



Development and Validation of an Awareness Tool for Safe and Responsible Driving (OSCAR)

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Authors' contributions

This work was carried out in collaboration between all authors. Authors OTML, TA, IG, MB, OTMEL and OTFHT for conception and design of the study, analysis and interpretation of data, critical revision of the manuscript for important intellectual content and administrative, technical and material support. Authors OTML and TA for obtaining and administrating funding authors OTML and MDA for data acquisition; authors OTML, TA, OTIG, MB, OTMEL, OTFHT and ODJR for analysis and author OTML for drafting of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Declines in driving ability may jeopardize the safety of older drivers and other road users.

Objective: This study aimed to develop and validate an awareness tool to foster and maintain the mobility of older drivers through safe driving.

Methods: A scoping study was conducted to select the best questions and tips to increase older drivers' awareness, followed by a validation with 12 older drivers.

Results: The awareness tool informs older drivers about competency as well as compensatory strategies for safe and responsible driving (OSCAR). It includes 15 questions and 15 tips on aging and driving. Participants were very interested in the tool, and confirmed its relevance and usefulness. Finally, the majority of older drivers said they would recommend OSCAR to other people and use it to discuss their concerns regarding driving with their family or health care professional.

Conclusions: Concise, complete, clear, accurate and written in accessible language, OSCAR fosters awareness and enables seniors to identify changes in themselves and learn about compensatory strategies and resources. While promoting safe driving and the prevention of collisions and injuries on the roads, OSCAR could ultimately allow seniors to maintain or increase their mobility in the community and their social participation.

Keywords: Older drivers; awareness tool; safe driving; compensatory strategies.

ABBREVIATIONS

OSCAR: Awareness tool for safe and responsible driving.

1. INTRODUCTION

Driving is an important activity for the independence and well-being of older adults [1], and their main and preferred mode of transportation [2]. Indeed, the number of driver licenses issued to older drivers has more than doubled in the last ten years and the average age of older drivers is increasing, regardless of their capacity to drive [3]. Driving is, however, a complex task that requires efficient and proper use of motor, sensory, and cognitive functions [3] that can deteriorate as a result of normal and pathological aging. For an equivalent number of kilometers traveled, older drivers have higher collision rates than the general population [3]. Also, due to increased fragility [3], older drivers have higher rates of mortality and morbidity following road crashes than younger adults [2].

Some older drivers have good self-awareness and an accurate perception of their ability to drive [4], and use compensatory strategies [3], that is, conscious means used to adjust for diminished capacities [5]. Drivers who use compensatory strategies travel half as many miles and expose themselves to fewer risky situations, considering, for example, weather and traffic conditions. Awareness can foster safe driving among older drivers [6] and has been identified as a preferred intervention to promote and improve individual and community health [7]. Awareness gives older drivers a better understanding of the influence of their own challenges on their ability to drive and, where relevant, a realization of the need to change, and increased openness to the use of compensatory strategies.

Older people can improve their skills through education and training [8,9] by working on activities directly related to driving or activities related to motor and cognitive skills in

general. Education and driving skills training programs are available and effective for older drivers [10-12] specifically if they include a 'Fitness' component focusing on flexibility, coordination and speed of movement and, where relevant, an 'Education' component combined with on-road practice [13]. The main difficulty facing these programs is that older drivers need to know about them. When remediation is not possible, the use of strategies to compensate for disabilities can be taught [14]. Increasing awareness among older adults could foster the use of training programs, compensatory strategies and prevent crashes. However, few screening or awareness tools have been rigorously developed and validated. The objective of this study was to develop and validate an awareness intervention tool to foster and maintain the mobility of seniors through safe and responsible driving.

2. RESEARCH DESIGN

To achieve this objective and to be consistent with the guidelines for the development of tools [15], a rigorous and precise methodological framework for scoping studies [16] was used. A broader review of the scientific and gray literature from 1980 to August 2010 was first conducted to identify tools related to driving and awareness for older drivers. Eight databases (Medline, OTDBASE, CINAHL, AMED, MANTIS, Embase, RITA and TRIS) were searched by combining key words using the following strategy: 1) driving or driver *, AND 2) aging, ageing, older, aged or elderly, AND 3) self-assess * / evaluate *, AND 4) questionnaire, tool or test. Awareness or screening tools identified were then evaluated based on 15 predefined criteria for optimal sensitization developed for the current initiative (Appendix 1). Thereafter, a content analysis using Michon's model [17] was used to deconstruct the tools and identify what they contained. The abilities required for safe driving were classified according to the tasks involved, mainly at the strategic level, awareness intervention and use of compensatory strategies, and to make a first selection of questions and tips. The questions and tips retained were then evaluated and selected using eight predefined criteria based on Streiner and colleagues [15] and developed for the current initiative (Appendix 2). Finally, as a first step of psychometric qualities' study, a content validation of the tool was conducted with 12 drivers aged 65 and over, without cognitive impairment, who typically drove at least once a week. These drivers were recruited through snowball sampling and posters at various seniors' organizations. Each participant was met individually to fill out a demographic questionnaire, examine the tool only once, but taking as much time as they wanted, and be interviewed using a semi-structured approach to collect their comments and perceptions about the tool. The interview guide consisted of 17 open-ended questions related in particular to the impact of the tool on their awareness of changes and their intentions to adopt certain compensatory strategies, to the usefulness of the tool overall and specifically as an aid to discussion, and to the layout of the tool. The participants' socio-demographic characteristics were described by means, standard deviations, median and interquartile interval, or frequencies and percentages according to the type of variable (continuous or categorical, respectively). Data from the interviews underwent content analysis using thematic saliency analysis methods [18] to identify recurrent and important themes. The Research Ethics Committee of the Health and Social Services Centre of the University Institute of Geriatrics of Sherbrooke approved this study.

3. RESULTS

The literature review identified 18 driving screening and awareness tools developed specifically for older drivers (Appendix 1). As these tools vary considerably in terms of quality and content, and few of them met the criteria for optimal sensitization (Appendix 1), it was

impossible to select a single one and the tools were deconstruct, analyze and evaluate. Among the 110 questions and 142 tips found in all the tools, most focused on the strategic level (Table 1), that is, the goals of driving and general context, and on the tactical level, namely the behaviors involved in applying the rules of the road and the immediate demands of the road and traffic including performing maneuvers. Following their evaluation on eight predefined criteria (Appendix 2), 24 of the 110 questions and 30 of the 142 tips were retained for further review during a second forum of key informants. Fifteen questions and tips linked with aging and driving were selected and included in the first version of the awareness tool for safe and responsible driving (OSCAR; Table 2). Guided by several theoretical models [17,19,20], this sensitization intervention encompasses various components including compensatory strategies, courses and assessment resources.

Finally, content validation was realized with 12 older drivers. Slightly more than half of the participants were female and they were aged between 63 and 82 years (Table 3). The majority were retirees, lived with their spouse, had 14 or more years of education and rated their health as very good. Weekly, most of them drove more than 50 kilometers and at least three times (Table 3).

The majority of participants appraised the tool as generally "very useful" (7, 58.3%) or "useful" (5, 41.7%). Specifically, a third of the participants (4, 33.3%) confirmed that the recommendations were very useful in reminding them of the concepts they already knew. Among other things, a quarter of the participants (3, 25%) noted that they are now aware of the link between road safety records and the ability to drive. Most participants said that OSCAR confirmed (8, 83.3%) or will allow them to better monitor (2, 16.7%) the occurrence of changes. These changes were mainly in their vision (9, 75%), attention and reaction time (5, 41.7%) or flexibility (2, 16.7%). For example, one of the participants mentioned having more difficulty finding street names, while others noticed slower reflexes when tired or when they needed to manage various types of information at once. However, following a first reading of OSCAR, over a third (5, 41.7%) reported that these recommendations did not help them directly and the majority of participants reported that they would not make changes in the way they drive (8, 66.7%). Nevertheless, one third of participants said they would pay closer attention on the road (4, 33.3%) and one person planned to take a refresher course (8.3%). Moreover, half of the participants reported having particularly enjoyed the section on resources (6, 50%). Finally, the majority said they would recommend OSCAR to people they knew (9, 75%) and would use it to discuss their driving-related concerns with their loved ones (7, 58.3%) or a health care professional (10, 83.3%). One participant reported OSCAR would help explain more easily how he feels to a health care professional, while another reported that, although OSCAR provides some good ideas, driving can still be a difficult topic to discuss with a doctor, for fear of losing one's license.

Table 1. Most frequent tips from the identified tools (n=18)

Tips	n (%)
Strategic level	
• Avoid driving at night	16 (88.9)
• Consult a health care professional	16 (88.9)
• Consider violations of the Highway Traffic Act a warning sign	15 (83.3)
• Consider weather and traffic conditions	14 (77.8)
• Use medications safely	13 (72.2)
Tactical level	
• Be able to analyze situations and react quickly	14 (77.8)
• Use assistive devices and vehicle equipment, such as mirrors, properly	11 (61.1)

Table 2. Examples of questions and tips found in the awareness tool for safe and responsible driving

Examples of targeted capacity	Sample questions fostering reflection on the educational abilities	Examples of tips fostering the adoption of compensatory strategies
Your vision	Is it harder than before to read road signs?	Since the majority of the information received by a driver is visual in nature, safe driving requires good eyesight. If detected early, most vision problems can be treated effectively. Have your vision checked by an eye specialist every year.
Your judgment, reaction time and concentration	Is it harder than before to merge with traffic on a busy highway?	With age, the ability to perceive depth decreases. It becomes more difficult to judge speed and distance from other vehicles. If you feel nervous or anxious when you need to merge with traffic on a busy highway, avoid these situations. If it is difficult for you to drive on busy highways, avoid using them during peak hours. Taking a refresher course could also help you improve your driving skills in these situations.
Your strength and flexibility	Is it harder than before to use the car pedals?	When braking, it is necessary to have sufficient leg strength. This strength also helps maintain stability in the control pedals without fatigue. Engage in regular exercise to strengthen and relax your leg muscles. Rehabilitation could also be required to improve your strength and flexibility. Check with a health care professional.
Your driving record and driving habits	Has it ever happened that you did not know what a road sign indicated?	Roads, signs and laws are constantly changing. A refresher course can help you improve your driving knowledge. It can also help you adjust to the limitations caused by aging and improve your driving skills.
Your medication and alcohol consumption	Do you drink alcohol?	It is well known that for people of all ages, alcohol has a significant negative impact on driving skills. Also, since alcohol tolerance decreases with age, it is important to avoid consuming alcohol before driving. In addition, alcohol increases the harmful effects of drugs on your driving skills. If you drink, do not drive.

Table 3. Participants' characteristics (n=12)

Continuous variables	Mean (S.D.)
Age (years)	69.7 (6.2)
Age when received driver' license (years)	24.5 (7.1)
Categorical variables	n (%)
Socioeconomic	
Woman gender	7 (58.3)
Marital status	
Widow	2 (16.7)
Married/Common-law	9 (75)
Divorced	1 (8.3)
Living with spouse	8 (66.7)
Education (years)	
≤ 11	4 (33.3)
12-14	1 (8.3)
> 14	7 (58.3)
Annual household income (Canadian \$)	
≤ 25,000	1 (8.3)
25,001-40,000	2 (16.7)
> 40,000	9 (75)
Occupation (retired)	11 (91.7)
Health and functional autonomy	
Absence of disease	7 (58.3)
Current self-rated health	
Fairly good	5 (41.7)
Very good	7 (58.3)
Health compared to 5 years ago	
Worse	2 (16.7)
The same	10 (83.3)
Health compared to other people of the same age	
The same	7 (58.3)
Better	5 (41.7)
Activities of daily living done without support	
Using the telephone	12 (100)
Doing grocery and other shopping	12 (100)
Preparing meals	11 (91.7)
Housekeeping	10 (83.3)
Taking one's medication	11 (91.7)
Managing finances	9 (75)
Driving habits Weekly distance (km)	
1-50	4 (33.3)
51-100	2 (16.7)
101-150	2 (16.7)
151-200	1 (8.3)
> 200	3 (25)
Driving frequency (days/week)	
1-2	3 (25)
3-6	4 (33.3)
7	5 (41.7)

4. DISCUSSION

This study allowed us to deconstruct, analyze and evaluate the content of the 18 tools identified in the scientific literature and gray literature. According to this analysis, tips focused mostly on the strategic and tactical levels of Michon's model, and less on the operational level, i.e. automatic actions and patterns involved in operating and maneuvering the vehicle. Based on these findings, three theoretical models, two expert consultations and a first test with 12 seniors, OSCAR was developed as an intervention tool designed to foster and maintain the mobility of older people through safe and responsible driving. Overall, older drivers reported much interest in OSCAR, and confirmed its relevance and usefulness. Concise, complete, clear, accurate and written in accessible language, OSCAR fosters awareness and helps seniors identify changes in themselves and helps them learn about compensatory strategies and resources, including courses and assessment centers.

The strengths and limitations of OSCAR can be compared to the tools retrieved in the literature (Appendix 1). Like the majority of them, OSCAR has the advantage to be based on a theoretical model, to be easy to understand and complete, to have a short completion time, and to have sections that can be divided and used separately. Contrarily to few tools, OSCAR is not yet available in both English and French language, and in print and electronic form, nor, although not the goal of sensitization tool, it allows point rating or it gives score that can be interpreted. Nevertheless, the OSCAR is among the few tools that have been developed through a rigorous synthesis of the evidence, an expert consultation, and being validated with 12 seniors. Moreover, OSCAR is reliable and valid, and leads seniors to question themselves directly about changes that may occur with aging and that are related to safe driving. As Michon's operational level is more difficult to target by an awareness tool, it might be more optimal to use OSCAR in combination to on road driving program. Finally, the changes that have occurred are related more clearly to personalized tips of habits and strategies to modify including available resources.

Considering the complexity of behavior change [20], OSCAR promotes the idea that awareness is necessary but not sufficient for change. Following a first reading of OSCAR, older drivers might not change how they drive even if the majority said the tool helped them confirm changes in their abilities. In addition, some seniors may not be aware of the effects of aging and health problems on their driving skills. Support from a relative or health care professional may thus be needed. As mentioned by the majority of seniors, OSCAR can be useful when discussing their own concerns about their driving.

5. CONCLUSION

This study was intended to develop a tool to promote and maintain seniors' mobility by fostering safe driving. The Awareness tool for safe and responsible driving (OSCAR) comprises a series of 15 questions and 15 tips linked to aging and driving. According to the study participants, OSCAR is written in an accessible language that fosters awareness regarding the competencies required for safe driving. The tool is interesting, relevant and useful in helping them identify the changes that occur with aging and the habits they should modify, including the use of compensatory strategies and resources.

Further studies should be conducted using a larger and representative sample to verify if using OSCAR can improve the interest, openness and knowledge of older drivers concerning the competencies required for safe driving and their use of compensatory

strategies. Furthermore, it might be useful to adapt OSCAR for relatives of the drivers, and other stakeholders, to better equip them to support older drivers in changing their driving habits and using compensatory strategies. Ultimately, OSCAR could be an important step to help seniors maintain or increase their community mobility while promoting the prevention of crashes and injuries.

CONSENT

All authors declare that 'written informed consent was obtained from the participants for publication of this study.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX

Appendix 1. Analysis of screening and awareness tools (n = 18)

Name of the tools	i	ii	iii	iv	v	vi	vii	viii	ix	x	xi	xii	xiii	xiv	xv	Total results /15
Drivers 55 Plus [21]					✓	✓	✓	✓	✓	✓	✓**	✓	✓**		✓	10
Safer driving [22]***			✓		✓		✓	✓				✓	✓	✓		7
Fitness-to-drive screening measure [23]					✓		✓	✓	✓			✓	✓		✓	7
How is your driving health [24]	✓				✓	✓	✓	✓			✓				✓	7
Older drivers' self-assessment questionnaire [25]					✓		✓	✓	✓	✓		✓	✓			7
Driving decisions workbook [8]			✓		✓		✓				✓	✓		✓		6
Roadwise review online [26]					✓				✓	✓	✓		✓	✓		6
Senior driver self-assessment [27]	?	?	?	?	✓		✓	✓	✓	✓		✓				6
Daily driving diary [28]		?		?	✓		✓	✓			✓	✓				5
Driving safely while aging gracefully [29]					✓		✓	✓			✓				✓	5
Road safety is for all ages [30]	✓					✓	✓				✓				✓	5
Safe driving behavior measure [1]		✓	✓		✓		✓				✓					5
Daily driving diary [31]		?		?	✓		✓				✓	✓				4
Mini self-assessment of driving ability [32]					✓		✓	✓							✓	4
Keeping on the go [33]	✓					✓	✓								✓	4
Driving skill assessment [34]					✓		✓	✓								3
The golden road self-assessment [35]							✓	✓						✓		3
Health in the driver's seat [36]	✓					✓	✓									3

* The new version of this tool is called 'Drivers 65 Plus'

** Criteria met for the paper version of the tool only

*** This tool is the new version of the 'Driving decisions workbook'

? Information not available

i: Available in English and French

ii: Reliable

iii: Valid (other than content)

iv: Sensitive to change

v: Based on a theoretical model or evidence

vi: Available in print and electronic form

vii: Easy to understand and complete

(no social comparison, plain and simple language, no negative labels)

viii: Completion time (<15 minutes)

ix: Allows point rating (score)

x: Score can be interpreted

xi: Divided into sections that can be used separately

xii: Questions (statement requiring a response that can lead to a score) rather than a checklist (statement to check or read, used as a reminder or to encourage reflection)

xiii: Personalized tips regarding individual competencies

xiv: Tips explaining the relationship between impairments and disabilities associated with driving

xv: Provides additional resource

Appendix 2. Eight evaluation criteria for questions and tips

For each question/tip in the list, please check if the answer to each of the following questions is yes:

- Does the question/tip help to educate the respondent on age-related changes in connection with driving?
- Does the question/tip help to educate the respondent on the use of compensatory strategies?
- Does the question/tip help to educate the respondent about crash prevention?
- Could the question/tip increase awareness of the respondent's own driving skills?
- Does the question/tip correspond to a situation or driving behavior actually encountered in older drivers (typical of this group of drivers)?
- Does the question/tip have scientific value? Is the question / tip well documented in the literature and does it reflect scientific knowledge?
- Is the question/tip clearly stated and easily understood by the older driver?
- For tips only: Does the tip inform the respondent about resources if he/she has doubts about his/her ability to drive or wants to get more information?

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