

Factors influencing older drivers' risky driving behaviors

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1.Objectives

Older drivers are among the most vulnerable road users in modern traffic systems. They exhibit higher crash rates per distance traveled and are disproportionately involved in intersection-related crashes (Cicchino and McCartt, 2015). Since a large proportion of traffic crashes can be attributed to driver behavior (Singh, 2018), understanding the mechanisms underlying risky driving among older adults is crucial for improving road safety. Using the DAHLIA (Data Repository for Human Life–Driving Anatomy) naturalistic driving dataset collected under the Nagoya University COI project, this study aims to identify and analyze the factors that influence older drivers' risky driving behaviors—specifically, harsh acceleration events and speeding behaviors. The findings will provide insights into behavioral and situational determinants of risk, contributing to the development of targeted interventions for enhancing older drivers' driving safety.

2. Material and methods

The data were obtained from DAHLIA dataset of the Nagoya University COI project. All participants were licensed drivers residing in the Nagoya Metropolitan Area who provided informed consent, and the study was approved by the Nagoya University Ethics Committee (Approval No. 2022-16).

A total of 58 older drivers aged 65 years and above participated. Each vehicle was equipped with a Yupiteru BU-DRHD421 driving recorder that continuously captured naturalistic driving behavior. The device

automatically detected two types of harsh events—sudden start/brake and sudden steering. The frequency of harsh event was defined as the number of sudden start, brake, or steering events per 1,000 km driven (Zhu et al., 2025). Vehicle speed data were recorded at 1 Hz to identify speeding behaviors. Demographics, personality traits (sensation seeking and impulsivity), functional abilities, and travel patterns were selected as potential predictors of older drivers' risky driving behavior.

Two modeling frameworks were developed to investigate the factors influencing older drivers' harsh events and speeding behaviors, respectively. The analysis was based on one year of naturalistic driving data collected from 58 older drivers. A structural equation modeling (SEM) framework was employed to explore the underlying mechanisms contributing to harsh events, while negative binomial regression models were applied to identify significant predictors of older drivers' speeding behaviors.

3. Results

Figure 1 presents the estimation results of the SEM examining the predictors of older drivers' harsh events. The analysis revealed a low-mileage bias among this sample of older drivers—those with lower driving exposure were more likely to engage in risky acceleration behaviors. The model further indicated that this low-mileage bias was mediated by risky route choice, as drivers who accumulated a higher proportion of their mileage on risky roads exhibited a greater frequency of harsh events. Additionally, impulsivity and reduced contrast

sensitivity were significantly associated with an increased frequency of harsh events, suggesting that both psychological and functional factors contribute to elevated driving risk among older adults.

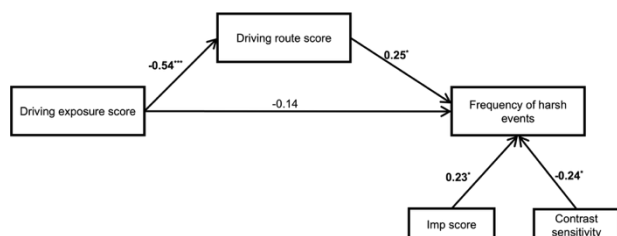


Figure 1 Estimation results of the SEM model (dependent variable: frequency of harsh event)

Table 1 Estimation results of the negative binomial regression model

Variables	IRR	95% CI
Residential location: outside Nagoya	1.31**	1.01-1.70
TMT-B (/10s)	0.96*	0.93-0.99
Ratio of driving in the rain (%)	0.95**	0.92-0.98

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Speeding events were defined as instances in which a vehicle was driven 1 km/h or more above the posted speed limit for at least 30 seconds (Zhu et al., 2025). Table 1 summarizes the estimation results of the negative binomial regression model used to identify factors influencing older drivers' speeding behaviors. Drivers residing outside Nagoya exhibited a 31% higher rate of speeding events than those within the city. In contrast, each 10-second increase in TMT-B completion time was associated with a 4% reduction in speeding, suggesting that slower cognitive processing may encourage more cautious driving. Similarly, a higher proportion of driving in rainy conditions led to a 5% decrease in speeding rates, indicating that

adverse weather encourage more defensive driving behavior among older drivers.

4. Discussion

This study revealed that older drivers with lower driving exposure were more likely to engage in harsh acceleration behaviors, partly due to their tendency to drive on riskier routes. Impulsivity and poorer contrast sensitivity further contributed to higher frequencies of harsh events, highlighting the combined influence of psychological and functional factors. Furthermore, drivers living outside Nagoya exhibited higher speeding rates, whereas slower cognitive processing (longer TMT-B completion times) and a higher proportion of driving in rainy conditions were associated with reduced speeding. These findings suggest that risky driving among older adults arises from the interplay of behavioral exposure, cognitive ability, and driving environment, underscoring the need for targeted safety interventions that address both behavioral and functional aspects of aging drivers.

Reference

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