

Protocol for Candrive II/Ozcandrive, a multicentre prospective older driver cohort study

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Abstract

The Candrive II/Ozcandrive study, a multicentre prospective cohort study examining the predictive validity of tools for assessing fitness to drive, aims to develop an in-office screening tool that will help clinicians identify older drivers who may be unsafe to drive. This paper describes the study protocol. We are following a cohort of drivers aged ≥ 70 years for up to 4 years. A total of 928 participants were recruited in seven cities in four Canadian provinces, as well as 302 participants in two sites in Melbourne, Australia and Wellington, New Zealand. Participants underwent a comprehensive assessment at baseline and repeat the assessment yearly thereafter, as well as a brief follow-up assessment at 4 and 8 months each year. A recording device is installed in participants' vehicles to assess driving patterns, and driving records are obtained from licensing authorities to determine the outcomes: at-fault crashes per kilometre driven and violations. The Candrive II/Ozcandrive study is unique owing to its size, duration, partnerships with Canadian, Australian and New Zealand stakeholders and international research collaboration.

Keywords: Older driver, Automobile driving, Health status, Clinical prediction rule, Multicentre study, Fitness to drive

1. Introduction

Driving a motor vehicle is an important component in maintaining a modern, independent lifestyle in most developed countries (Classen et al., 2009). As driving is a demanding task that requires a high level of mental and physical skill, it is critical that those who maintain a valid driver's licence are medically and functionally fit to operate a motor vehicle. The impairments associated with chronic health conditions can lead to impaired driving ability, with subsequent changes in driving patterns and/or increased risk of crash or injury (Man-Son-Hing et al., 2007; Marshall, 2008). Loss of licensure for health reasons often has a negative effect on individuals' quality of life (Dickerson et al., 2007; Langford and Koppel, 2006; Oxley and Whelan, 2008; Pellerito, 2009), including low self-esteem, social isolation, depression and loss of independence; ultimately this contributes to greater need for family and community support (Anstey et al., 2005; Fonda et al., 2001; Marotteli et al., 2000; Ragland et al., 2004). As much as it is desirable to promote continued driving in older adults, the safety implications of the effects of health on driving require careful consideration.

In North America as well as Australia and New Zealand, people over the age of 65 represent the fastest-growing segment of the population, with this age group predicted to constitute 20–25% of the population by 2030 (Australian Bureau of Statistics, 1999; Bell et al., 2011; Bongaarts, 2009; Canadian Study of Health and Aging, 1994; Demography Division, Statistics Canada, 2005; Smith and Tayman, 2003). As a result, the number of older people holding driver's licences has increased in both percentage and absolute terms (Dobbs, 2008; Lyman et al., 2002; Road Safety Program Office, Safety

Policy & Education Branch, Ontario Ministry of Transportation, 2006; Transport Canada, 2011). It is well known that changes in health, including reduced vision and hearing, neurological impairment, impaired joint mobility, chronic disease and cognitive decline, occur with aging; all these conditions can make driving more challenging (Charlton et al., 2010; Dobbs, 2005; Marshall, 2008; Gresset and Meyer, 1994; Vaa, 2003). Therefore, it is not surprising that the over-70 age group has one of the highest crash rates per kilometre driven (Braver and Trempe, 2004; Brorsson, 1989; Claret et al., 2003; Daigneault et al., 2002; Di Stefano and Macdonald, 2003; Griffin, 2004).

The characteristics of collisions involving older drivers are different from those involving other age groups: they often occur in daylight, during good weather conditions and close to home (Baker et al., 2003; Ryan et al., 1998). In addition, older drivers are more likely than other age groups to be involved in “at-fault” motor vehicle collisions (MVCs) (Baldock et al., 2002; De Raedt and Ponjaert-Kristoffersen, 2001; Griffin, 2004; Stewart et al., 1999). While recent research demonstrates that crash-related morbidity and mortality rates for older drivers have started to decline (Cheung and McCartt, 2011), as has occurred for younger drivers (Dellinger et al., 2004; Tavris et al., 2001), the burgeoning older driver population will make medical fitness to drive a continuing concern for drivers, administrators and society. The effect of crash translates into a tremendous social cost, and while an Ontario-based report does not focus on older drivers, it is estimated that each fatal collision potentially costs society \$15.7 million and each injury-related collision an average of \$82,000 (Vodden et al., 2007); the corresponding Australian figures for 2006 (AUD 2.67 million and AUD 266,000 for injuries requiring hospitalization [Bureau of Infrastructure, Transport and Regional

Economics, 2009]) mirror the significant health and economic consequences of motor vehicle collisions. Although health care professionals, particularly physicians, are legally obligated in some jurisdictions to report patients who are medically unfit to drive, there is little reliable scientific data upon which they can base their decisions at the individual level (Eby and Molnar, 2010). Clearly, better methods of identifying drivers who are at an increased risk for MVCs need to be established (Jang et al., 2007; Marshall, 2008; Voelker, 1999).

The Candrive I (Canadian Driving Research Initiative for Vehicular Safety in the Elderly) team, established in 2002, received a New Emerging Team Grant from the Canadian Institutes of Health Research (CIHR) to bring together researchers from various disciplines, as well as key stakeholders, from across the country to focus on issues related to older drivers. The Candrive I team fostered relationships with older driver consumer groups and provincial and federal transportation agencies and was able to complete a CIHR-funded feasibility pilot study. In 2008 the CIHR Team for Older Driver Research (Candrive II) was awarded a CIHR Team Grant consisting of seven interrelated subprojects centred on a cohort of older Canadian drivers. Similarly, for more than a decade, Australian researchers at Monash University and collaborators have led a program of research focusing on improvements for assessing and managing older driver licensing (Fildes et al., 2008; Langford et al., 2009). In 2009 the Australian team was awarded an Australian Research Council (ARC) Linkage Grant to collaborate in the Candrive II project with sites in Melbourne, Australia and Wellington, New Zealand (Ozcandrive). A primary objective of the Candrive/Ozcandrive project is to develop a valid, easy-to-use in-office screening tool that will help clinicians identify older drivers

who may be unsafe to drive or who require a comprehensive driving assessment to establish driving safety. The objective of this manuscript is to describe the methodology of the Candrive/Ozcandrive Common Cohort study as it relates to the development of a clinical decision rule for identifying potentially at-risk older drivers.

2. Study protocol

2.1 Design

This study is a multicentre prospective cohort trial funded for 5 years to follow older drivers for up to 4 years. Participants attend an annual comprehensive evaluation of approximately 2.5 to 4 hours during which they undergo vision, physical and cognition assessment as well as answer questionnaires in relation to driving behaviours. Further psychosocial questionnaires in relation to driving are completed by participants at home. The participant's vehicle is instrumented with an in-vehicle recording device that passively records vehicle as well as global positioning system data throughout the study. The study is centrally coordinated through the Ottawa Hospital Research Institute, Ontario, Canada. Recruitment began in the summer of 2009 in seven Canadian cities/university sites located in four provinces: Montreal (Quebec), Ottawa, Toronto, Hamilton, Thunder Bay (Ontario), Winnipeg (Manitoba) and Victoria (British Columbia). Melbourne, Australia and Wellington, New Zealand began recruitment in June 2010.

2.2 *Ethics*

All of the sites involved with this study received ethics approval from their respective institutions. Written informed consent to participate, consent to release information from the ministry of transportation and consent to have an in-vehicle recording device installed in the participant's vehicle were obtained at the baseline assessment, before any measures were administered. A unique exception to confidentiality required by some institutional research ethics boards is the need to inform the participant's family physician if a change in health status is identified by the research that may clearly affect the ability to drive (based on Canadian Medical Association guidelines [2006]).

2.3 *Research associate training*

At each site one or more research associates (RAs) administers the comprehensive annual assessment and also installs and collects data from the in-vehicle recording device. Training of the RAs for the administration of the assessment tools, questionnaires and physical examination measures for each site included group training prior to commencement of the study. A protocol manual for the study was created, and an instructional DVD demonstrating and explaining the baseline assessment was developed. All RAs were trained in installation of the in-vehicle recording device, and further instructional videos were developed by the device supplier to serve as an educational resource. Further training and monitoring was carried out by means of regular RA

teleconferences as well as formal site audits.

2.4 Recruitment and enrolment

The original target sample was a convenience sample of 1,000 older drivers across the Canadian sites. Recruitment for the Canadian sites closed in November 2010, with 928 participants enrolled. A further 302 participants were recruited through the Australian/New Zealand sites; recruitment for these sites closed in June 2011. The participants were primarily recruited via media attention through newspaper (community and city), television and radio interviews during which contact information for the study was included; as well, newsletters, posters and presentations to various seniors' associations contributed to identifying volunteers for the study. Partnerships with various national, provincial and local associations for seniors formed through the Candrive I and Ozcandrive projects assisted further with recruitment efforts. The Candrive website (www.candrive.ca) was also used to provide study information and address frequently asked questions.

Our aim was to recruit drivers aged 70 years or more who were active drivers with regular access to a vehicle. Older adults who expressed interest in study participation were telephoned by an RA from the local site and fully screened for eligibility and study commitment. The full study inclusion and exclusion criteria are shown in Table 1. The overall aim was to recruit older, active drivers who would potentially be able to participate in the study for up to 4 years. The only difference in the inclusion and exclusion criteria between Canada and Australia/New Zealand was that the

minimum enrolment age for Canada was 70 years, whereas it was 75 years for Australia/New Zealand. This difference in age was based on the desire to particularly target the higher-risk older age group based on Australian/New Zealand crash epidemiology.

Potential participants who met the eligibility criteria were scheduled to complete the baseline assessment. Before the appointment, participants were sent a package containing a letter outlining the study protocol, their anticipated commitment and a consent form for participation in the study, as well as permission to access their driving records from the provincial licensing authority. Participants were considered to be formally enrolled in the study when they had signed the appropriate consent forms, completed the baseline assessment and had the in-vehicle recording device installed. Characteristics of individuals who were not eligible for study participation or who were no longer interested in participating after the study was described to them were also logged.

2.5 Assessment

All participants underwent an initial baseline assessment that incorporated measures and data collection elements that were deemed to measure important prerequisites of driving safety and would be easy to administer in a primary care clinic setting (Table 2). The assessment, which took 2.5 to 4 hours, included measures of sensory, physical and cognitive function, and information about psychosocial factors, driving habits and behaviours, and health status, all of which may influence or be

predictive of driving ability. Cognition measures chosen included validated office-based screening measures such as the Montreal Cognitive Assessment (MoCA) (Nasreddine et al., 2005) and the mini-mental status examination (MMSE) (Davey and Jamieson, 2004). Other perceptual-cognitive measures included the Trail Making Test A and B (Moses, 2004), ability to state the months in reverse order (Katzman et al., 1983), digit span (Wechsler, 1981) and Motor-free Visual Perceptual Test (MVPT) (Ball et al., 2006). One year after commencement of the study, the DemTect cognition screen (Kalbe et al., 2004) was added to the cognition test battery, and the order of administration of the cognition tests within the test battery was randomized for participants in order to adjust for potential fatigue effects and confounding from administration of multiple cognition screens.

At the end of the baseline assessment, the participants were provided with a photocopy of the signed consent form and study personnel contact information. A take-home package of self-administered scales (Table 2) was also given to the participants, with the request that it be returned by mail within 2 weeks. Finally, the in-vehicle recording device was installed in the participants' vehicles by the RA. Annual assessments, at which the full battery of measures is administered, are completed for up to 4 years.

Every 4 months an RA telephones participants to determine whether there have been any changes in their health status, medications or driving patterns. Participants are also asked whether they have had any collisions. If a collision has occurred, self-report information regarding the collision is obtained from the participant.

2.6 *In-vehicle recording device*

In order to objectively quantify driving exposure, a custom-designed in-vehicle recording device (OttoView-CD autonomous data logging device) plus software suite was developed for Candrive by Persen Technologies Inc. (Winnipeg, Manitoba) (Fig. 1) (see Porter et al. , submitted for this issue, for more details on the device and software). Monitoring of the participants' driving patterns is ongoing over the course of the study via the device. The RA meets with the participant approximately every 4 months (at the research site or a location convenient for the participant) to exchange the memory card in the device.

The in-vehicle device has the following features:

- Powered by the participant's vehicle through the on-board diagnostic system, present in all vehicle model years from 1996 in Canada and from 2003 in Australia and New Zealand
- Collects information from the vehicle itself (time/date of trip, speed, distance travelled and vehicle parameters [e.g., throttle position]).
- A global positioning system antenna mounted on the dash and a receiver in the main device box allows vehicle location information to be collected.
- An optional radio frequency identifier system (antenna plus key chain fob) for participants who drive a vehicle that is shared with another driver, which can identify the participant as the vehicle driver, so that data on driving done by people other than the participant can be removed.
- An SD memory card is used to store the participant's data at a rate of 1 Hz, to

allow information to be collected over a period longer than 4 months.

2.7 Driving records

Participants' complete driving records (on collision involvement as well as traffic violations) were obtained for the 2-year period before enrolment. During the study they are obtained annually. These records are provided by the licensing authority (ministry of transportation or equivalent in the province/state) where the participant resides. All collision reports will be reviewed by two independent collision experts (experienced collision investigators from Transport Canada) using a standardized protocol to determine at-fault status; they will be blinded to all participant data. At-fault status for collision (the primary outcome variable) will be assigned as 50% or greater at-fault, less than 50% at fault or not at-fault. In cases in which consensus is not reached, the researchers' initial interpretation of at-fault status based on a decision algorithm (Brubacher et al., 2012) will be used to make a final determination. All collisions (both at-fault and not at-fault) as well as traffic violations will be used as secondary outcome measures.

2.8 Driving cessation, withdrawal, vehicle problems and change in health status

If at any time a participant indicates that he or she has stopped driving or plans to discontinue driving for at least 3 months, a driving cessation interview is conducted. Driving cessation is defined as occurring when the participant has decided to voluntarily stop driving and does not intend to return to driving, as well as involuntary cessation

where the participant has had his or her driver's licence revoked and is no longer an active driver and not expected to return to driving. These participants do not have further annual assessments completed. The RA records the events leading to and the reasons for driving cessation on a cessation form. Temporary driving cessation is defined as a cessation in driving of at least 1 month but where the participant intends to return to driving; it may be related to health events or temporary loss of licence (e.g., licence suspension for violations). These participants continue to be followed with ongoing assessments.

Participant withdrawal is defined as cases in which the participant identifies that he or she no longer is able to or wishes to participate in the study owing to personal reasons and is therefore withdrawn from the study. In such cases the RA notes the reason for withdrawal. Data for these participants are maintained up to the point of withdrawal.

If a participant has vehicle problems that may be related to the in-vehicle recording device, he or she is given the opportunity to have the device removed and to remain in the study. In such cases odometer readings are collected at the usual assessment times, and all annual, 4- and 8-month assessments continue to be administered.

Any significant changes in a participant's health status at any point during the study are documented. The RAs are also responsible for notifying their respective site investigators of health conditions that clearly may affect driving safety that are not already known to the participant's primary care physician. In this instance, the site investigator informs the physician by letter about the existence of the health condition, as per the ethics protocol.

2.9 Data management

With the exception of the driving exposure data, the data are being coordinated through the Ottawa Hospital Research Institute Methods Centre. The data are processed via teleforms (TeleForm Workgroup software, version 9.1, Autonomy Cardiff, Vista, Calif.), which are scanned and uploaded to the Candrive website. Each teleform is reviewed for errors and omissions and, if necessary, returned to the originating site for correction. Once files pass the verification stage, they are transferred to the Ottawa Hospital Research Institute Methods Centre, where they are downloaded and reviewed again for errors and omissions. The anonymous data files are housed at the Methods Centre. The data are cleaned and locked annually and then made available to the research team.

For the driving patterns data, the RAs send the memory card data files to the Winnipeg site using a file transfer protocol server at the University of Manitoba. The files are then processed and checked against follow-up questionnaire data to verify that the in-vehicle device is functioning properly and that data for drivers other than participants can be removed appropriately.

2.10 Statistical analysis

The primary outcome of interest in this study is at-fault MVCs, but the relatively low incidence makes this a challenging outcome to study (Lindstrom-Forneri et al., 2007). We determined that a sample size of 1000 participants was needed to generate a

sufficient incidence of MVCs to develop a clinically useful decision rule with sufficient precision to identify older drivers who are at risk (or not at risk) for future at-fault MVCs. The sample size calculation accounted for attrition over the course of the study.

The sample size was determined with the aim to maximize specificity and positive predictive value (PPV) with the understanding that sensitivity may be sacrificed.

Targeting a high sensitivity would lead to a high false-positive rate (i.e., classification of drivers as being at risk for an at-fault MVC when in fact they are not) (Table 3). With a high sensitivity approach, the PPV would be 5.4% (14/260). Therefore, for every driver appropriately identified as being at risk for at-fault MVC, approximately 16 drivers would be inappropriately so identified and would potentially lose their licences or be subjected to further testing of their driving ability. From a resource and public perspective, this would not be acceptable in most jurisdictions. Therefore, to minimize the inappropriate identification of older drivers as being at risk, a clinically useful risk stratification tool must achieve very high specificity in order to achieve a high PPV.

The sample size for this study was calculated to achieve this goal based on the following assumptions: 1) an at-fault MVC rate of 1.4% based on Ontario collision rates for drivers over the age of 65 (Road Safety Program Office, Safety Policy & Education Branch, Ontario Ministry of Transportation, 2006), which is conservative given that our participants are aged ≥ 70 and we are assuming that 50% of collisions will be at-fault (Rakotonirainy et al., 2012); and 2) sensitivity of 50% and specificity of 99.5% (Table 4). We further assumed that only 25% of drivers inappropriately classified as being at risk would lose their licences after further training or on-road assessment. Based on these assumptions, a sample size of 1000 participants would produce a PPV of 85.1%.

Doubling the sample size to 2000 would increase the PPV to 87.4%, which does not translate into a meaningful gain in relation to the incremental cost of resources and time for recruitment to achieve this 2.3% increase in PPV.

Statistical analysis will be performed with the objective of determining which combinations of predictor variables are highly specific for detecting at-fault MVCs. The strength of association between each variable and the primary outcome of at-fault collision will be determined through univariate analysis. The appropriate univariate technique will be chosen according to data type: chi-square test with continuity correction for nominal data, Mann-Whitney U test for ordinal variables and unpaired two-tailed *t*-test for continuous variables. Logistic regression will derive a model to predict at-fault MVC. Specifically, we will use a random effects model to account for the use of repeated measures. Variables found to be associated ($p < 0.10$) with at-fault MVC will be tested using either recursive partitioning (KnowledgeSEEKER software, version 2.1, Angoss Software International, Toronto, Ont.) or logistic regression modelling. Similar analysis will be completed for secondary outcome measures, including all collisions, self-report collisions and violations.

3. Discussion

The Candrive/Ozcandrive cohort study is the largest and longest prospective study of older drivers conducted to date. A number of elements in the design will assist in the development of a valid decision rule for identifying at-risk older drivers. For instance, the prospective nature of the study is a key element as it allows for changes in health status,

since most participants were likely in relatively good health when they volunteered for the study. Annual assessment of participants is an important feature since the value of the information regarding health and function collected at one point in time becomes less reliable as time progresses (Staplin et al., 2003). The ability to monitor driving patterns using an in-vehicle recording device is another critical feature since the likelihood of collision is linked to driving (taking things to the extreme, the people least likely to have a collision are those with active licences who never drive).

A limitation of our methodological approach is the use of a convenience sample for recruitment. This was necessary owing to the study environment, where a feasibility study provided evidence that cold-call or random-digit dialling would not be an effective method for recruitment (Marshall et al., 2013 in this issue). However, we have completed a comparison of our study cohort to an independently collected and larger sample of older Canadian drivers that supports that our cohort is representative of the older Canadian driving population (Gagnon et al., 2013 in this issue). This study will enable the derivation of a driving decision rule to identify older medically at-risk drivers, further validation of this tool can be completed using split-sample analysis or bootstrapping techniques pending more formal validation of the decision rule on an independent sample.

While the development of a driving decision rule is a central component of this team research, other subprojects are being conducted simultaneously, including studies of 1) psychosocial factors such as driving comfort, 2) driving simulation assessment, 3) driving pattern changes over time using data from the in-vehicle device, 4) direct driving observation using a newly developed tool, the Driver Observation Schedule (Koppel et

al. 2013 in this issue), and 5) car design preferences of older drivers as well as 6) pilot work to investigate interventions to prolong the safe driving period for older drivers. Data from this study will have the potential to answer many important questions related to older drivers and the changes that occur to their driving as they age and experience changes in their health status.

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The study has been registered at [ClinicTrials.gov](https://clinicaltrials.gov) (Record #NCT01237626).

Table 1

Inclusion and exclusion criteria for the Candrive II/Ozcandrive Common Cohort study.

	Rationale
Inclusion criteria	
Has general class driver's licence and has been actively driving for at least 1 year	Active, experienced drivers required for primary outcome of at-fault collision
Age ≥ 70 years (≥ 75 years for Ozcandrive participants)	Heavier medical burden with advancing age
Drives at least 4 times per week (4 round trips)	Active driving required for primary outcome of at-fault collision, and it is anticipated that driving frequency will decline over the course of study
Agrees to undergo annual physical and cognitive assessment and be contacted at least quarterly for vehicle data pick-up and interview	
Resides in the local region of one of the study cities for at least 10 months a year	Assessment is required annually, and replacement of in-vehicle recording device is necessary every 4 months; also, details of driving environments (e.g., speed zones, signage) have been mapped out for each site, which will help with interpretation of driving patterns
Is followed actively by family physician	Some of the institutional research ethics boards require that the participant's family physician be informed if a change in health status that may clearly affect the ability to drive is identified and the family physician is not already aware of the condition
Intends to continue driving for next 5 years	
Is fluent in English	
Consents to release driving information from licensing authorities in his/her region	Need to be able to obtain collision reports since at-fault collision, as determined from collision reports, is the primary outcome
Has access to vehicle of model year 1996 or newer (2002 or newer in Australia/New Zealand)	Information on vehicle driving exposure and patterns is collected through an in-vehicle device that requires an on-board diagnostic system port (OBDII), which became standard equipment in vehicles in North America and Australia/New Zealand in 1996 and 2002 respectively
Drives one vehicle $\geq 70\%$ of the time	To allow for adequate recording of driving exposure since only one vehicle is instrumented for study
Exclusion criteria	
Planned move out of region	Inability to follow participant
Medical contraindication to	Medical stability in relation to driving needed be

driving within previous 6 months according to Canadian Medical Association guide (2006) or Austroads guide (2006)

established before study entry

Diagnosis of progressive condition that could affect driving (e.g., Alzheimer's disease, macular degeneration)

High likelihood of inability to complete study identified at study outset

Table 2

Measures administered at the baseline and yearly assessments.

General health
Cumulative Illness Rating Scale (modified) (Hudon et al., 2007)
36-item Short Form Health Survey (SF-36) (Ware et al., 1993)
Medication list
Health and physical measures
Whispered voice test (Swan and Browning, 1985)
Joint range of motion (Carr et al., 2010)
Manual test of motor strength (Carr et al., 2010)
Timed Up & Go test (Podsiadlo and Richardson, 1991)
Rapid pace walk test (Carr et al., 2010)
One-leg stance (Vereeck et al., 2008)
Western Ontario and McMaster Universities Osteoarthritis Index, version 3.0 (Bellamy et al., 1988)
Sleep Impairment Index (Morin, 1993)
Older American Resources & Services questionnaire (McCusker et al., 1999)
Marottoli Method (Marottoli et al., 1998)
Vision/visuospatial measures
Motor-free Visual Perceptual test, 3rd edition (Ball et al., 2006)
Snellen test (Currie et al., 2000)
Visual fields by confrontation test (Kerr et al., 2010; Prasad et al., 2011)
Pelli–Robson contrast sensitivity (Keay et al., 2009)
Coordination
Sequential finger–thumb opposition (Jahn et al., 2006)
Rapid foot taps (Kent-Braun et al., 1998)
Physical reaction time
Vericom Stationary Reaction Timer
Ruler drop test (Fingertip reaction time, 2006)
Mood: 15-item Geriatric Depression Scale (Yesavage et al., 1982)
Individual factors/environment
Demographic factors
Historical driving factors
Vehicle factors
Current driving factors
Winter driving factors
Driver Behaviour Questionnaire (Obriot-Claudiel and Gabaude, 2004)
Cognition
Montreal Cognitive Assessment (Nasreddine et al., 2005)
Mini-mental status examination (Davey and Jamieson, 2004)
Trail Making Test A and B (Moses, 2004)
Months in reverse order (Katzman et al., 1983)
Traffic sign recognition test

Digit span (Weschler, 1981)

Psychosocial measures

Symptom checklist (Tuokko et al., 2007)^a

Decisional balance (Tuokko et al., 2006)^a

Driving habits and intentions (Lindstrom-Forneri et al., 2007)^a

Driving Comfort Scales (Myers et al., 2008; Blanchard and Myers, 2010)^a

Perceived Driving Abilities scales (MacDonald et al., 2008; Blanchard and Myers, 2010)^a

Situational Driving Frequency scale (MacDonald et al., 2008; Blanchard and Myers, 2010)^a

Situational Driving Avoidance scale (MacDonald et al., 2008; Blanchard and Myers, 2010)^a

Driving cessation interview (if participant gives up driving)

^a Completed at home.

Table 3

2 × 2 table illustrating false-positive rate for classification of drivers ($N = 1000$) as being at risk for an at-fault MVC using high sensitivity (99%), low specificity (75%) and an annual incidence of at-fault crash for drivers over the age of 65 of 1.4%.^a

	At-fault MVC	No at-fault MVC
Predicted at-fault MVC	14 (true positive)	246 (false positive)
Not predicted at-fault MVC	0 (false negative)	740 (true negative)
Total	14	986

MVC = motor vehicle crash.

^a Based on Ontario collision rates (Road Safety Program Office, Safety Policy & Education Branch, Ontario Ministry of Transportation , 2006).

Table 4

2 × 2 table illustrating false-positive rate for classification of drivers ($N = 1000$) as being at risk for an at-fault MVC using low sensitivity (50%), high specificity (99.5%) and an annual incidence of at-fault crash for drivers over the age of 65 of 1.4%.^a

	At-fault MVC	No at-fault MVC
Predicted at-fault MVC	7 (true positive)	1 (false positive)
Not predicted at-fault MVC	7 (false negative)	985 (true negative)
Total	14	986

MVC = motor vehicle crash.

^a Based on Ontario collision rates (Road Safety Program Office, Safety Policy &

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Fig. 1. In-vehicle recording device.