

# Actual Conditions of Leisure Activity Among Older Community-Dwelling Japanese Adults

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## Abstract

For healthy longevity, according to the theoretical framework of “successful aging,” it is not only essential to avoid disease and disability, and to keep high levels of mental and physical functioning, but also to engage with life. Thus, satisfactory leisure activity is important for the aged. We examined actual conditions of leisure activity among older adults in Japan, which can contribute to the development of a standardized leisure activity scale. Participants were 843 community-dwellers (390 men and 453 women, 70.5 ± 6.9 years old) who completed 58 draft leisure activity items. Three procedures (including item selection, factor analyses, and correlation analyses) were conducted to finalize the leisure activity list and evaluate its psychometric properties. Through item selection procedures, 15 items were regarded as inappropriate and were omitted from the analysis. The factor analyses resulted in an 11-factor solution with 43 items. Correlation analysis revealed that Factors 2 (social-public), 5 (social-private), 7 (technology use), 8 (travel), and 10 (developmental activity) had relationships with health outcomes (including functional capacity, social network, subjective well-being, and health literacy). A standardized leisure activity list among modern middle-aged and elderly people was developed, and was associated in part with health outcomes.

## Keywords

leisure activity, middle-aged and older adults, successful aging, subjective well-being, cognition

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## Introduction

Along with the worldwide aging of the general population, the maintenance of subjective well-being among older adults, in particular considering their functional limitations, has been a focus of research. For healthy longevity, according to the theoretical framework of “successful aging” (Rowe & Kahn, 1997), it is essential not only to avoid disease and disability, and to keep high levels of mental and physical functioning, but also to engage with life. Thus, satisfactory leisure activity is important for the aged. Leisure activity has been defined as “activities that individuals engage in for enjoyment or well-being that are independent of work or activities of daily living” (Verghese et al., 2006, p. 822).

According to the fundamental principles underlying an aging society in Japan proposed by the Japanese government (Cabinet Office, Government of Japan, 2014), accelerating the feeling of *Ikigai* (purpose in life) and health promotion (including prevention for long-term care) are highly recommended by encouraging older adults to engage in leisure-time activity and social participation. In addition, older adults are now expected to be “capable personnel” who can support such an aging society. In a framework for the prevention of long-term care in Japan, they have been expected to be not only

persons who are supported by someone but who can also play an important role and be active in community-building (Ministry of Health, Labour and Welfare, 2012).

Here, we confirm previous findings regarding a relationship between leisure activity and health issues among older adults. Leisure activity is reportedly associated with prevention of cognitive decline and dementia incidence (Iwasa et al., 2012; Verghese et al., 2003; Wang, Xu, & Pei, 2012; Wilson et al., 2002). In addition, leisure activity is reportedly associated with reduced mortality and functional decline (Fushiki, Ohnishi, Sakauchi, Oura, & Mori, 2012; Tomioka, Kurumatani, & Hosoi, 2016b) as well as subjective well-being (Menec, 2003; Zhang, Feng, Lacanienta, & Zhen, 2017).

Standardized procedures for measuring leisure activity among middle-aged and elderly adults are needed to efficiently compare scientific reports. Currently available assessment tools in Japan include a 42-item list by Tejima

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and Shimizu (1992) and a 29-item list for leisure activity (“Japanese Interest Checklist for the Elderly”) by Nakamura and Yamada (2009). Takeda, Kondo, Yoshii, Kuze, and Higuchi (2005) developed a list for leisure activity among community-dwelling older adults that consists of eight categories: sports, education and cultural activity, music, creative activity (e.g., handcraft and ceramic art), natural activity (e.g., crop work and gardening), sightseeing, social engagement, and other (e.g., watching TV and gambling). Saito et al. (2015) compiled a list of leisure activities among community-dwelling older adults based on a previous study (Takeda et al., 2005) that included 25 items: “walking,” “travel,” “using a PC,” “reading books,” “gardening,” “playing golf,” “playing *igo* and *shogi*,” “photography,” “karaoke,” “fishing,” “crop work,” “needle work,” “gymnastics,” “painting,” “dance,” “playing Japanese croquet,” “gambling,” and others. Kozono et al. (2016) conducted a survey with older adults living in a community (aged 69–71 years) regarding a total of 138 leisure activities that they had experienced in the week, utilizing 11 categories based on previous reports (Jopp & Hertzog, 2010). In European and Western countries, Jopp and Hertzog (2010) reported a list of 70 items of leisure activity. However, previous studies have some limitations: (a) the lists did not fully encompass leisure activities among older adults living in a community; and (b) the lifestyle among modern older adults is now more diverse than it was before (e.g., diffusion of information and communication technology [ICT]). Therefore, a new list of leisure activities among modern older adults is needed.

We aimed to explore basic findings regarding leisure activities among older adults in Japan, which can contribute to development of a standardized leisure activity scale, (a) by clarifying the actual conditions of leisure activities among older adults using a data set of representative samples, and (b) by analyzing relationships between leisure activities and health outcomes (including functional capacity, social networking, subjective well-being, and health literacy).

## Method

### Participants

Individuals aged 60 to 84 years living in the community in Japan participated in this study. Using a stratified two-stage random-sampling procedure, we selected 1,200 individuals (555 men and 645 women) for participation. As a first step, we divided Japan into 28 layers according to seven regional blocks and four city scales, and then selected 50 points from the layers. As a second step, 24 individuals per point were randomly selected from municipal resident registration files to obtain 1,200 representative participants. The survey was conducted using a mail survey method between February and March 2013. We obtained a total of 849 surveys (total response proportion 70.8%). Of these, six were excluded

**Table 1.** Basic Characteristic of Participants (N = 843).

Age (years)	70.5 ± 6.9
Gender (women), n (%)	454 (53.8)
Living alone, n (%)	110 (13.0)
Self-rated health (poor), n (%)	169 (20.0)
Functional capacity (points) <sup>a</sup>	11.5 ± 2.4
Subjective well-being (points) <sup>b</sup>	15.5 ± 5.5
Employment (no), n (%)	535 (63.4)
Subjective economic status (poor), n (%)	220 (26.1)
Education (compulsory), n (%)	171 (20.3)
Stroke, n (%)	65 (7.7)
Heart disease, n (%)	100 (11.8)
Diabetes mellitus, n (%)	101 (11.9)
Cancer, n (%)	97 (11.5)
Ability to travel (unable by oneself), n (%)	39 (4.6)

<sup>a</sup>Measured by the Tokyo Metropolitan Institute of Gerontology Index of Competence.

<sup>b</sup>Measured by the Japanese version of the World Health Organization-Five Well-Being Index (WHO-5-J).

because of missing leisure activity questionnaires or information about who responded to the questionnaire. Ultimately, 843 participants (valid response proportion 70.3%; 390 men and 453 women; 70.5 ± 6.9 years old) with complete responses were included. Table 1 shows the characteristics of the participants.

The study was approved by the Ethics Committee of Fukushima Medical University. The study was described to all participants, who were advised that (a) their participation would be entirely voluntary; (b) they could withdraw from the study at any time; and (c) if they chose to withdraw or to not participate, they would not be disadvantaged in any way.

### Measurements

**Leisure activity items.** In addition to the definition of leisure activity by the previous study (Verghese et al., 2006) mentioned above, we expanded the definition in this study by adding a few points: (a) how often the activity is performed annually (e.g., every day, 2 to 3 times per a week, and a few times per year); and (b) each item must include a concrete activity (in other words, simply belonging to a community, such as a club for the aged, should be excluded from our definition).

We developed leisure activity questionnaire items for older adults living in the community based on the above definition (Verghese et al., 2006) and previous reports (Jopp & Hertzog, 2010). However, as there may be cultural differences regarding leisure activity, we modified the items as follows: (a) we excluded items that are inappropriate for the Japanese culture of older adults (e.g., engaging in political activities and gambling); (b) we excluded items that are expected to have a low frequency among older Japanese adults (i.e., engaging in prayer or meditation); and (c) in addition, we excluded “Watching TV” because it is inappropriate based on the definition

of leisure activity in this study (as it is a passive activity) and is possibly associated with the development of Alzheimer's disease (Lindstrom et al., 2005).

In the next step, referring to previous studies in Japan (Nakamura & Yamada, 2009; Takeda et al., 2005; Tejima & Shimizu, 1992), we added a few activities that older Japanese adults are thought to frequently engage (e.g., calligraphy and flower arrangement) into the item pool. Finally, the chosen 58 items were blushed-up in wording. Leisure activity items used a 9-point Likert-type scale (ranging from 1 = *every day* to 9 = *never*) in this study. We defined a "yes" response as 1 (*every day*) through 8 (*less than once per year*), and a "no" response as 9 (*never*), and calculated the frequency of "yes" for each item.

**External criterion variables.** We administered the following scales to examine factors associated with leisure activity: First, as an indicator of functional capacity, we administered the Tokyo Metropolitan Institute of Gerontology Index of Competence (TMIG-IC; Koyano, Shibata, Nakazato, Haga, & Suyama, 1991), wherein participants reported whether they were independent in 13 daily tasks (e.g., using public transportation) on a dichotomous rating scale (0 = *no*, 1 = *yes*). The Cronbach's alpha was .88. Subjective well-being was measured using the Japanese version of the World Health Organization-Five Well-Being Index (WHO-5-J; Awata et al., 2007; Iwasa et al., 2014), which is a self-administered questionnaire comprising five items assessing the degree of subjective well-being during the past 2 weeks on a 6-point Likert-type scale. The Cronbach's alpha was .90. Size of social networks was measured using the Japanese version of the Lubben Social Network Scale-6 (LSNS-6; Kurimoto et al., 2011; Lubben et al., 2006), which is a self-administered questionnaire comprising six items assessing the number of persons that one contacts and seeks support from. The Cronbach's alpha was .88. Health literacy was measured using the Health Literacy Scale (HLS; Ishikawa & Kiuchi, 2010; Ishikawa, Takeuchi, & Yano, 2008). According to the World Health Organization (WHO), health literacy represents "the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health" (Nutbeam, 1998, p. 357). The HLS is a self-administered questionnaire comprising five items assessing the degree of health literacy on a 5-point Likert-type scale. The Cronbach's alpha was .93.

**Other measurements.** Data for age, gender, living arrangement, self-rated health, functional capacity, subjective well-being, employment status (employed/unemployed), subjective financial circumstances, education (compulsory/higher), chronic disease (stroke, heart disease, diabetes mellitus, and cancer), and basic ability to travel were included in the survey to obtain information on participants' basic characteristics. Basic

ability to travel was self-rated by participants on a scale ranging from 1 (*able to travel by oneself using public transportation, car, or bike*) to 6 (*bedbound*), and dichotomized from 1 to 2 as "able by oneself," or others (3 to 6) as "unable by oneself" (Shinkai et al., 2001).

### Data Analysis

First, basic properties of the 58 leisure activity items (yes response rate with 95% confidence intervals) were shown. To identify the inappropriate items, we calculated the following: (a) the ratio of "yes" responses and (b) gender-based differences. Items in which 80% or more of participants responded "yes" were regarded as inappropriate because they may not be able to discriminate the difference between participants who engage in leisure activities frequently and those who do not. Gender-based differences were assessed because the items would possibly be used for a leisure-time activity scale and no gender differences in each item of the scale would be better for a generic assessment tool. To examine gender-based differences in each of the items, chi-square tests were performed using phi coefficients as indicators of effect size (Cohen, 1988, 1992); in accordance with previous studies (Cohen, 1988, 1992), a medium effect size (i.e., phi coefficient  $\geq 0.30$ ) indicated that the item contained gender- or region-based differences.

Second, to identify the final scale items, we performed an exploratory factor analysis (EFA) for the ordinal scale of the items (a polychoric correlation matrix, weighted least squares method with oblimin rotation was applied) using the items chosen in the first stage of the analysis. The number of factors extracted was decided by referring to the results of a parallel analysis (Reise, Waller, & Comrey, 2000). In addition, a confirmatory factor analysis (CFA) for the ordinal scale of the items was performed with a polychoric correlation matrix and the weighted least squares estimation method. The indexes of model fit used were the comparative fit index (CFI) and root mean square error approximation (RMSEA; Byrne, 2009).

Finally, to examine the concurrent validity of the leisure activity items, we calculated the Pearson correlation coefficients between summary scores of the leisure activities and all external criterion variables. All probability values were two-tailed. We used IBM SPSS version 22 (IBM Corp., Armonk, NY), R version 3.2.2 (The R Foundation for Statistical Computing, Vienna, Austria), and Mplus version 7 (Muthén & Muthén, 1998-2017) for the analyses.

### Results

Table 2 shows the basic properties of the 58 leisure activities items (yes response rates with 95% confidence intervals).

Using the following analyses, seven out of the 58 potential items were considered inappropriate (Table 2).

**Table 2.** Basic Properties of the 58 Potential Items of Leisure Activity (N = 843).

No.	Items	Yes response (%)	95% confidence intervals	Gender difference (phi)
1	Flexibility (stretching, yoga, tai chi)	29.4	[26.3, 32.5]	0.10
2	Weight lift, strength, calisthenics	28.9	[25.9, 32.0]	-0.03
3	Aerobics (cardio, fitness, workout)	18.9	[16.2, 21.5]	0.05
4	Go for walks	75.8	[72.9, 78.7]	0.03
5	Japanese croquet (ground golf)	9.0	[7.1, 10.9]	-0.08
6	Outdoor (sail, fish, backpack)	22.8	[19.9, 25.6]	-0.10
7	Exercise (jog, bike, swim)	31.4	[28.3, 34.6]	-0.05
8	Recreational (tennis, bowling, golf)	12.8	[10.6, 15.1]	-0.22
9	Do woodwork/carpentry	28.0	[25.0, 31.0]	-0.49 <sup>b</sup>
10	Crop work (work on a farm)	33.8	[30.6, 37.0]	-0.06
11	Gardening	60.7	[57.4, 64.0]	0.15
12	Breed an animal	24.9	[22.0, 27.8]	0.01
13	Play mah-jongg	5.0	[3.5, 6.5]	-0.12
14	Do crossword puzzles	24.9	[22.0, 27.8]	0.17
15	Play go and shogi	7.1	[5.4, 8.9]	-0.26
16	Do sudoku	14.9	[12.5, 17.4]	0.11
17	Play video game	8.8	[6.9, 10.7]	-0.04
18	Listen a radio	59.5	[56.2, 62.9]	-0.13
19	Go out with friends	69.2	[66.0, 72.3]	0.24
20	Visit friends or relatives	76.6	[73.8, 79.5]	0.10
21	Chatting with friend	83.2 <sup>a</sup>	[80.6, 85.7]	0.21
22	Give dinner for friends	73.1	[70.1, 76.1]	0.19
23	Eat out at restaurant	85.2 <sup>a</sup>	[82.8, 87.6]	0.08
24	Go Karaoke	26.8	[23.8, 29.8]	-0.10
25	Shopping except housework	85.2 <sup>a</sup>	[82.8, 87.6]	0.08
26	Visiting a neighboring spa	52.3	[48.9, 55.7]	0.01
27	Attend club meetings	23.4	[20.5, 26.2]	0.02
28	Attend organized social events	44.5	[41.1, 47.8]	0.08
29	Volunteer	24.2	[21.3, 27.1]	-0.09
30	Participate a neighborhood association	53.3	[49.9, 56.6]	0.01
31	Participate elderly club activity	20.2	[17.5, 22.9]	0.03
32	Attend church service	8.5	[6.7, 10.4]	0.05
33	Visit a temple or shrine	75.0	[72.0, 77.9]	0.02
34	Domestic travel	62.9	[59.6, 66.1]	0.08
35	Travel abroad	13.8	[11.4, 16.1]	0.03
36	Collection	7.4	[5.6, 9.1]	-0.04
37	Read for leisure	68.2	[65.1, 71.4]	0.10
38	Read newspaper	90.4 <sup>a</sup>	[88.4, 92.4]	-0.03
39	Write letters	51.2	[47.9, 54.6]	0.13
40	Calligraphy	10.8	[8.7, 12.9]	0.09
41	Tea ceremony	4.4	[3.0, 5.8]	0.11
42	The art of flower arrangement.	19.0	[16.3, 21.6]	0.41 <sup>b</sup>
43	Haiku (Japanese poem)	5.9	[4.3, 7.5]	0.10
44	Japanese dance	7.0	[5.3, 8.7]	0.16
45	Sewing, knitting, needlework	25.0	[22.1, 28.0]	0.49 <sup>b</sup>
46	Cooking except housework	36.7	[33.4, 39.9]	0.11
47	Attend public lecture	38.9	[35.6, 42.2]	-0.01
48	Painting	11.5	[9.4, 13.7]	0.02
49	Ceramic art	4.2	[2.8, 5.5]	0.04
50	Go to library	27.3	[24.3, 30.3]	-0.01
51	Study foreign language	6.4	[4.8, 8.1]	-0.05
52	Attend movies	34.6	[31.4, 37.9]	0.05
53	Attend music appreciation	41.2	[37.8, 44.5]	0.05
54	Engage in photography	37.7	[34.5, 41.0]	-0.13
55	Play an instrument	8.3	[6.4, 10.2]	-0.01
56	Use Internet	28.1	[25.1, 31.1]	-0.13
57	Use a computer	33.8	[30.6, 37.0]	-0.17
58	Use an email	46.1	[42.8, 49.5]	0.02

Note. Gender: 1 = men, 2 = women.

<sup>a</sup>Eliminated due to a very high ( $\geq 80\%$ ) ratio of "yes" responses.

<sup>b</sup>Eliminated for gender-based differences ( $\phi > 0.3$ ).



Four items were regarded as inappropriate because 80% or more of participants responded “yes” to them. These included Items 38 “read newspaper” (90.4%), 21 “chatting with friends” (83.2%), 23 “eat out at a restaurant” (85.2%), and 25 “shopping except housework” (85.2%). In addition, gender-based differences were found for Items 9 “do woodwork/carpentry” (51.5% of “yes” responses from men and 7.7% from women;  $\phi = 0.49$ ), 42 “the art of flower arrangement” (1.5% of “yes” responses from men and 33.9% from women;  $\phi = 0.41$ ), and 45 “sewing, knitting, needlework” (2.1% of “yes” responses from men and 44.8% from women;  $\phi = 0.49$ ); thus, these items were considered inadequate and were excluded.

We used the remaining 51 items and conducted an EFA, which resulted in an 11-factor solution when referring to the results of parallel analysis (Table 3). In addition, eight items that did not belong to any factors (factor loadings were no more than 0.3) were excluded (i.e., Items 4 “go for walks,” 6 “outdoor,” 18 “listen to the radio,” 24 “go to karaoke,” 32 “attend a church service,” 46 “cooking except housework,” 52 “attend movies,” and 53 “attend music appreciation”) and we conducted an EFA again. The second round of EFA resulted in an 11-factor solution. Items that had factor loadings of 0.4 or higher were included in the relevant factor.

Factor 1 contained three items and was labeled “physical activity.” Factor 2 contained six items and was labeled “social-public.” Factor 3 contained two items and was labeled “raising plants.” Factor 4 contained two items and was labeled “intellectual games (do puzzles).” Factor 5 contained three items and was labeled “social-private.” Factor 6 contained two items and was labeled “competitive games.” Factor 7 contained six items and was labeled “technology use.” Factor 8 contained three items and was labeled “travel.” Factor 9 contained three items and was labeled “creative activity.” Factor 10 contained four items and was labeled “developmental activity.” Factor 11 contained four items and was labeled “cultural activity” (Table 3).

We then subjected the 43 items chosen through the above method to CFA to examine the fit of the 11-factor structure to the data. The results of the analysis indicated that the hypothesized 11-factor model had acceptable model fit indices (Byrne, 2009),  $\chi^2(800) = 1,778.15$ ,  $p < .01$ , CFI = 0.966, RMSEA = 0.038.

Table 4 shows the results of the correlational analysis between summary scores of leisure activity and the external criterion variables. Medium levels of correlation (correlation coefficients  $>0.25$ ) are shown below. Significant correlations were found between Factor 2 (social-public) leisure activity scores and functional capacity ( $r = .25$ ), subjective well-being ( $r = .25$ ), and social network ( $r = .33$ ). Significant correlations were found between Factor 5 (social-private) leisure activity scores and functional capacity ( $r = .41$ ), subjective well-being ( $r = .29$ ), social network ( $r = .50$ ), and health literacy ( $r = .29$ ). Significant correlations were found between Factor 7 (technology use) leisure activity scores

and functional capacity ( $r = .27$ ), and health literacy ( $r = .43$ ). Significant correlations were found between Factor 8 (travel) leisure activity scores and functional capacity ( $r = .29$ ), social network ( $r = .27$ ), and health literacy ( $r = .28$ ). Significant correlations were found between Factor 10 (developmental activity) leisure activity scores and functional capacity ( $r = .37$ ), subjective well-being ( $r = .25$ ), social networking ( $r = .26$ ), and health literacy ( $r = .36$ ).

## Discussion

Out of the 11 factors identified as a result of factor analyses, seven factors of physical activity (Factor 1), social-public (Factor 2), social-private (Factor 5), technology use (Factor 7), travel (Factor 8), developmental activity (Factor 10), and cultural activity (Factor 11) were similar to the results of a previous study (Jopp & Hertzog, 2010). This suggests that there are similar aspects when it comes to leisure activities to some extent, even though there are thought to be cultural differences. On the contrary, four factors (raising plants [Factor 3], intellectual games [Factor 4], competitive games [Factor 6], and creative activity [Factor 9]) occurred as unique components in this study. Raising plants, which includes gardening, is one of the most favored activities among middle-aged and older adults in Japan (Japan Productive Center, 2013). Intellectual games, which include “do Sudoku” (Item 16) and “do crossword puzzles” (Item 14) are activities that people can easily enjoy mainly as solitary and low-budget activities. Competitive games, which include “play mahjong” (Item 13) and “play go and *shogi*” (Item 15), are traditionally favored by older Japanese people (Japan Productive Center, 2013). “Recreational sports (tennis, bowling, golf)” (Item 8), which include competitive and enjoyable activities with multiple players, was also related to this factor, even though with a relatively lower coefficient (0.33). Creative activity mainly relates to Japanese fine art (i.e., “ceramic art” [Item 49], “tea ceremony” [Item 41], and “painting” [Item 48]). In addition, despite a low loading (0.30), “collection” (Item 36) was also associated with this factor, because most participants may have responded with the intention of answering that they ever collect paintings or pottery.

Correlation analyses were conducted to explore the association between the 11 factors of leisure activity and external criterion variables, and the findings are shown below. Social activities (including social-public [Factor 2] and social-private [Factor 5]) are essential for various health domains (i.e., functional capacity, subjective well-being, social networking, and health literacy). This finding is consistent with a previous study that reported a significant relationship between social networking and functional capacity among older adults (Tomioka, Kurumatani, & Hosoi, 2016a). In addition, among social activities, the social-private (Factor 5) items (i.e., relations with friends and family) had a relatively stronger relationship with health issues than did the social-public items (Factor 2).

**Table 3.** Factor Loadings in Exploratory Factor Analysis Using Weighted Least Square Method With Oblimin Rotation of Leisure Activity Items (N = 843).

No.	Item	Physical	Social- public	Raising plants	Intellectual game	Social- private	Competitive game	Technology use	Travel	Creative	Developmental	Cultural
3	Aerobics (cardio, fitness, workout)	<b>0.88</b>										
2	Weight lift, strength, calisthenics	<b>0.77</b>										
1	Flexibility (stretching, yoga, tai chi)	<b>0.73</b>										
7	Exercise (jog, bike, swim)	0.31										
31	Participate elderly club activity		<b>0.85</b>									
5	Japanese croquet (ground golf)		<b>0.82</b>									
30	Participate a neighborhood association		<b>0.60</b>									
29	Volunteer		<b>0.49</b>								0.33	
27	Attend club meetings		<b>0.48</b>									0.33
28	Attend organized social events		<b>0.40</b>									
11	Gardening			<b>0.85</b>								
10	Crop work			<b>0.58</b>								
12	Breed an animal			0.33								
16	Do sudoku				<b>0.99</b>							
14	Do crossword puzzles				<b>0.68</b>							
19	Go out with friends					<b>0.85</b>						
22	Give dinner for friends					<b>0.83</b>						
20	Visit friends or relatives					<b>0.50</b>						
13	Play mah-jongg						<b>0.59</b>					
15	Play go and shogi						<b>0.49</b>					
8	Recreational (tennis, bowling, golf)						0.33					
56	Use Internet							<b>0.97</b>				
57	Use a computer							<b>0.94</b>				
58	Use an email							<b>0.56</b>				
17	Play video game							<b>0.48</b>				
54	Engage in photography							<b>0.44</b>				
55	Play an instrument							<b>0.40</b>				
34	Domestic travel								<b>0.60</b>			

(continued)

**Table 3. (continued)**

No.	Item	Physical	Social- public	Raising plants	Intellectual game	Social- private	Competitive game	Technology use	Travel	Creative	Developmental	Cultural
35	Travel abroad							<b>0.50</b>				
26	Visiting a neighboring spa							<b>0.50</b>				
33	Visit a temple or shrine							0.31				
49	Ceramic art								<b>0.87</b>			
41	Tea ceremony								<b>0.55</b>			
48	Painting								<b>0.47</b>			
36	Collection								0.30			
37	Read for leisure									<b>0.64</b>		
50	Go to library									<b>0.62</b>		
39	Write letters									<b>0.40</b>		
47	Attend public lecture		0.33							<b>0.40</b>		
43	Haiku (Japanese poem)											<b>0.53</b>
51	Study foreign language							0.36				<b>0.49</b>
40	Calligraphy											<b>0.44</b>
44	Japanese dance					0.32						<b>0.40</b>

Note. Out of the 51 items, eight items that did not belong to any factors (factor loadings were no more than 0.3) were excluded (e.g., Items 4 "go for walks," 6 "outdoor," 18 "listen to the radio," 24 "go to karaoke," 32 "attend a church service," 46 "cooking except housework," 52 "attend movie," and 53 "attend music appreciation"), after which, factor analysis was conducted again. Boldfaced values indicate that items that had factor loadings of 0.4 or higher were included in the relevant factor.

**Table 4.** Correlation Analysis Between 11-Factor Leisure Activity and Health Outcomes (N = 843).

No.	Factor name	Functional capacity	Subjective well-being	Social network	Health literacy
F1	Physical	.17**	.17**	.14**	.23**
F2	Social-public	.25**	.25**	.33**	.22**
F3	Raising plants	.21**	.19**	.24**	.14**
F4	Intellectual game	.17**	.08*	.14**	.14**
F5	Social-private	.41**	.30**	.50**	.29**
F6	Competitive game	.04	.07	.04	.14**
F7	Technology use	.27**	.20**	.18**	.43**
F8	Travel	.29**	.23**	.27**	.28**
F9	Creative	.07*	.06	.03	.11**
F10	Developmental	.37**	.25**	.26**	.36**
F11	Cultural	.11**	.15**	.14**	.18**

Note. Pearson correlation coefficients are stated in the table.

\* $p < .05$ . \*\* $p < .01$ .

Our findings show that individuals who engage in social activities were more likely to have good mental health states, which coincides with a previous finding (Zhang et al., 2017), and that engaging in social activities (public/private) had a significant relationship with social network size, suggesting that individuals who have a disposition to engage in social activities would be likely to have wider relationships with others in their community (Costa & McCrae, 1988). Our findings also show that engaging in social activities had a significant association with level of health literacy. During interactions, while engaging in social activities, people sometimes obtain health information and may provide such information to others (Ishikawa & Kiuchi, 2010). Therefore, those who engage in social activities may be more likely to have higher levels of health literacy.

Technology use (Factor 7) is closely associated with health issues (i.e., functional capacity and health literacy). Our findings show that using new technology (mainly ICT) had a significant association with level of functional capacity (Koyano et al., 1991). Currently, as the life circumstances of older individuals are significantly changing with regard to the urgent diffusion of ICT, older adults also need to use ICT for energetic living. Our findings show that using new technology had an association with level of health literacy. As obtaining health information in modern society relies mostly on ICT usage (Norman, 2011), those who use ICT frequently in daily life would be likely to have higher levels of health literacy.

Travel (Factor 8) is essential for various health domains (including functional capacity, social networking, and health literacy). Our findings show that individuals who engage in travel as a leisure activity were more likely to maintain functional capacity. Travel is a leisure activity that requires multifaceted functioning (i.e., physical fitness and cognitive function). For instance, because travel includes transfers for relatively long trips by train, bus, airplane, and walking, people who travel need some level of physical fitness to bear the burden during the trip. In addition, to plan for and

carry out a journey, those who travel need cognitive functioning at a higher level (e.g., executive function and memory). Physical fitness (Makizako et al., 2010) and cognitive function (Iwasa et al., 2008) are reportedly two major correlates of functional capacity among the elderly. Our findings show that engaging in travel as a leisure activity was associated with social networking. Regardless of whether one travels alone or with company, travel can increase and strengthen social ties, through experiences and social interactions during the journey. In addition, while traveling with an acquaintance, the journey itself includes social interaction processes and can strengthen friendships. Our findings show that travel as a leisure activity was associated with level of health literacy. Based on the relationship between travel and health literacy, we have a speculative interpretation for the finding. As stated above, older adults who travel for leisure would be likely to maintain functional capacity and widen their social network. Those individuals may be highly motivated to obtain and transmit health information.

Developmental activity (Factor 10) is related closely to various health domains (including functional capacity, subjective well-being, social networking, and health literacy). Our study found that development activity was related to functional capacity. Continuously engaging in development activity may help maintain and improve cognitive function, which is a strong predictor for functional capacity. Out of functional capacity, "Intellectual activity" ( $r = .42$ , data not shown in the "Results" section; Koyano et al., 1991), which is especially related to cognitive function (Iwasa et al., 2003), would be sensitive to such development activity. Our study found that older adults who engage in development activity had higher levels of subjective well-being. A relationship between cognitive function and subjective well-being has been reported (Llewellyn, Lang, Langa, & Huppert, 2008). Our findings, like previous findings, suggest that a spirit of intellectual enquiry and an intellectually active lifestyle may help maintain and improve subjective well-being among older adults, via preserving cognitive



function (Bures, Cech, Mikulecka, Ponce, & Kuca, 2016). We found that engaging in development activity had an association with social networking. As development activity includes group activities that involve many people and solitary activities, those who engage in development activity may be proactive about social interaction. Our finding confirmed that there was a relationship between development activity and health literacy. Those who engage in development activity may be likely to increase their knowledge of health information and strengthen their ability to check and make practical use of health information (Ishikawa & Kiuchi, 2010).

The study confirmed that some leisure activities had significant relationships to health outcomes. In addition, our findings could be used as part of an assessment tool for “cognitive reserve” (Opdebeeck, Martyr, & Clare, 2016) among older adults. Recent postmortem brain anatomical studies have reported a dissociation between brain lesions and symptoms of Alzheimer’s disease. Price and colleagues (2009) investigated 97 postmortem brains with no symptoms of dementia; 40% of the brains met the neuropathological criteria of Alzheimer’s disease. Traditional studies (“Nun study”; Snowdon, 2001; Snowdon et al., 1997) similarly showed that individuals with cognitively active lifestyles were less likely to experience neurocognitive symptoms even if they had a neuropathological brain. These findings suggest that there are some individual differences in resistance to dementia incidence, which are associated with long-term lifestyles. Previous studies have reported protective factors including educational attainment, work experiences, intelligence, and lifestyles (including leisure activities), referring to cognitive reserve (Wang et al., 2012). Recent studies have started to develop multiphase assessment tools, including the Cognitive Reserve Index Questionnaire (Nucci, Mapelli, & Mondini, 2012) and the Cognitive Reserve Scale (Leon, Garcia-Garcia, & Roldan-Tapia, 2014), for measuring cognitive reserve. In future research, the present findings should be applied to the development of a measurement tool for assessing cognitive reserve.

This study has two limitations. First, the sample’s representativeness is restricted, given that the participation rate at baseline was 70.7%. Therefore, our participants might differ from nonparticipants in terms of health characteristics (Iwasa et al., 2007). Second, this study only examined the cross-sectional relationship between leisure activity and health outcomes. Therefore, causality cannot be confirmed because of limitations in the study methodology. Future studies should examine the predictive validity of the leisure activity list (e.g., prediction of cognitive decline).

### Authors’ Contributions

HI and YY engaged in study conceptualization, data collection, data analysis, interpretation of results, and had primary responsibility for writing this paper. All the authors read and approved the final manuscript.

### Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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