourself to be:
   - ☐ **Hispanic or Latino** (A person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race)
   - ☐ **Not Hispanic or Latino**

4. What is your race? Would you say you are:
   - ☐ **American Indian / Alaska Native / First Nations / Aboriginal or Inuit**: having origins in any of the original peoples of North, Central, or South America, and who maintains tribal affiliation or community attachment.
   - ☐ **Asian**: having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.
   - ☐ **Black or African American**: having origins in any of the black racial groups of Africa.
   - ☐ **Native Hawaiian or Other Pacific Islander**: having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.
   - ☐ **White**: having origins in any of the original peoples of Europe, the Middle East, or North Africa.
   - ☐ Other: specify _____

5. Do you live alone? (If “Yes” – Go to question # 8)
   - ☐ No
   - ☐ Yes
   - ☐ Mostly (for part of the year)

6. Who lives with you?
   - ☐ Spouse or partner
   - ☐ Child
   - ☐ Family/Other relative: specify: _____
   - ☐ Friend(s)
   - ☐ Paid caregiver
   - ☐ Other: specify _____

7. How many other licensed drivers are in your household? _____

8. What is your highest level of education?

   - ☐ Did not go to school
   - ☐ Completed Grade school (5th grade)
   - ☐ Completed Middle school (8th grade)
   - ☐ Completed High School/G.E.D. (12th grade)
   - ☐ Completed Vocational Training
   - ☐ Some College after High School Graduation
   - ☐ Associate Degree
   - ☐ Bachelor’s Degree
   - ☐ Some Professional School after College Graduation
   - ☐ Master’s Degree
   - ☐ Doctoral Degree

9. Do you use any of the following assistive devices?
   - ☐ Corrective lenses (such as eyeglasses or contacts)
   - ☐ Hearing device \ hearing aid
   - ☐ Mobility device (such as cane, walker, wheelchair)
   - ☐ Car devices (such as seat pad, pedal assist, spinner knob)
   - ☐ Other: (list)_____

Safe Driving Behavior Measure

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B. Driving History Profile

Instructions:

1. **Please answer all 18 questions to the best of your ability.**
2. **Answer by checking the box or filling in the blank.**

1. How many days a week do you typically drive?
   - ☐ 0
   - ☐ 1
   - ☐ 2
   - ☐ 3
   - ☐ 4
   - ☐ 5
   - ☐ 6
   - ☐ 7

2. When you drive, who usually rides with you?
   (Please check all that apply)
   - ☐ Spouse / Partner
   - ☐ Family member
   - ☐ Friend
   - ☐ Caregiver
   - ☐ Other
   - ☐ No one

3. Has a health condition limited your ability to drive?
   - ☐ No
   - ☐ Yes

4. Has taking medications limited your ability to drive (over the counter or prescribed)?
   - ☐ No
   - ☐ Yes

5. Did you get any of the following tested in the last year?
(Please check all that apply)

- ☐ Vision
- ☐ Hearing
- ☐ Physical exam / checkup
- ☐ Other tests (list)_____

6. In the past year, did you complete any of the following car maintenance?
(Please check all that apply)

- ☐ Oil change
- ☐ Checking tires
- ☐ Checking fluid levels
- ☐ Checking headlights, brake lights and parking lights

7. Do you avoid (when possible) any of these driving situations?
(Please check all that apply)

- ☐ Rush hour/heavy traffic
- ☐ Interstate/ highway driving
- ☐ Rain
- ☐ Night-time driving
- ☐ Left hand turns against traffic
- ☐ Other (list)_____
- ☐ None

8. Do you use alternative transportation (such as taking a bus or taxi)?

- ☐ Always
- ☐ Often
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

9. Would you consider alternative transportation if it were available?

- ☐ No
- ☐ Yes

10. As the driver on a long trip, how frequently do you take breaks?

- ☐ Every 1 to 2 hours
- ☐ Every 3 to 4 hours
- ☐ Every 5 to 6 hours
- ☐ Rarely or Never

11. Is it difficult for you to fasten your seatbelt?
    - ☐ Always
    - ☐ Often
    - ☐ Sometimes
    - ☐ Rarely
    - ☐ Never

12. As a driver, have you been involved in a crash in the past 3 years? (If you mark “No”, go to question # 14)
    - ☐ No
    - ☐ Yes

13. As a driver, how many crashes were you involved in during the past 3 years?
    - ☐ 1
    - ☐ 2
    - ☐ 3
    - ☐ 4
    - ☐ 5 or more

14. How many moving violations, citations or traffic tickets have you had in the past 3 years? (If you mark “0”, go to question #16)
    - ☐ 0
    - ☐ 1
    - ☐ 2
    - ☐ 3
    - ☐ 4
    - ☐ 5 or more

15. What moving violations, citations or traffic tickets did you receive in the past three years? (Please check all that apply)
    - ☐ Failure to yield
    - ☐ Going too slowly
    - ☐ Not obeying traffic lights
    - ☐ Not obeying traffic signs (such as stop sign)
    - ☐ Improper passing
    - ☐ Improper turning
    - ☐ Careless driving
    - ☐ Reckless driving
    - ☐ Driving under influence of drugs or alcohol (DUI/DWI)
    - ☐ Speeding
    - ☐ Tailgating
    - ☐ Other (list)_____

16. When did you last attend a driver education, training or retraining course? (If you mark “Never”, go to question #18)
    - ☐ Within the past year
    - ☐ 1 – 3 years ago
    - ☐ More than 3 years ago
    - ☐ Never

17. If you have attended a driver education class, training or re-training, what type was it? (Please check all that apply)
    - ☐ On-line class
    - ☐ Classroom course for all drivers
    - ☐ Classroom course for mature drivers
    - ☐ Course with classroom and behind the wheel instruction
    - ☐ Other (list)_____

18. How do you keep up with changes in road rules or laws? (Please check all that apply)
    - ☐ Driving class
    - ☐ Newspaper
    - ☐ TV
    - ☐ Driver’s handbook
    - ☐ Friends or family
    - ☐ Computer
    - ☐ Police or law enforcement
    - ☐ Driver’s license office (DMV)
    - ☐ Other (list)_____
    - ☐ None of the above

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C: Safe Driving Behavior Measure

Instructions:

1. **Please answer all 68 questions to the best of your ability.**
2. **Based on your driving in the last three (3) months, tell us how much difficulty you have with the driving behaviors on the following pages.**
3. **Mark one of these answers:**

Cannot Do - too difficult to manage
Very Difficult - doing it is a major challenge
Somewhat Difficult – doing it is a moderate challenge
A Little Difficult- doing it is a minor challenge
Not Difficult- you can do it with ease
Not Applicable – question does not apply

Note the example below:

BASED ON YOUR DRIVING IN THE LAST 3 MONTHS, HOW DIFFICULT IS IT FOR YOU TO…					
A. Put your key in the ignition?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑

BASED ON YOUR DRIVING IN THE LAST 3 MONTHS, HOW DIFFICULT IS IT FOR YOU TO…					
1. Open your car door?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
2. Get in your car?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
3. Turn the steering wheel?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
4. Adjust your car mirrors?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
5. Stay awake while driving?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
6. Adjust the driver's seat so you can see above the steering wheel?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
7. Stop for pedestrians crossing the roadway?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
8. Drive in good weather?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
9. Stay in your own lane?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
10. Drive during daylight hours?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑

BASED ON YOUR DRIVING IN THE LAST 3 MONTHS, HOW DIFFICULT IS IT FOR YOU TO…						
11. Remember to turn on your headlights before driving in the dark?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
12. Check for a clear path when backing out from a driveway or parking space?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
13. Reach the gas pedal (accelerator) and brake pedal?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
14. Press the gas or the brake when intended?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
15. Use your car controls (such as the turn signals, windshield wipers, or headlights)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
16. Place your car in the correct gear (such as drive or reverse)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
17. Operate your emergency brake?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
18. Check your mirrors when changing lanes?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
19. Read road signs far enough in advance to react (such as make a turn)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
20. Obey varied forms of traffic lights (such as green arrow for turn lane or flashing lights)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑

BASED ON YOUR DRIVING IN THE LAST 3 MONTHS, HOW DIFFICULT IS IT FOR YOU TO…					
21. Drive and hold a conversation with one or more passengers?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
22. Drive with a passenger who is providing driving directions or assistance?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
23. Drive in light rain?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
24. Drive on a highway with two or more lanes in each direction?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
25. Keep up with the flow of traffic?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
26. Keep distance from other vehicles when you change lanes?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
27. Change lanes in moderate traffic?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
28. Drive cautiously (to avoid collisions) in situations when others are driving erratically (such as speeding, road rage, crossing lane lines or driving distracted)?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
29. Brake at a stop sign so car stops completely before the marked line?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
30. Maintain lane when turning (not cut corner or go wide)?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑

BASED ON YOUR DRIVING IN THE LAST 3 MONTHS, HOW DIFFICULT IS IT FOR YOU TO…						
31. Back out of parking spots?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
32. Enter the flow of traffic when turning right?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
33. Share the road with vulnerable road users such as bicyclists, scooter drivers, motorcyclists?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
34. Drive on graded (unpaved) road?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
35. Check blind spots before changing lanes?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
36. Drive with tractor-trailers (transport trucks) around you?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
37. Merge onto a highway?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
38. Use a map while driving?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
39. Make a left hand turn crossing multiple lanes and entering traffic (with no lights or stop signs)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
40. Parallel park?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑

BASED ON YOUR DRIVING IN THE LAST 3 MONTHS, HOW DIFFICULT IS IT FOR YOU TO…						
41. Stay within the lane markings unless you have to make a lane change?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
42. Stay within your lane in the absence of road features such as clearly marked lane lines, reflectors or rumble strips?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
43. Keep distance between your car and others (allow time to react to hazards)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
44. Look left and right before crossing an intersection?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
45. Drive in a construction zone?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
46. Drive in dense traffic (such as rush hour)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
47. Pass (overtake) a car in the absence of a passing lane?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
48. Pass (overtake) a larger vehicle such as a RV, tractor-trailer (transport truck), or dump truck in the absence of a passing lane?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
49. Drive in an unfamiliar urban area?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
50. Control your car when going down a steep hill?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑

BASED ON YOUR DRIVING IN THE LAST 3 MONTHS, HOW DIFFICULT IS IT FOR YOU TO…						
51. Exit an expressway, or inter-state from a left-hand lane?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
52. Drive in a highly complex situation (such as a large city with high-speed traffic, multiple highway interchanges and several signs)?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
53. Control the car (brake hard or swerve) to avoid collisions?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
54. Drive a different car (such as another person's car or a rental car)?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
55. Alter your driving in response to changes in your health (such as vision, reaction time, fatigue, thinking, joint stiffness, medications)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
56. Drive when you are upset (anxious, worried, sad or angry)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
57. Stay focused on driving when there are distractions (such as radio, eating, drinking, pet in the car)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
58. Drive in an unfamiliar area?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
59. Drive at night?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑

BASED ON YOUR DRIVING IN THE LAST 3 MONTHS, HOW DIFFICULT IS IT FOR YOU TO…						
60. Avoid dangerous situations (such as car door opening, car pulling out, road debris, or an animal darting in front of you)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
61. Drive when there is fog?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
62. Drive at night on a dark road with faded or absent lane lines?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
63. Drive when there is glare or the sun is in your eyes?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
64. Turn left across multiple lanes when there is no traffic light?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
65. Drive in a thunderstorm with heavy rains and wind?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
66. Control your car on a wet road?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
67. Control your car on a snow covered road?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
68. Control your car on an icy road?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑

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Safe Driving Behavior Measure

A. Demographic Profile/ Caregiver

Instructions:
1. **Please answer all 15 questions to the best of your ability.**
2. **Answer by checking the box or filling in the blank.**

1. What is your birth year? _____

2. What is your gender?
   - ☐ Male
   - ☐ Female

3. What is your ethnicity? Do you consider yourself to be:
   - ☐ **Hispanic or Latino** (A person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race)
   - ☐ **Not Hispanic or Latino**

4. What is your race? Would you say you are:
   - ☐ **American Indian / Alaska Native / First Nations / Aboriginal or Inuit**: having origins in any of the original peoples of North, Central, or South America, and who maintains tribal affiliation or community attachment.
   - ☐ **Asian**: having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.
   - ☐ **Black or African American**: having origins in any of the black racial groups of Africa.
   - ☐ **Native Hawaiian or Other Pacific Islander**: having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.
   - ☐ **White**: having origins in any of the original peoples of Europe, the Middle East, or North Africa.
   - ☐ Other: specify _____

5. What is your highest level of education?

- ☐ Did not go to school
- ☐ Completed Grade school (5th grade)
- ☐ Completed Middle school (8th grade)
- ☐ Completed High School/G.E.D. (12th grade)
- ☐ Completed Vocational Training
- ☐ Some College after High School Graduation
- ☐ Associate Degree
- ☐ Bachelor's Degree
- ☐ Some Professional School after College Graduation
- ☐ Master's Degree
- ☐ Doctoral Degree

6. Do you have a driver's license?

- ☐ No
- ☐ Yes

7. How many days a week do you typically drive?

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7

8. Do you live alone? (If "Yes" – Go to question # 10)

- ☐ No
- ☐ Yes
- ☐ Mostly (for part of the year)

9. Who lives with you?

- ☐ Spouse or partner
- ☐ Child
- ☐ Family/Other relative: specify: _____
- ☐ Friend(s)
- ☐ Paid caregiver
- ☐ Other: specify _____

10. What is your relationship with the driver we are testing?
    - ☐ Spouse or partner
    - ☐ Child
    - ☐ Family/Other relative: specify: _____
    - ☐ Friend(s)
    - ☐ Paid caregiver
    - ☐ Other: specify _____

11. How many other licensed drivers are in your household? _____

12. Do you rely on the driver for any of the following trips or activities?
    - ☐ Shopping
    - ☐ Grocery store
    - ☐ Social activities
    - ☐ See friends or family
    - ☐ Church
    - ☐ See doctor or get medical care
    - ☐ Work related activities
    - ☐ Other (please list)_____

13. How many days a week do you ride with the driver for whom you are completing the checklist?
    - ☐ 0
    - ☐ 1
    - ☐ 2
    - ☐ 3
    - ☐ 4
    - ☐ 5
    - ☐ 6
    - ☐ 7

14. If the driver reduced or stopped driving would it significantly impact your current lifestyle?
    - ☐ No
    - ☐ Yes

15. If “Yes” to question 14, please explain_____

_____

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C: Safe Driving Behavior Measure / Caregiver version

Instructions:

1. **Please answer all 68 questions to the best of your ability.**
2. **From your observations of the driver over the past three months, rate the amount of difficulty he or she has with the driving behaviors on the following pages.**
3. **Mark one of these answers:**
   Cannot do - too difficult to manage
   Very Difficult - doing it is a major challenge
   Somewhat Difficult – doing it is a moderate challenge
   A Little Difficult- doing it is a minor challenge
   Not Difficult- can do it with ease
   Not Applicable – question does not apply

Note the example below:

FOR THE PERSON YOU ARE RATING, BASED ON THE LAST 3 MONTHS, HOW DIFFICULT IS IT FOR HIM OR HER TO…					
A. Put the key in the ignition?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑

FOR THE PERSON YOU ARE RATING, BASED ON THE LAST 3 MONTHS, HOW DIFFICULT IS IT FOR HIM OR HER TO…					
1. Open the car door?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
2. Get in his or her car?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
3. Turn the steering wheel?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
4. Adjust the car mirrors?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
5. Stay awake while driving?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
6. Adjust the driver's seat so he or she can see above the steering wheel?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
7. Stop for pedestrians crossing the roadway?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
8. Drive in good weather?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
9. Stay in the proper lane?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
10. Drive during daylight hours?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑

FOR THE PERSON YOU ARE RATING, BASED ON THE LAST 3 MONTHS, HOW DIFFICULT IS IT FOR HIM OR HER TO…						
11. Remember to turn on the headlights before driving in the dark?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
12. Check for a clear path when backing out from a driveway or parking space?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
13. Reach the gas pedal (accelerator) and brake pedal?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
14. Press the gas or the brake when intended?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
15. Use the car controls (such as the turn signals, windshield wipers, or headlights)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
16. Place the car in the correct gear (such as drive or reverse)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
17. Operate the emergency brake?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
18. Check car mirrors when changing lanes?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
19. Read road signs far enough in advance to react (such as make a turn)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
20. Obey varied forms of traffic lights (such as green arrow for turn lane or flashing lights)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑

FOR THE PERSON YOU ARE RATING, BASED ON THE LAST 3 MONTHS, HOW DIFFICULT IS IT FOR HIM OR HER TO…					
21. Drive and hold a conversation with one or more passengers?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
22. Drive with a passenger who is providing driving directions or assistance?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
23. Drive in light rain?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
24. Drive on a highway with two or more lanes in each direction?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
25. Keep up with the flow of traffic?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
26. Keep distance from other vehicles when changing lanes?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
27. Change lanes in moderate traffic?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
28. Drive cautiously (to avoid collisions) in situations when others are driving erratically (such as speeding, road rage, crossing lane lines or driving distracted)?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
29. Brake at a stop sign so car stops completely before the marked line?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
30. Maintain lane when turning (not cut corner or go wide)?	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑

FOR THE PERSON YOU ARE RATING, BASED ON THE LAST 3 MONTHS, HOW DIFFICULT IS IT FOR HIM OR HER TO…						
31. Back out of parking spots?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
32. Enter the flow of traffic when turning right?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
33. Share the road with vulnerable road users such as bicyclists, scooter drivers, motorcyclists?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
34. Drive on graded (unpaved) road?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
35. Check blind spots before changing lanes?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
36. Drive with surrounding tractor trailers (transport trucks)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
37. Merge onto a highway?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
38. Use a map while driving?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
39. Make a left hand turn crossing multiple lanes and entering traffic (with no lights or stop signs)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
40. Parallel park?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑

FOR THE PERSON YOU ARE RATING, BASED ON THE LAST 3 MONTHS, HOW DIFFICULT IS IT FOR HIM OR HER TO…						
41. Stay within the lane markings unless making a lane change?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
42. Stay within proper lane in the absence of road features such as clearly marked lane lines, reflectors or rumble strips?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
43. Keep distance between his or her car and others (allow time to react to hazards)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
44. Look left and right before crossing an intersection?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
45. Drive in a construction zone?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
46. Drive in dense traffic (such as rush hour)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
47. Pass (overtake) a car in the absence of a passing lane?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
48. Pass (overtake) a larger vehicle such as a RV, tractor-trailer (transport truck), or dump truck in the absence of a passing lane?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
49. Drive in an unfamiliar urban area?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
50. Control his or her car when going down a steep hill?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑

FOR THE PERSON YOU ARE RATING, BASED ON THE LAST 3 MONTHS, HOW DIFFICULT IS IT FOR HIM OR HER TO…						
51. Exit an expressway, or inter-state from a left-hand lane?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
52. Drive in a highly complex situation (such as a large city with high-speed traffic, multiple highway interchanges and several signs)?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
53. Control the car (brake hard or swerve) to avoid collisions?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
54. Drive a different car (such as another person's car or a rental car)?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
55. Alter his or her driving in response to changes in health (such as vision, reaction time, fatigue, thinking, joint stiffness, medications)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
56. Drive when upset (anxious, worried, sad or angry)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
57. Stay focused on driving when there are distractions (such as radio, eating, drinking, pet in the car)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
58. Drive in an unfamiliar area?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
59. Drive at night?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑

FOR THE PERSON YOU ARE RATING, BASED ON THE LAST 3 MONTHS, HOW DIFFICULT IS IT FOR HIM OR HER TO…						
60. Avoid dangerous situations (such as car door opening, car pulling out, road debris, or an animal darting in front of car)?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
61. Drive when there is fog?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
62. Drive at night on a dark road with faded or absent lane lines?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
63. Drive when there is glare or the sun is in his or her eyes?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
64. Turn left across multiple lanes when there is no traffic light?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
65. Drive in a thunderstorm with heavy rains and wind?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
66. Control his or her car on a wet road?		**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
67. Drive on a snow covered road?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑
68. Drive on an icy road?	Not Applicable ❑	**Cannot Do** ❑	**Very Difficult** ❑	**Somewhat Difficult** ❑	**A Little Difficult** ❑	**Not Difficult** ❑