

# Regional Differences in Collision Avoidance Emergency Braking Frequency Measured by Dashcams of Elderly Drivers

- Study on Driver Characteristics for Delaying Driving Cessation (47)-

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**Introduction:** The increase in traffic accidents due to the decline in driving ability of elderly drivers has been a problem. The previous report confirmed a correlation between collision avoidance emergency braking frequency per driving distance measured by elderly drivers' dashcams in the Nagoya area and their safe driving ability by instructor. In this report, to determine whether safe driving ability can be assessed based on the frequency of collision-avoidance emergency braking per driving distance across different regions, we compare the proportion of collision-avoidance events and the frequency of collision-avoidance emergency braking in the Nagoya and Tukuba areas, which have distinct driving environments.

**Test Method:** The experiment participants consisted of 70 elderly drivers aged 55-85 years, 44 Nagoya participants with a mean age of 73 ( $SD=6.2$ ), and 26 Tukuba participants with a mean age of 71.6 ( $SD=5.1$ ). The participants drove with driving recorder in natural driving. The driving data was measured by the drive recorder (Yupiteru, DU-DRHD421) including GPS, 3-axis accelerometer, vehicle front view camera. The collision avoidance emergency braking frequency per driving distance were analyzed by the drive recorder data. To investigate whether there were any differences in cognitive-physical and driving awareness of participants from Nagoya and Tukuba, we utilized the MMSE (Mini-Mental State Examination), the Trail-Making Test (TMT) Parts A & B, the Field of View (UFOV), three types of emergency reaction times of the National Police Agency-style CRT Driving Aptitude Test and the safe driving awareness, the following subscales of the Simplified Comprehensive Questionnaire on Driving Characteristics (SQ-CCDC) were used: safe driving attitude, anxiety about causing traffic accidents, coping with adverse conditions, coping with passengers, cognitive decline, self-awareness of functional declines, perception of workload, and difficulty controlling emotions and nervousness.

**Test Results:** Although no significant differences were observed in the mean scores on the MMSE, TMT-B, and UFOV between participants from Nagoya and Tukuba. There were no significant differences in the mean scores for the three types of emergency reaction times on the CRT driving aptitude test between Nagoya and Tukuba. Therefore, there are no major differences in the cognitive and physical characteristics of the participants from Nagoya and Tukuba. There was no significant difference between the mean scores on the eight subscales of the SQ-CCDC between Nagoya and Tukuba, indicating that there is no difference in driving attitudes between participants. An analysis of the driving conditions based on data from the dashcam revealed a significant difference in average trip speed: 15.3 km/h in Nagoya and 21.5 km/h in Tukuba. The frequency of emergency braking to avoid collisions per 10,000 km driven, after log transformation and normalization, was 3.91 in Nagoya and 2.7 in Tukuba; the frequency was significantly higher in Nagoya. In the Nagoya area, compared to Tukuba, a higher proportion of collision avoidance emergency braking involving cars, bicycles, and pedestrians at stop signs and traffic-light-controlled intersections. In the Tukuba area, compared to Nagoya, a higher proportion of emergency braking maneuvers were performed to avoid rear-end collisions on straight roads and near intersections, as well as to avoid head-on collisions on narrow curved roads. The frequency of emergency braking to avoid collisions is lower in Tukuba than in Nagoya; this is likely because the higher driving speeds in Tukuba result in a lower frequency of emergency braking per 10,000 km driven. Figure 1 shows the relationship between driving speed and the frequency of emergency braking to avoid collisions in Nagoya and Tukuba. Since Figure 1 shows that the relationship between driving speed and the frequency of emergency braking to avoid collisions is nearly identical for Nagoya and Tukuba, correcting the frequency of emergency braking to avoid collisions per 10,000 km of driving distance based on driving speed allows for the evaluation of elderly drivers' driving ability using the frequency of emergency braking to avoid collisions per driving distance, even if the proportion of each type of emergency braking event differs between urban and suburban areas.

**Conclusion:** We hypothesized that the lower frequency of collision-avoidance emergency braking per 10,000 km driven in Tukuba compared to Nagoya was due to higher driving speeds in Tukuba. By adjusting the frequency of collision-avoidance emergency braking based on the average trip speed, we found that it is possible to compare the frequency of collision-avoidance emergency braking when the proportion of individual collision-avoidance events differs between urban areas in Nagoya and suburban areas in Tukuba.

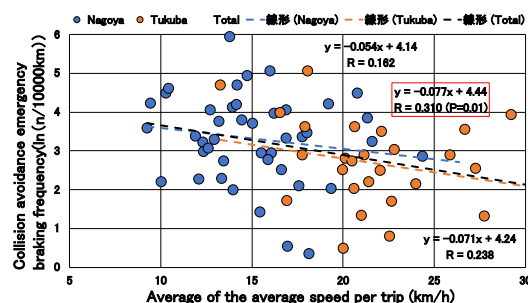


Fig.1 Relationship of average speed per trip and collision avoidance emergency braking frequency in Tukuba and Nagoya