

Test-retest reliability of the driving habits questionnaire in older self-driving adults

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Abstract. [Purpose] The purpose of this study was to investigate the test-retest reliability of the Driving Habits Questionnaire in community-dwelling older self-drivers. [Subjects and Methods] Seventy-four participants were recruited by convenience sampling from local rehabilitation centers. This was a cross-sectional study design that used two clinical measures: the Driving Habits Questionnaire and Mini-mental State Examination. To examine the test-retest reliability of the Driving Habits Questionnaire, the clinical tool was measured twice, five days apart. [Results] The Driving Habits Questionnaire showed good reliability for older community-dwelling self-drivers. The Cronbach's alpha coefficients for the four domains of dependence (0.572), difficulty (0.871), crashes and citations (0.689), and driving space (0.961) of the Driving Habits Questionnaire indicated good or high internal consistency. Driving difficulty correlated significantly with self-reported crashes and citations and driving space. [Conclusion] The results of this study suggest that the Driving Habits Questionnaire is a reliable measure of self-reported interview-based driving behavior in the community-dwelling elderly.

Key words: Driving, Habit, Older adults

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INTRODUCTION

Driving is an important activity for community-dwelling and social and job integration in older adults because of the effects of independent mobility on well-being. Motor crashes, injuries, and fatality rates continue to be a concern in older adults because they increase along with motor, sensory, and cognitive disabilities during normal aging and with illnesses; many older adults restrict their on-road exposure, with an ultimate decrease in driving activities in daily living. Older drivers tend to manifest incorrect driving behaviours, such as turning left against oncoming traffic, failure to yield the right-of-way at intersections, driving under the influence of alcohol, not maintaining speed, not staying in a lane, and confusing gas and brake pedals. Safe driving is the result of the absence of near misses and crash-related injuries occurring at personal, vehicle, and environmental levels. Understanding safe driving is essential in preventing crash-related injuries: thus an accurate and precise clinical measurement tool is necessary for older drivers¹⁻³⁾.

The measurement tool should test specific driving characteristics including driving patterns and errors. There are valid and reliable measurement tools for comprehensive driving evaluation by an on-road test conducted by a driving rehabilitation specialist. The on-road test is a performance-based measure, but is time-consuming and has limited accessibility; therefore, other complementary assessment tools are needed for meaningful evaluation of an older driver's abilities and associated factors. The Driving Habits Questionnaire (DHQ) is a precise and accurate clinical measurement of driving abilities⁴⁾. The purpose of this study was to investigate the test-retest reliability of DHQ, and evaluate correlations among safe driving behaviors, driving habits and cognitive function in older self-driving adults.

SUBJECTS AND METHODS

A total of 74 community-dwelling older individuals, recruited from three senior complex community centers, participated in this study. This convenience sample used a leaflet that provided information regarding the purposes, procedures, rights of subjects, data use, and other aspects of this study. The study was carried out in accordance with the International Ethical Guidelines and the Declaration of Helsinki and was approved by the local institutional review board. All participants signed consent forms. The inclusion criteria were as follows: age above 65 years, valid driver's license, driving at the time of recruitment, cognitive abil-

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ity to complete the DHQ, with no missing limbs or a major psychiatric diagnosis. The absence of neurological deficits or severe orthopedic diseases that would impair driving skills was required. Participants were excluded if they had been medically advised not to drive, had experienced uncontrolled seizures in the past year, took medications that caused central nervous system impairment, or had serious visual impairment. Table 1 shows the clinical and demographic characteristics of the participants, including sex, age, height, weight, and driving exposure.

This was a cross-sectional study, in which two clinical tools were used: the Mini-Mental State Examination (MMSE), and DHQ. Two occupational therapists with clinical experience evaluated participants' performance on all measurements, and followed a standardized method for administration of each clinical measure in a small tidy therapy room. For data collection, the first session examined common characteristics, and the MMSE and DHQ; the second session five days later assessed DHQ only for intrarater reliability between two occupational therapists. The testing times in the first and second sessions were 40 and 15 minutes respectively.

The DHQ was developed by Owsley et al. to obtain information about driving during the prior year. The tool is designed to be interviewer-administered, and consists of 34 items grouped into six domains, including current driving status and miscellaneous issues (items 1–10), driving exposure (items 11–14), dependence on other drivers (items 15–16), driving difficulty (items 17–24), self-reported crashes and citations (items 25–28), and driving space (items 29–34). Four domains of this tool, i.e., dependence on other drivers, driving difficulty, self-reported crashes and citations, and driving space, are computed by summing scores. The dependence on other drivers ranges from 1 (I drive) to 3 (this person drives), and the self-reported crashes and citations and driving space are answered yes (1) or no (0). Although the driving difficulty ranges from 1 (so difficult I no longer drive in that situation) to 5 (no difficulty), the domain is scored on a 100-point scale. The formula for calculating the driving difficulty is: (mean score of eight items – 1) × 25. A score below 90 is interpreted as driving difficulty³.

The MMSE is a valid, reliable, and extensive screening test for dementia and delirium developed by Folstein and Folstein in 1975. The tool is a 30-point questionnaire, with scores ranging from 0 (complete cognitive impairment) to 30 (no cognitive impairment), and consists of 10 items⁵.

Descriptive statistics were used for characterized demographics and prevalence of driving habits, such as current driving status and miscellaneous issues and driving exposure in the participants. Test-retest reliability of four domains of the DHQ, including dependence on others, driving difficulties, self-reported crashes and citations, and driving space were statistically evaluated with Cronbach's alpha and intraclass correlations co-efficients (ICC). Pearson correlations were used to determine the relationships between the four domains. The collected data were analyzed using PASW version 18.0 for Windows (SPSS Inc., Chicago, IL, USA). Significance testing used alpha = 0.05 in all statistical evaluations.

Table 1. General characteristics of the study participants (N=74)

Characteristics	Participants
Gender (male/female)	54/ 20
Age (years)	68.1±3.1
Height (cm)	166.4±6.5
Body weight (kg)	65.3±6.9
Duration of driving (months)	270±101.7
Mini-Mental State Examination	28.7±1.3

Table 2. Current driving and miscellaneous issues of the study participants (N=74)

Items	Number	Percent (%)
1. Currently drive (Yes/No)	74/0	100.0/0.0
4. Wear glasses when driving (Yes/No)	42/32	56.8/43.2
5. Wear seatbelt when driving (Yes/No)	Feb-72	97.3/2.7
6. Way you prefer to get around (drive self/someone else drives/ public transportation)	56/0/18	75.7/0.0/24.3
7. How fast you drive		
Much faster	2	2.7
Somewhat faster	18	24.3
About the same	34	45.9
Somewhat slower	18	42.3
Much slower	2	2.7
8. Suggested you limit or stop driving (Yes/No)	8/66	10.8/89.2
9. Rate quality of driving		
Excellent	6	8.1
Good	26	35.1
Average	40	54.1
Fair	2	2.7
Poor	0	0
10. Not want to drive		
Ask a friend or relative to drive you	8	10.8
Call a taxi or take the bus	60	81.1
Drive yourself regardless of how you feel	2	2.7
Cancel or postpone your plans and stay home	2	2.7
Other	2	2.7

RESULTS

This study examined 74 licensed drivers (54 males and 20 females) with a mean age of 68.1 years, a mean height of 166.4 cm, and a mean body weight of 65.3 kg. The mean duration of driving was 270 months, and the mean MMSE score was 28.7 (Table 1). Table 2 shows the current driving status and miscellaneous issues of the participants. All participants were currently driving, and 56 reported that they preferred to transport themselves. More than two out of three participants reported that they usually drive the same or faster, compared to the general flow of traffic, and all

Table 3. Test-retest reliability of Driving Habit Questionnaire in the participants (N=74)

Domains	Cronbach's alpha	ICC intra-rater	95% CI
Dependence	0.572	0.572	0.320–0.730
Difficulty	0.871	0.871	0.796–0.919
Crashes and citations	0.689	0.689	0.507–0.804
Driving space	0.961	0.961	0.938–0.975

participants reported fair or better driving quality. However, eight participants over the prior year had been advised to limit or stop driving (Table 2).

The Cronbach's alpha coefficients for dependence (0.572), difficulty (0.871), crashes and citations (0.689), and driving space (0.961) indicated good or high internal consistency (Table 3). Relationships of these four domains are shown in Table 4. Driving difficulty correlated significantly with self-reported crashes and citations and driving space. However, dependence on other drivers was not significantly correlated with difficulty, crashes and citations, and driving space (Table 4).

DISCUSSION

This study examined the test-retest reliability of DHQ and the correlations among dependence on other drivers, driving difficulty, driving space, and self-reported crashes and citations for community-dwelling older self-drivers. The DHQ showed good reliability. The subjects reported low crashes and citations, and high driving space when they had lower driving difficulty and reported high driving.

Driving behavior can be affected by many internal and external cognitive and physical factors such as depression, psychological distress, occupational impairment, functional disability, and driving anxiety. Previous studies have developed specific methods to enable older adults to describe their physical and cognitive abilities in self-driving^{1, 6–8}. Although self-driving is a major method of transportation for older adults, there is still insufficient information to evaluate and document their on-road self-driving performance. As the population of elderly is growing, the number of older drivers is also increasing in modern industrialized societies worldwide. Older drivers tend to experience deficits in the necessary components of driving, with blurred vision, cataracts, glaucoma, and cognitive decline; there is a decline in processing speed, memory, problem solving ability, and executive functioning. The elderly tend to reduce weekly driving distances, do not maintain the speed limit, and experience an increase in crashes or citations compared to most other age groups. Therefore, proper assessment and re-education of driving behavior and habits are needed for older drivers.

The DHQ is an interviewer-administered tool that evaluates current driving, exposure, dependence, difficulty, crashes and citations, and driving space. This study examined the test-retest reliability of four domains of the DHQ, i.e., dependence, difficulty, crashes and citations, and driving space, to determine whether they are reliable for evaluating

Table 4. Correlations among 4 domains of Driving Habit Questionnaire in the participants (N=74)

	Dependence	Difficulty	Crashes and citations	Driving space
Dependence		0.121	-0.124	-0.630
Difficulty	0.121		-0.269*	0.747**
Crashes and citations	-0.124	-0.269*		0.048
Driving space	-0.630	0.747**	0.048	

* $p < 0.05$, ** $p < 0.01$

self-driving behaviors in the elderly. Wong et al. suggested that the DHQ has implications for our understanding of driving self-regulation by older adults⁷. Sandlin et al. also reported that the DHQ documents an adaptive and apparent self-regulatory practice in older drivers with contrast sensitivity impairment⁸. The results of this study also show good internal consistency of the four domains. The driving difficulty domain showed a good relationship with crashes and citations and driving space in this study. Therefore, the results of this study suggest that the DHQ is a good and reliable measure of self-reported, interview-based driving behavior in the community-dwelling elderly.

The results of this study encouraged us to further study the use of the DHQ as a precise and accurate measure for detecting driving habits in the self-driving elderly population. However, this study used only one instrument to assess driving behavior. Further studies with more and different instruments are needed to test actual driving skills, because the DHQ is self-reported.

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