

Relationship between Online Driving Aptitude Assessment and On-Road Driving Evaluation for Elderly Drivers

- (49) Study on Driver Characteristics for Delaying Driving Cessation -

Rin Ito ¹⁾ Shunji Taniguchi ¹⁾ Hirofumi Aoki ¹⁾

*1) Nagoya University, Institutes of Innovation for Future Society
Furo-cho, Chikusa-ku, Nagoya, 464-8601, Japan*

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With the aging of the population in Japan, traffic accidents involving older drivers have become an important social issue. At the same time, driving is essential for maintaining mobility and supporting daily life among older adults. Safe driving depends on multiple physical and cognitive functions, including cognition, vision, and physical ability. Conventional face-to-face assessments, however, require participants to visit designated facilities and may impose geographical, physical, and time-related burdens. To reduce these limitations, an online driving aptitude assessment was introduced to allow drivers to evaluate several driving-related functions using their own computers. Previous work showed correspondence between online and face-to-face assessments. The present study examined whether indicators obtained from the online assessment were associated with actual on-road driving performance.

The participants were 21 drivers, including 18 men and 3 women, with a mean age of 59.6 years ($SD = 12.8$). Indicators from the online driving aptitude assessment included estimated grip strength, Trail Making Test Parts A and B (TMT-A/B), the Multi-Stimulus Vision Tester (MVT), and Hazard Perception (HP). Grip strength was estimated from subjective difficulty ratings for opening plastic bottles and holding objects of various weights using multiple regression (MR) and a neural network (NN).

On-road driving performance was evaluated on public roads by a qualified driving instructor seated in the passenger seat. The evaluation included an overall driving score out of 100 points and 74 unsafe-driving items. Because individual unsafe behaviors occurred infrequently, the items were grouped into right- and left-turn errors at signalized intersections, right- and left-turn errors at unsignalized intersections, and failure-to-stop errors. A total number of unsafe behaviors was also calculated. Correlation analyses examined relationships between the online indicators, age, and driving performance.

TMT-A and TMT-B completion times were positively correlated with age, whereas HP performance was negatively correlated with age, suggesting age-related decline in some cognitive functions. Table 1 shows the correlation coefficients between physical/cognitive measures and driving performance. Estimated grip strength based on MR was positively associated with the overall driving score and negatively associated with the total number of unsafe behaviors and unsafe turning behaviors at signalized intersections. In contrast, grip strength estimated by NN showed no clear association with on-road driving measures. This may be because the NN model was developed using data that did not include older adults and may not have adequately reflected the age characteristics of the participants. Longer TMT-A completion time was associated with fewer failure-to-stop errors. Similarly, longer TMT-B completion time was associated with a higher overall driving score, fewer total unsafe behaviors, and fewer failure-to-stop errors. MVT and HP showed no significant associations with driving performance.

The TMT findings differed from the expectation that poorer cognitive performance would be related to poorer driving performance. One possible explanation is compensatory driving behavior. Participants with lower cognitive performance may have driven more cautiously, such as by checking surrounding traffic more carefully. A previous study of 141 older drivers with a mean age of 74.5 years reported that poorer cognitive function was associated with more errors related to preventive safety behaviors. This difference may partly reflect age distribution. The present participants were younger and may have been better able to compensate for cognitive decline through driving experience and cautious behavior. In contrast, among older drivers, cognitive decline may exceed the ability to compensate. Previous research also reported that higher cognitive function was sometimes associated with more errors such as failure to stop and speeding, possibly reflecting overconfidence in driving ability, which is partly consistent with the present findings.

Overall, selected indicators from the online driving aptitude assessment were associated with on-road driving performance. In particular, estimated grip strength based on multiple regression was associated with the overall driving score and several unsafe driving behaviors, while TMT-A/B performance was also associated with specific driving evaluation indices. Notably, longer TMT completion times were associated with fewer unsafe driving behaviors, suggesting that compensatory driving strategies, such as more cautious checking behavior, may influence the relationship between cognitive function and actual driving performance. Further studies with larger samples and broader age ranges are needed to clarify the roles of age and compensatory behavior and to examine the practical usefulness of online assessment as a convenient tool for evaluating driving-related abilities.

Table 1 Correlation coefficients between physical/cognitive measures and driving performance

Measure	Overall Driving Score	Total NG	Failure-to-Stop NG	Right/Left-Turn NG at Intersections	
				Signalized	Unsignalized
Grip Strength (MR)	.595 **	-.495 *	-.137	-.442 *	-.351
Grip Strength (NN)	.245	-.308	-.262	-.189	-.180
TMT-A	.205	-.244	-.498 *	-.104	.058
TMT-B	.491 *	-.580 **	-.652 **	-.352	-.308
MVT	.163	-.029	-.145	.048	.261
HP	-.255	.155	.111	.016	-.158

** $p < .01$, * $p < .05$