Journal of Transport & Health 9 (2018) 282–287

Contents lists available at ScienceDirect

Journal of Transport & Health

journal homepage: www.elsevier.com/locate/jth

Driving frequency associated with deficits in lower extremity function, dynamic vision, and physical activity in Japanese older adults

Takumi Abe[a,b,*], Keisuke Fujii[a,c], Jaehoon Seol[a], Yuya Fujii[d], Kaya Joho[d], Ayane Sato[a], Mijin Kim[e], Tomohiro Okura[e]

[a] Doctoral Program in Physical Education, Health and Sport Sciences, University of Tsukuba, 1-1-1 Tennodai, Tsukuba, Ibaraki 3058574, Japan
[b] Japan Society for the Promotion of Science, 5-3-1 Kojimachi, Chiyoda-ku, Tokyo 1028472, Japan
[c] Department of Occupational Therapy, Ibaraki Prefectural University of Health Science, 4669-2 Ami, Inashiki-gun, Ibaraki 3000394, Japan
[d] Master's Program in Health and Sport Sciences, University of Tsukuba, Tsukuba, 1-1-1 Tennodai, Tsukuba, Ibaraki 3058574, Japan
[e] Faculty of Health and Sport Sciences, University of Tsukuba, 1-1-1 Tennodai, Tsukuba, Ibaraki 3058574, Japan

1. Introduction

In Japan, approximately 17.7 million older adults have a driver's license, which is equivalent to 56.7% of the older population (National Police Agency, 2017). This implies that private cars are a major means of transportation for Japanese older adults. Various factors such as physical/cognitive function and medical conditions effect driving ability, and these factors are associated with the incidence of car crashes (Anstey et al., 2005). To prevent car accidents, it is necessary to fully understand the health status of older drivers.

Accumulated evidence suggests that driving cessation accelerates the deterioration of physical, cognitive, and social functions (Choi et al., 2014; Edwards et al., 2009b). It is also associated with a decrease in outside activity (Marottoli et al., 2000), an increased risk of depressive symptoms (Chihuri et al., 2016), entry into long-term care (Freeman et al., 2006), and mortality (O'Connor et al., 2013). Data from the National Health and Aging Trends Study showed that frailty, which is a state of increased vulnerability for adverse health outcomes, is a risk factor for driving cessation (Bond et al., 2017). Although previous longitudinal studies showed that current drivers are healthier than non-drivers, including former or never drivers, the association between frequency of car driving and current drivers' health status is unclear.

Older drivers tend to reduce their driving before they decide to cease completely (Hakamies-Blomqvist and Wahlström, 1998). One cohort study has reported that older drivers cite various reasons for limiting their driving, including vision problems, weakness, and disability (Ragland et al., 2004). Based on this research on current older drivers, it is likely that older adults who drive infrequently have a poor health status. However, little has been reported on a comprehensive evaluation of the characteristics of drivers who limit their driving.

We conducted exploratory research to reveal the association between frequency of car driving and health-related indicators in older adults. These indicators included physical and cognitive functions, physical activity, depressive symptoms, and social networks. The present research is expected to contribute to the prevention of driving cessation in older drivers.

* Correspondence to: Graduate School of Comprehensive Human Sciences, University of Tsukuba, 1-1-1 Tennodai, Tsukuba, Ibaraki 305-8574 Japan.
E-mail address: s1530485@u.tsukuba.ac.jp (T. Abe).

https://doi.org/10.1016/j.jth.2018.01.010
Received 23 November 2017; Received in revised form 24 January 2018; Accepted 24 January 2018
Available online 14 February 2018

2. Methods

2.1. Participants

The Kasama Health Checkup for Longevity is a cohort study on community-dwelling older adults without long-term care insurance. The study is conducted in Kasama, Japan. The city has a population of 75,794 (population density: 315.3/km^2) and an aging rate of 30.0% (Ibaraki prefecture, 2017). We conducted a cohort study on preventive nursing care and achieving successful aging, undertaking a comprehensive assessment. Other information from the cohort study has been previously described (Okura et al., 2017). The present study used cross-sectional data collected from the cohort study via a 2017 survey. A total of 400 participants aged from 65 to 89 years took part in the survey; however, we excluded 56 participants because of missing data (physical function, n = 19; cognitive function, n = 13; physical activity, n = 10; mental health, n = 11; social network, n = 3). Finally, the data of 344 participants were used for analysis. This study was approved by the Ethical Committee of the University of Tsukuba (Ref No., Tai 26–31). We fully explained the study to the participants and obtained their informed written consent.

2.2. Transportation

We used a questionnaire to examine the participants' driving status: current driver or non-driver. Current drivers were asked how often they usually drive. In this study, former drivers and never drivers are categorized as non-drivers because it is suggested that the characteristics of former drivers resemble that of never drivers (Freeman et al., 2006; Choi et al., 2014). Additionally, all participants asked, "How many days a week do you use a bicycle?".

2.3. Physical function

We used eight physical performance tests: grip strength (upper-extremity strength), one-leg stand with eyes open (static balance), five-times-sit-to-stand test (lower extremity strength), timed up and go (TUG; functional mobility), 5-meter habitual walk (walking ability), peg moving task (hand dexterity), choice reaction time (reaction ability), and dynamic vision test (dynamic vision). The methods of each test have been noted previously, except for the dynamic vision test (Tsunoda et al., 2013). The dynamic vision test was conducted using equipment with 20 touch sensors. Participants were asked to simultaneously touch two flashing sensors out of 20. Every time they touched two sensors, the position of the two flashing sensors changed. We recorded the time it took participants to touch the sensors 20 times. This test was performed two times, and the quicker time was adopted for analysis.

2.4. Cognitive function

The trail making test (TMT) parts A and B were used to evaluate visual search, speed of processing, and attention (Reitan, 1958; Tombaugh, 2004). Participants were required to draw lines from 1 to 25 in numerical order in TMT-A and to connect numbers and *hiragana*, Japanese characters, alternately in TMT-B. If participants did not finish the TMT-B task within 360 seconds, we deemed that they could not complete the task and treated the result as missing data (Carlson et al., 2009). Five cognitive tests were administered. They tested for attention memory, visuospatial function, verbal fluency, and reasoning domains (Miyamoto et al., 2009). We calculated the total score of these tests to evaluate general cognitive function (Sato et al., 2015).

2.5. Other health measures

Physical activity was evaluated using the Physical Activity Scale for Elderly (PASE) (Hagiwara et al., 2008; Washburn et al., 1993). PASE enables the assessment of leisure-time physical activities such as walking and light- to vigorous- intensity recreational activity, household physical activity, and work-related physical activity in the past week. Each score is weighted by content and frequency. The total PASE score was used in analysis. The 15-item Geriatric Depression Scale (GDS) was used to evaluate depressive symptoms (Sheikh and Yesavage, 1986). Individuals gained one point for each negative answer in the questionnaire. A lower GDS score is interpreted as good mental health. The abbreviated Lubben Social Network Scale (LSNS) is a standardized questionnaire for the assessment of social networks (Lubben et al., 2006). The LSNS score was calculated based on family and friends networks. A higher LSNS score represents belonging to a good social network.

2.6. Covariates

In reference to previous studies about driver health (Bond et al., 2017; Edwards et al., 2009b), we selected age, sex, body mass index (BMI), education, clinical history of stroke, diabetes, and heart disease, and living arrangement as covariates. BMIs were calculated from height and weight measurements. The other data were obtained from a self-administered questionnaire.

2.7. Statistical analysis

Participants were categorized as follows: high frequency driver ($\geq$ 4 d/w), low frequency driver ($\leq$ 3 d/w), and non-driver. To compare each category's characteristics, we performed a one-way analysis of variance for continuous variables and a chi-square test