Transportation mode usage and physical, mental and social functions in older Japanese adults

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Kenji Tsunoda [a,*], Naruki Kitano [b,c], Yuko Kai [a], Taishi Tsuji [c,d], Yuki Soma [b], Takashi Jindo [b], Jieun Yoon [b], Tomohiro Okura [e]

[a] Physical Fitness Research Institute, Meiji Yasuda Life Foundation of Health and Welfare, 150 Tobuki, Hachioji, Tokyo 1920001, Japan
[b] Graduate School of Comprehensive Human Sciences, University of Tsukuba, 1-1-1 Tennodai, Tsukuba, Ibaraki 3058574, Japan
[c] The Japan Society for the Promotion of Science, 8 Ichiban, Chiyoda, Tokyo 1028472, Japan
[d] Gerontology Research Center, University of Jyväskylä, PO Box 35, 40014 Jyväskylä, Finland
[e] Institute of Health and Sport Sciences, University of Tsukuba, 1-1-1 Tennodai, Tsukuba, Ibaraki 3058574, Japan

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ABSTRACT

Objective: The purpose of this study was to cross-sectionally examine associations between frequencies of bicycle and motor vehicle travel, physical and mental statuses and social networks.

Methods: This study was conducted from 2009 to 2012 with 629 community-dwelling older adults (73.3 ± 5.2 years old, female 53.7%) in Kasama City, Rural Japan. Travel status, physical activity scale for the elderly, Lubben social network scale and geriatric depression scale were collected via a self-administrated questionnaire. We also calculated a standardized physical function score through physical performance tests.

Results: After adjusting for age, gender, education, living arrangement, body mass index and clinical history, we found a positive association between frequency of bicycle and motor vehicle travel and physical activity, social networks and mental status (Trend $P < 0.05$). Physical function was also significantly associated with motor vehicle travel (Trend $P < 0.05$). Additional analysis revealed that older adults who mainly stayed within a walking area were more likely to experience less physical activity and social networking and have diminished mental status and physical function (Trend $P < 0.05$).

Conclusion: Extending the travel area through use of transportation modes might provide health benefits. Assessing transportation mode usage could improve screening and assistance strategies for people who are physically or mentally frail or lonely.

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1. Introduction

Japan is well known for its growing aged population, and the Japanese government has made increasing healthy life expectancy a key issue for preserving one's quality of life and for national economic stabilization (Cabinet Office, Government of Japan, 2010). With this goal in mind, the Japanese Ministry of Health, Labour and Welfare (MHLW) has looked toward preventing individuals from becoming homebound; the national frailty index of Japan's "Kihon Checklist" developed by Ministry of Health, Labour and Welfare (MHLW) (2012) asks whether an individual goes out at least once a week as a screening measure for the homebound. This population approach is important for decreasing dependency in older adults at the national level. However, once individuals become homebound, they may have more difficulty caring for themselves or receiving outside public support because of their frailty (Fujita et al., 2004; Shimada et al., 2010; Shinkai et al., 2005), isolation (Shinkai et al., 2005) and depression (Fujita et al., 2006; Shinkai et al., 2005), which can worsen with their restricted living arrangement. To avoid long-term care, it is also important to target individuals before they become homebound.

Some studies report that decreasing life-space is linked with physical frailty (Baker et al., 2003; Shimada et al., 2010), depressive symptoms (Baker et al., 2003), cognitive decline (Crowe et al., 2008) and a higher risk of mortality (Boyle et al., 2010). Optimal mobility, which entails freedom of movement to places people want to go via all forms of transportation, is necessary for healthy aging (Satariano

et al., 2012). To travel further from home without the stress of limited mobility requires a transportation mode such as a bicycle or motor vehicle. Without a readily accessible mode of transportation, an older adult's life-space would be limited to a small area; this could adversely impact their physical, mental and social functions. Although the health benefits of extending life-space have been reported (Baker et al., 2003; Boyle et al., 2010; Crowe et al., 2008; Shimada et al., 2010), there is insufficient evidence to confirm the association between frequency of transportation usage and health status. Revealing this relationship could help in development of effective screening and assistance strategies for long-term care prevention.

The purpose of this study was to investigate whether frequencies of travel by bicycle or motor vehicle are linked with physical and mental status and social networks.

2. Methods

2.1. Participants and data collection

This cross-sectional study used data from an open cohort study called "Kasama study" (Tsunoda et al., 2012, 2013) conducted yearly in August from 2009 to 2012 in Kasama City, a rural region in Ibaraki prefecture, Japan (population 78,069, area 240.3 km^2, proportion of older adults 25.2% in 2013). We mailed invitation letters to 3800 community-dwelling older adults, not residing in a care facility, aged 65–85 years old (1200 individuals in 2009, 900 individuals each in 2010 and 2011 and 800 individuals in 2012) randomly drawn from the basic resident register. To avoid overlapping of samples, names were drawn from a different geographical area of the region each year. A total of 688 people participated in the study conducted in the Health Center of Kasama City. Of these participants, 39 were excluded due to incomplete data for demographic variables and/or no travel variable data, and 20 were eliminated due to inability or difficulty ambulating. There were 629 eligible participants (eligibility rate 16.6%). All participants provided a signed informed consent. This study was approved by the Ethical Committee of University of Tsukuba.

2.2. Measurement variables

We collected data through physical performance tests for estimating a physical function score and a self-administrated questionnaire which included travel status, physical activity, social networks, mental status and demographic information. Demographic variables included age (years), gender, education (years), living arrangement (living alone or with others), body mass index (kg/m^2) and clinical history (heart disease, stroke, low back pain, knee pain and hip pain). In each year of the study we mailed the self-administrated questionnaire to participants two weeks prior to the day of their scheduled performance tests to allow them time to complete the questionnaire. On the day of their performance tests, they hand delivered it to the technicians at the Health Center in Kasama City. We assessed medical histories via face-to-face interviews.

2.2.1. Travel status

We used four items to assess going out and transportation mode usage: (1) frequency (days per week) of going out including working, shopping, meeting relatives/friends and engaging in a hobby; (2) frequency of travel by bicycle; (3) frequency of travel by motor vehicle (household vehicle, bus, train or taxi); and (4) the main travel area, which is an additional assessment of travel status (Tsunoda et al., 2012). In the questionnaire, the frequencies of bicycle and motor vehicle travel were divided into five categories: "less than 1 day per week," "1 day per week," "2–3 days per week," "4–5 days per week" and "6–7 days per week." Since almost no people went out less than 1 day per week (Fig. 1), for our comparison analysis, we combined the first two categories and used the following four groups: "1 day per week or less," "2–3 days per week," "4–5 days per week" and "6–7 days per week." To assess the main travel area, participants were asked "Where do you mainly travel in a typical week?" The three possible responses, "an area that can be travelled by walking," "an area that can be travelled by bicycle," and "an area that can be travelled by motor vehicle" defined the destination as a "walking area," "bicycle area," or "motor vehicle area," respectively.

2.2.2. Health status measures

(1) Physical activity
The physical activity scale for the elderly (PASE) (Hagiwara et al., 2008; Washburn et al., 1993) was used to assess physical activity. The PASE consists of a 12-item questionnaire that measures the average number of hours per day over the previous 7 days spent in leisure-time physical activity including walking and light- to heavy-intensity recreational activities, household physical activity, e.g. light and heavy house work, lawn work or yard care, and work-related physical activity including paid and volunteer work. These items are weighted based on intensity of each activity, and the PASE score is the sum of the 12 weighted items (Washburn et al., 1993).

(2) Social networks
To assess social networks, we used the 10-item Lubben social network scale (LSNS) (Ishikawa, 1996; Lubben, 1988). The LSNS is designed to assess social isolation in older adults by measuring family and friend networks such as number of close relatives and friends, and mutual support including receiving and providing advice for an important decision. Range of each item is zero to five with zero indicating minimal social integration.

(3) Mental health
The 15-item geriatric depression scale (GDS) with "yes" or "no" responses was used to assess depressive symptoms (Sheikh and Yesavage, 1986; Yatomi, 1994). A low score on this scale indicates good mental health.
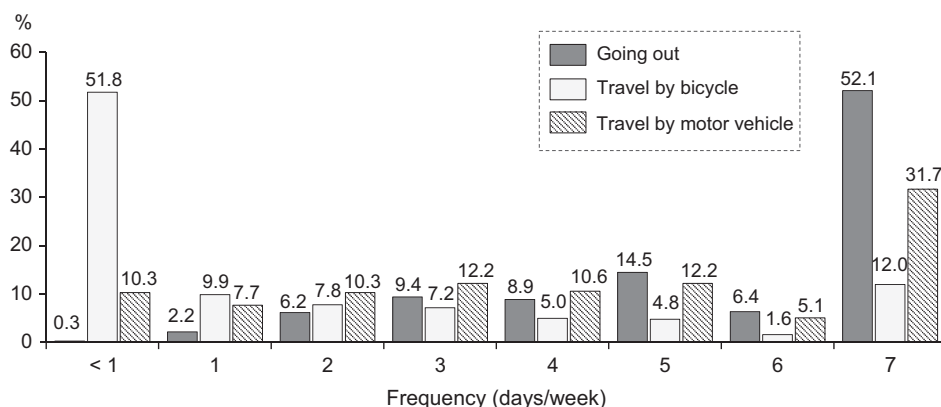

Fig. 1. Descriptive data for travel status.