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Study on Cognitive Function Tests at Resident' Health Checks and Accelerator Pedal and Brake Pedal Misapplication

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This document is based on the following research presentation.
"A Population-Based Study on the Possible Factors in Pedal Misapplication" by Takahiko Kimura, Kazumitsu Shinohara, and Takeshi Hatta (2017)
2017 JSAE Congress (Autumn) Technical Paper Presentation Proceedings, 470-474
https://www.bookpark.ne.jp/cm/jsae/select.asp?pageno=25&pagenum=10&category=103&lang=J&table=JSAP

Overview of This Study

☞ Organized collection of data at local residents' health checks

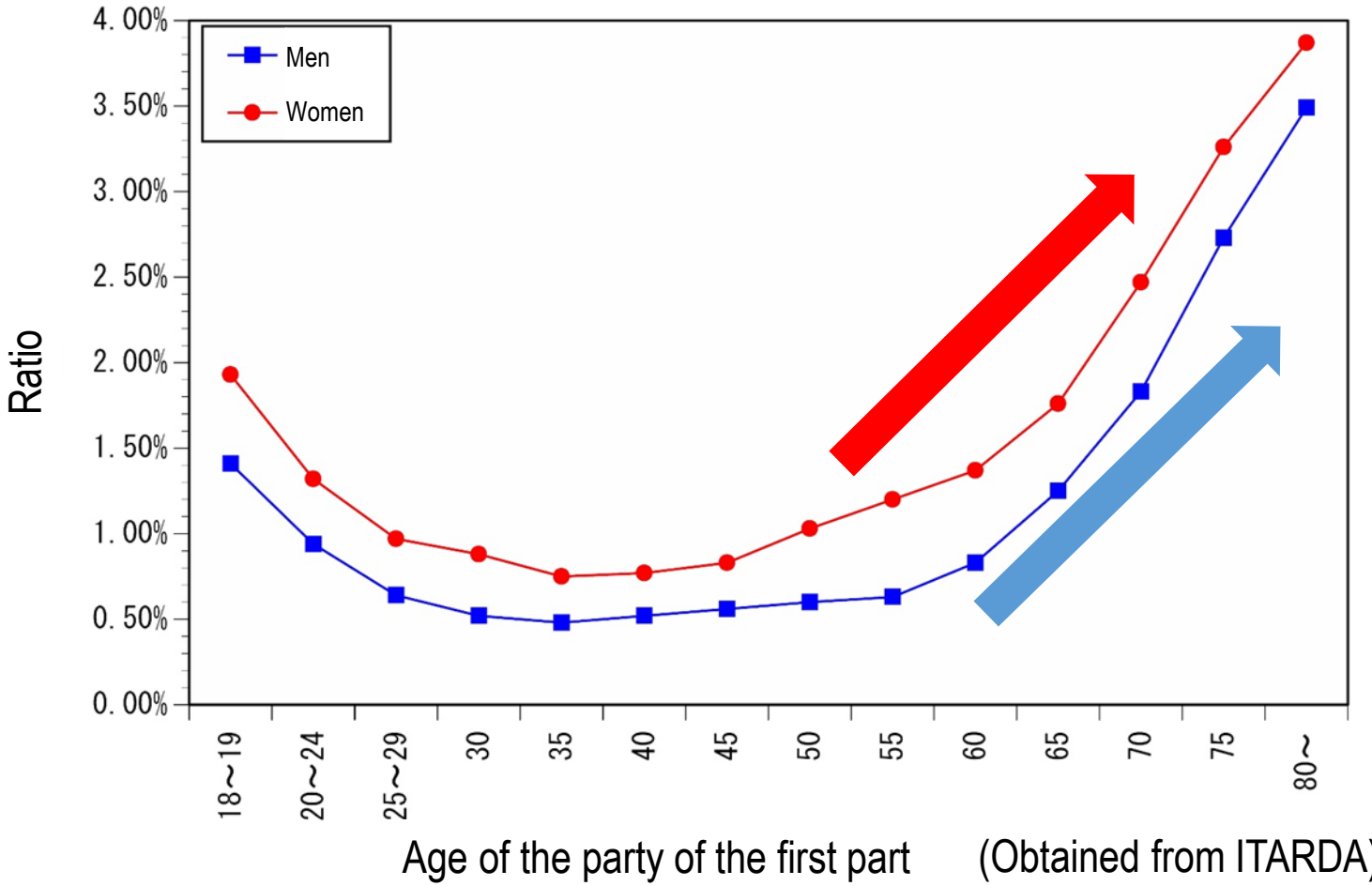
☞ Survey on daily living, driving, and cognitive functions

☞ Results

- Differences not observed in attention focusing, memory performance, and spatial cognition.
- In the Stroop Task, in which inhibition function is involved, the group having experience in pedal misapplication can execute the task faster.

☞ As approaches from both the physical and cognitive aspects are important in preventing accidents and clarifying the factors for accelerating and braking, we plan to continue carefully examining and studying the details of the survey.

Awareness of the Issue (1): Age and Misapplication



(Obtained from ITARDA)

Accidents due to pedal misapplication have increased among both men and women aged 65 or older.

Awareness of the Issue (2): Attention to Residents' Health Checks

☞ Data can be collected systematically from multiple perspectives

- Traffic accidents often occur during routine movements in such places routes and parking lots in the local community.
- It is possible to collect data efficiently from subjects living in the same area with similar livelihood bases.

☞ Examine the causes of occurrence of accidents due to accelerator/brake pedal misapplication

Description of Collected Data

- ☞ Daily life questionnaire sheet

  Psychological matters such as the level of happiness or sentiments

- ☞ Matters related to the driving of automobiles

  Frequency of driving, level of confidence about driving, position of the heel when stepping on the brake pedal, presence/absence of experience in accelerator/brake pedal misapplication, level of risk if there is such experience, and level of confidence in one's athletic ability

  - ☞ Frequency of falling down related to maintenance of motor functions

- ☞ Cognitive functions (based on Hatta, 2004, etc.)

  Memory, mental rotation, executive functions, and attentional functions

Results

☞ With experience in pedal misapplication: 37 people (18 men, 19 women, average age of 60.16, SD = 9.80)

☞ With no experience in pedal misapplication: 360 people (191 men, 169 women, average age 62.04, SD = 9.56)

☞ Regardless of the presence or absence of experience in pedal misapplication, more than 80% of the subjects replied in connection with the frequency of their driving that they “drive every day.”

↓

Driving on a daily basis in the local community

Results: Level of confidence in driving

	Have confidence	Moderately confident	Normal	Not much	None	No answer
With experience in pedal misapplication	0.08	0.16	0.62	0.11	0.03	
With no experience in pedal misapplication	0.23	0.15	0.55	0.07	0.01	0.00278

In the group with experience in pedal misapplication, there tended to be more people whose self-assessment was lower than a “high” level of confidence compared to those in the group with no experience in pedal misapplication.

Results: Level of confidence in athletic ability

	Have confidence	Moderately confident	Normal	Not much	None	No answer
With experience in pedal misapplication	0.05	0.11	0.68	0.14	0.03	0.00
With no experience in pedal misapplication	0.13	0.17	0.58	0.09	0.02	0.02

In the group with no experience in pedal misapplication, there was distribution toward a high level of confidence concerning the level of confidence in athletic ability compared to the group with experience in pedal misapplication.

Results: Experience in falling down

	Never	Once	Twice or more	No answer
With experience in pedal misapplication	0.76	0.14	0.05	0.08
With no experience in pedal misapplication	0.85	0.09	0.04	0.02

In the group with experience in pedal misapplication, there tended to be more people who have fallen down once or more times.

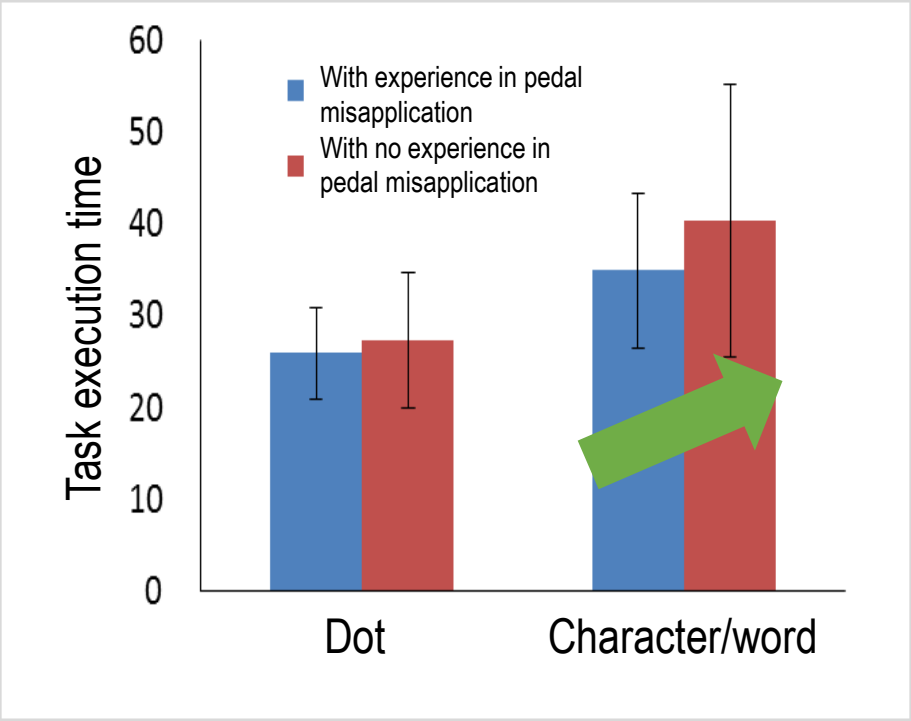
☞ Taken in consideration together with the level of confidence in athletic ability, there is a possibility of the occurrence of pedal misapplication in the case where self-assessment of athletic ability is low and the risk of falling down is high.

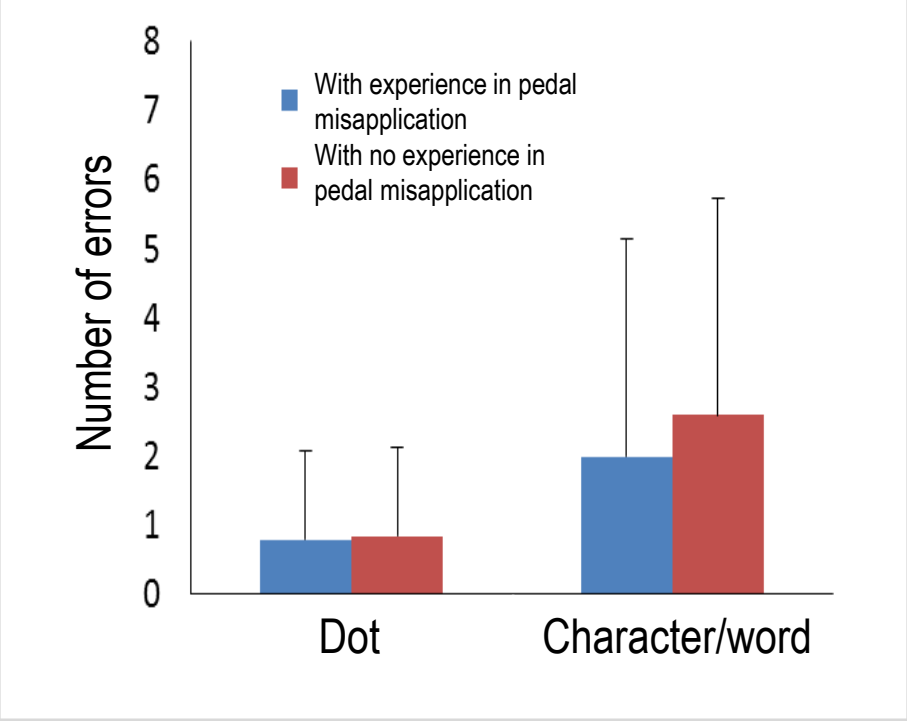
Results: Memory and spatial cognition

	Number of reproduction of prosaic accounting (number)	Mental rotation (number of correct answers)
With experience in pedal misapplication	14.85	11.04
With no experience in pedal misapplication	13.89	10.48

No differences were observed in memory functions (reproduction task) and spatial cognition (mental rotation task) regardless of the presence or absence of experience in pedal misapplication.

Results: Inhibition task





Those in the group with experience in pedal misapplication were significantly faster solely with regard to the execution time for the character/word task compared to those in the group with no experience in pedal misapplication [$t(47.91)=2.79$, $p<.008$].

☞In connection with previous studies (Kimura and Shinohara, 2017), there is a possibility that the tendency of impulsive behaviour is associated with this, thus requiring further consideration.

Summary of Results

(1) Subjective evaluation concerning driving of automobiles and athletic ability

It was indicated that those in the group with experience in pedal misapplication scored relatively lower.

(2) Risk of falling down

Tendency to be higher for those with experience in pedal misapplication.

(3) Cognitive functions

Differences not observed in attention focusing, memory performance, and spatial cognition.

In the Stroop Task, in which inhibition function is involved, the group having experience in pedal misapplication were able to execute the task faster.

Discussion

Matters necessary for the studying factors causing occurrence of pedal misapplication

☞ Evaluation of one's basic physical functions such as motor functions and the meta cognition that is involved in the execution of those functions (how one is grasping this).

☞ Using cognitive functions, especially inhibition functions, as an index is effective (Kimura & Shinohara, 2012; Shinohara et al., 2012)

Studying both the aspect of motor functions and the aspect of cognitive functions is important for clarifying the factors for pedal misapplication.

Future research

(1) Importance of studying both the aspect of motor functions and the aspect of cognitive functions for clarifying the factors for pedal misapplication.

(2) Development of easy and simple method for extracting drivers who possess potential accident factors through group screenings such as residents' health checks