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Original Article

The Association between Social Relationships and Decline in Instrumental Activities of Daily Living among Japanese Community-Dwelling Older People

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SUMMARY

Background: Social relationships might be a key factor for preventing the decline of instrumental activities of daily living (IADL). In the current study, we examined the association between social relationships and IADL decline, and how this association differed by age.
Methods: The study employed a prospective cohort design by introducing complete sampling. Questionnaires were distributed in 2011 and 2017 to all residents over 65 years old living in a suburban area of central Japan. Analysis included 501 residents who were independent in IADL in 2011 and who participated after 6 years without missing data. Social relationships were evaluated by the Index of Social Interaction, and IADL were measured by the Tokyo Metropolitan Institute of Gerontology Index of Competence. Multiple logistic regression analysis was used to examine the association between social relationships and IADL. An age-stratified analysis was also conducted.
Results: One hundred three participants showed IADL decline after 6 years. Age (OR = 1.18) and social relationships (OR = 0.79) were significantly associated with IADL decline. In the age-stratified analysis, age (OR = 1.21) and having a musculoskeletal disease (OR = 5.09) were significantly associated with IADL decline among individuals 65–74 years old. Among individuals 75 years old or older, age (OR = 1.31) and social relationships (OR = 0.58) were significantly associated with IADL decline.
Conclusion: Social relationships might prevent IADL decline in older people. Furthermore, their effects might differ by age group. Promoting social relationships considering ageis important for prevention of IADL decline.

1. Introduction

As societal aging is accelerating worldwide, Japan has the largest aging population in the world. In 2025, over 30% of the population is expected to be older people, and the proportion of individuals over 75 years old is expected to increase rapidly in the meantime.[1] Accordingly, maintaining older people's instrumental activities of daily living (IADL), which are to living independently in their community, is becoming more important. IADL decline is associated with decreased quality of life,[2] the need for long-term care,[3] and the occurrence of dementia in older persons.[4] Thus, maintaining IADL is essential for older people.

Previous research has reported comprehensive factors related to IADL decline such as hospitalization, heart disease, mental health status, physical function, and physical activity.[5,6] Social relationships have also received attention in preventing the need for care in recent years.[7] Social relationships can be defined as the interaction between individuals and their social environment. Cohen[8] suggested that social relationships are a major contributor to human health. Previous studies have shown that poor social relationships are associated with depression,[9] mortality,[10] and the occurrence of dementia.[11] Furthermore, the studies conducted in Japan have shown that social capital is associated with mortality.[12] Lower social participation, including participation in community club activities, were associated with IADL declines.[13,14] The lack of a social life, including fewer opportunities to take part in consultations and visit with others, was also associated with IADL declines.[5]

However, past studies focused on a relatively limited set of social relationships, and there remain few longitudinal studies on this topic in Japan. Clarifying the longitudinal effect of social relationships on IADL would add knowledge to efforts regarding preventive practice for IADL decline among older people. Furthermore, there still remains the question if are there any age differences in the effect of social relationships while few studies have addressed such age differences. Because of the physiological changes that occur with aging,[15] the effect of social relationships on IADL might be different between young-old and older adults. Examining the age differences in the effect of social relationships might bring new practical knowledge to current prevention practices, particular in identifying effective age-specific groups. Thus, the aim of this study was to determine the effect of social relationships on IADL using longitudinal data of 6 years from Japanese community-dwelling older people, and how these effects differ by age.

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2. Materials and methods

2.1. Participants

The present study used data from a community-based cohort study conducted among all residents living in a suburban area in central Japan. This cohort study began in 1991, and questionnaire surveys have been conducted every 2 to 3 years since. The study area was a metropolitan suburb with a population of around 4,397 in 2015, of which around 30.6% were 65 years old or over (nationwide: 26.6%).[16] We used data from the 2011 and 2017 surveys. The target participants were aged 65 years old or over (n = 1,209) in 2011. The inclusion criteria were (1) participated in both the 2011 and 2017 survey, (2) showed independence in IADL in 2011, and (3) did not have any missing data for the IADL measure in either 2011 or 2017. This study was approved by the ethics committee of Tsukuba University (1331). The data were anonymized and provided by the municipality via written contracts.

2.2. Methods

The study used a prospective cohort design. This study conducted a questionnaire survey by introducing a complete sampling frame aiming to avoid selection bias. Ours was a collaborative survey of researchers and government's municipality for evaluation of health policy in the municipality. The drop-off/pick-up method was utilized in the current study. Questionnaires were distributed to all residents aged over 65 years and living in the targeted area. Volunteers assigned by the municipality visited all potential participants, distributed the questionnaire, and then revisited participants to collect the completed questionnaires two weeks later. The participants answered the questionnaire themselves. In cases where the participant showed severe functional decline such as cognitive decline or amblyopia, a family member completed the questionnaire on participants' behalf. The cohort study team were also available to conducted interviews if participants wanted. The questionnaire assessed individuals' basic characteristics, medical conditions, job status, subjective economic status, lifestyle habits, IADL, and social relationships.

2.3. IADL evaluation

IADL were assessed with the IADL subscale of the Tokyo Metropolitan Institute of Gerontology Index of Competence, which was an evaluation tool to assess higher-level competence and showed high construct, discriminant and predictive validity and reliability (reliability coefficient alpha 0.91) among Japanese older people.[17] This subscale comprises 5 items, including use of public transportation, shopping, preparing meals, paying bills, and personal banking. Each item had three answer options, which were assigned 0 or 1 points. "I can and I do" and "I can but I don't" were each given 1 point, while "I can't" was given 0 points.[18] The total score ranges from 0 to 5 points.

2.4. Social relationships

Social relationships were evaluated by the Index of Social Interaction (Supplement 1), which showed high validity and reliability (Cronbach alpha 0.78) among Japanese community dwelling older adults in previous study.[19] This scale measures various social relationships, including interactions with family and others, and the frequency of participation in daily living. The scale comprises 18 items (e.g., "Do you often communicate with your family members?" "Do you communicate with non-family persons regularly?"), each rated on a 4- or 5-point scale. Participants who answered an item with "rare" were given 0 points for that item, while any other answer (e.g., "often," "sometimes") was coded as 1 point. The total score ranged from 0 to 18 points.

2.5. Covariates

The basic characteristics, which included medical conditions, job status, and subjective economic status, were obtained from a survey on daily life needs.[18] The medical conditions items evaluated the presence of 17 diseases (e.g., hypertension, diabetes, heart disease, stroke, musculoskeletal disease). Subjective economic status was evaluated using a 4-point scale: "have leeway," "have a little leeway," "a little hard up," and "hard up." Individuals were classified as having a "good" economic status if they answered "have leeway" or "have a little leeway," while they were classified as having "poor" economic status if they answered "a little hard up," and "hard up." The lifestyle habits were smoking, drinking behavior, and daily physical exercise. Individuals were classified as "smoking" if they were current smokers and as "not smoking" if they gave another answer. Drinking behavior was dichotomized into "every day" and "other." Finally, for daily physical exercise, participants were classified as "yes" if they answered "always" or "often," and "no" if they answered "rare."

2.6. Analysis

The independent variables were age, social relationships, medical conditions, job status, subjective economic status, and lifestyle habits (smoking, drinking behavior, and physical exercise) at baseline. The dependent variable was whether participants showed an IADL decline after 6 years. Participants who maintained independence in 2017 were classified as the "IADL steady" group, and those who showed a decline to 4 or fewer points were classified as the "IADL decline" group.

We examined the association between the independent variables at baseline and IADL decline after 6 years. Chi-square tests, Fisher's exact tests, and the Mann-Whitney U test were used for the bivariate analysis. Next, multiple logistic regression analysis was used. Age, sex, and all variables significantly associated with IADL decline in the bivariate analysis were entered into the model using the simultaneous forced entry method. Furthermore, considering the possible difference in effects by age,[20] an age-stratified analysis was conducted (65–74 years old vs. 75 years old or older). SAS 9.4 was used for all data analysis. The significance level (alpha) was set as 0.05.

3. Result

Of the 1,083 participants who completed the survey in the baseline year (2011), 194 were excluded because they were not independent in their IADL at baseline; thus, 708 were followed up after 6 years. At the follow-up assessment, 568 individuals completed the follow-up survey (92 died during the follow-up period), of which 501 without missing data for IADL were included in the analysis (Figure 1). One hundred three participants (20.6%) showed a decline in IADL after 6 years. The mean age of these participants was 72.4 years (SD = 5.81), and 292 of the participants were female (58.3%). Their mean (SD) social relationship score was 16.6 (1.75) (Table 1).

The bivariate analysis revealed that age, social relationships,

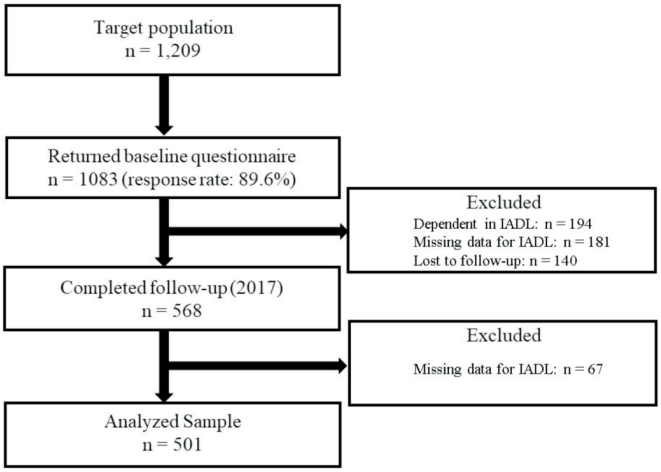

Figure 1. Flow chart of enrollment of study participants.

having a musculoskeletal disease, having an ear disease, job status, and daily physical exercise were significantly associated with IADL declines after 6 years (Tables 2 and 3). When entering these variables into the multivariate analysis (along with sex), we found that age (odds ratio [OR] = 1.18, 95% CI: 1.12–1.26) and social relationships (OR = 0.79, 95% CI: 0.66–0.93) were significantly associated with IADL decline after 6 years (Table 4).

The age-stratified analysis revealed different results by age. First, in the 65–74 years old group, age (OR = 1.21, 95% CI: 1.02–1.42) and having a musculoskeletal disease (OR = 5.09, 95% CI: 1.37–19.00) were significantly associated with IADL decline. By contrast, in the 75 years old or older group, age (OR = 1.31, 95% CI: 1.13–1.52) and social relationships (OR = 0.58, 95% CI: 0.42–0.80) were significantly associated with IADL decline (Table 4).

4. Discussion

We examined the association between social relationships and IADL decline among community-dwelling older people. We found that age and social relationships were significantly associated with IADL decline in the whole sample. Remarkably, social relationships were significantly related to IADL decline only in the 75 years old or older group in the age-stratified analysis. In the 65–74 years old group, having a musculoskeletal disease was associated with IADL decline instead.

We enrolled all residents living in a suburban community in Japan; thus, our results are highly generalizable. Further, most previous studies conducted in Japan among community-dwelling older adults only focused on a few aspects of social relationships (e.g., community club activities).[13] Moreover, few conducted a longitudinal analysis focusing on the relationship between broad social

Table 1
Participants' basic characteristics (n = 501).

Variables	
Age (Mean ± SD)	72.4 ± 5.81
Sex	
Male	209 (41.7)
Female	292 (58.3)
Economic status	
Low	251 (53.4)
High	219 (46.6)
Job status	
Having	250 (51.9)
None	232 (48.1)
Smoking	
Smoking	50 (10.6)
Non smoking	420 (89.4)
Drinking	
Every day	95 (19.6)
Other	391 (80.4)
Physical exercise	
High	300 (66.8)
Low	149 (33.2)
Social relationship (Mean ± SD)	16.6 ± 1.75

n (%).
Missing data in economic status: n = 31; job status: n = 19; smoking: n = 31; drinking: n = 15; physical exercise: n = 52; social relationships :n = 139.

Table 2
The association between basic characteristics and IADL after 6 years in the bivariate analysis.

	Total			65–74			≥ 75		
	IADL steady	IADL decline	*p*	IADL steady	IADL decline	*p*	IADL steady	IADL decline	*p*
Age (Mean ± SD)	71.2 ± 4.96	77.0 ± 6.54	< 0.01	68.7 ± 2.79	69.7 ± 2.41)	0.04	77.9 ± 2.93	80.7 ± 4.48	< 0.01
Sex			0.82			0.19			0.84
Male	165 (41.5)	44 (42.7)		124 (42.6)	19 (54.3)		41 (38.3)	25 (36.8)	
Female	233 (58.5)	59 (57.3)		167 (57.4)	16 (45.7)		66 (61.7)	43 (63.2)	
Economic status			0.61			0.87			0.94
Low	203 (54.0)	48 (51.1)		156 (56.5)	18 (58.1)		47 (47.0)	30 (47.6)	
High	173 (46.0)	46 (48.9)		120 (43.5)	13 (41.9)		53 (53.0)	33 (52.4)	
Job status			0.01			0.74			0.15
Having	210 (54.8)	40 (40.4)		166 (58.9)	19 (55.9)		44 (43.6)	21 (32.3)	
Not having	173 (45.2)	59 (59.6)		116 (41.1)	15 (44.1)		57 (56.4)	44 (67.7)	
Smoking			0.48			0.23			0.61
Smoking	38 (10.1)	12 (12.6)		31 (11.1)	6 (18.2)		7 (7.4)	6 (9.7)	
Non-smoking	337 (89.9)	83 (87.4)		249 (88.9)	27 (81.8)		88 (92.6)	56 (90.3)	
Drinking			0.83			0.85			0.75
Every day	76 (19.7)	19 (18.8)		61 (21.5)	8 (22.9)		15 (14.9)	11 (16.7)	
Other	309 (80.3)	82 (81.2)		223 (78.5)	27 (77.1)		86 (85.1)	55 (83.3)	
Physical exercise			0.04			0.03			0.39
High	248 (69.1)	52 (57.8)		188 (69.1)	16 (50.0)		60 (69.0)	36 (62.1)	
Low	111 (30.9)	38 (42.2)		84 (30.9)	16 (50.0)		27 (31.0)	22 (37.9)	
Social relationship (Mean ± SD)	16.8 ± 1.67	16.0 ± 1.94)	< 0.01	16.7 ± 1.79	16.3 ± 1.88	0.20	16.9 ± 1.23	15.7 ± 1.97	< 0.01

n(%).
IADL = instrumental activities of daily living.

Table 3
The association between medical conditions and IADL after 6 years in the bivariate analysis.

	Total			65–74			≥ 75		
	IADL steady	IADL decline	*p*	IADL steady	IADL decline	*p*	IADL steady	IADL decline	*p*
Hypertension	167 (42.0)	45 (43.7)	0.75	110 (37.8)	11 (31.4)	0.46	57 (53.3)	34 (50.0)	0.67
Stroke	13 (3.3)	4 (3.9)	0.76	8 (2.7)	1 (2.9)	1.00	5 (4.7)	3 (4.4)	1.00
Heart disease	27 (6.8)	8 (7.8)	0.73	19 (6.5)	1 (2.9)	0.71	8 (7.5)	7 (10.3)	0.52
Diabetes	49 (12.3)	10 (9.7)	0.47	32 (11.0)	4 (11.4)	1.00	17 (15.9)	6 (8.8)	0.18
Hyperlipidemia	36 (9.0)	8 (7.8)	0.68	31 (10.7)	4 (11.4)	0.78	5 (4.7)	4 (5.9)	0.74
Respiratory disease	15 (3.8)	6 (5.8)	0.35	11 (3.8)	2 (5.7)	0.64	4 (3.7)	4 (5.9)	0.71
Internal disease	24 (6.0)	5 (4.9)	0.65	17 (5.8)	2 (5.7)	1.00	7 (6.5)	3 (4.4)	0.74
Kidneyor prostate disease	21 (5.3)	6 (5.8)	0.83	11 (3.8)	1 (2.9)	1.00	10 (9.3)	5 (7.4)	0.65
Musculoskeletal disease	30 (7.5)	16 (15.5)	0.01	14 (4.8)	7 (20.0)	< 0.01	16 (15.0)	9 (13.2)	0.75
External injury	8 (2.0)	2 (1.9)	0.96	5 (1.7)	1 (2.9)	0.50	3 (2.8)	1 (1.5)	1.00
Cancer	8 (2.0)	1 (1.0)	0.69	8 (2.7)	1 (2.9)	1.00	0 (0.0)	0 (0.0)	†
Blood, immune diseases	8 (2.0)	1 (1.0)	0.69	6 (2.1)	0 (0.0)	†	2 (1.9)	1 (1.5)	1.00
Depression	0 (0.0)	2 (1.9)	†	0 (0.0)	1 (2.9)	†	0 (0.0)	1 (1.5)	†
Dementia	0 (0.0)	2 (1.9)	†	0 (0.0)	1 (2.9)	†	0 (0.0)	1 (1.5)	†
Parkinson's disease	1 (0.3)	0 (0.0)	†	1 (0.3)	0 (0.0)	†	0 (0.0)	0 (0.0)	†
Eye disease	63 (15.8)	17 (16.5)	0.87	44 (15.1)	4 (11.4)	0.56	19 (17.8)	13 (19.1)	0.82
Ear disease	16 (4.0)	12 (11.7)	< 0.01	10 (3.4)	3 (8.6)	0.15	6 (5.6)	9 (13.2)	0.08

n (%).
† Not available.

Table 4
Multivariate logistic regression analysis of factors associated with IADL decline after 6 years.

Variables	Total (n = 342)			65–74 (n = 246)			≥ 75 (n = 109)		
	OR	95% CI	*p*	OR	95% CI	*p*	OR	95% CI	*p*
Age	1.18	1.12–1.26	< 0.01	1.21	1.02–1.42	0.02	1.31	1.13–1.52	< 0.01
Sex	1.36	0.71–2.62	0.35	2.33	0.95–5.73	0.07	1.66	0.62–4.46	0.32
Job status	1.15	0.60–2.23	0.67		-				
Physical exercise	0.79	0.40–1.55	0.50	0.66	0.26–1.69	0.38			
Musculoskeletal disease	1.76	0.71–4.35	0.22	5.09	1.37–19.00	0.02			
Ear disease	2.76	0.88–8.67	0.08		-				
Social relationships	0.79	0.66–0.93	< 0.01	0.89	0.73–1.08	0.24	0.58	0.42–0.80	< 0.01

Reference variables are as follows: Age, continuous; Sex, female; Job status, not having; Physical exercise, low; Disease, None; Social relationships, continuous.

relationships in daily settings and IADL in Japan. Our study suggested that promoting a broad set of social relationships in daily life might be essential for prolonged maintenance of individuals' IADL. Furthermore, we found that the effect of social relationships on IADL decline might differ by age group. These results inform that maintaining and facilitating social relationships might be a suitable strategy for those aged 75 years or older. Additionally, the early screening or control of diseases might be essential for those aged younger than 75 years for preventive care in cases of IADL decline. Our study emphasizes the importance of age-specific care in preventing functional decline and the need for long-term care; further, it contributes to current practice including the consideration of effective target populations for future intervention.

This study showed that poor social relationships were associated with IADL decline 6 years later. This resultis consistent with those of previous studies, such as that social capital (including friendship) was associated with mortality[12] and that poor social participation (e.g., club activity participation) was related to IADL decline.[13,14] There are several possible reasons that social relationships influence IADL. According to previous studies, enrichment of social relationships can improve performance of daily physical activities and might contribute to maintenance of physical function.[21] In addition, poor-quality social relationships are related to future onset of cognitive decline.[22,23] Because both physical and cognitive function are linked to IADL, it follows that social relationships would be linked to IADL as well. Another possible reason is that social relationships make it easy for individuals to get information and advice about health, which might influence their health maintenance behavior.[7]

The age-stratified analysis in this study revealed that social relationships were associated with IADL decline only among individuals 75 years old or older. Among individuals 65–74 years old, musculoskeletal disease was significantly associated with IADL decline instead. Tomioka et al.[20] similarly found that the effect of poor social participation on IADL decline was larger among individuals 75 years old or older than among those 65–74 years old. Medical conditions might have a larger effect than social environmental factors on young-old adults. For instance, a previous study reported that physical function was a strong longitudinal predictor of activities of daily living among young-old adults.[24] Thus, the effect of social relationships might increase as an individual's age increases. Considering these findings, it may be necessary to conduct early screening and control of diseases among individuals younger than 75 years old to prevent IADL decline. On the other hand, among those 75 years old or older, maintaining and facilitating social relationships might be a more suitable strategy.

This study has several limitations. First, this study was conducted in only one suburban area of Japan. Although all residents were invited to participate, examining whether the results hold when multiple areas are included would enhance the generalizability of the results. Second, the IADL measure used in the current study has sufficient validity[17] and has been used in many research projects and practices throughout Japan. However, the results might have been influenced by reporting bias because the measurement relies on

participants' subjective reports. Further, since IADL was evaluated at two points, our data lacks a multi-point measurement, which could decrease the accuracy of our estimate. Third, covariate evaluations were subjective, dichotomized, and not introduced as specific scales in the current study, which might reduce the power and accuracy of the results. Furthermore, there may be other potential factors which may related to IADL decline. Further investigations should be done to address these limitations in the future.

5. Conclusion

This study found that social relationships are associated with IADL decline among Japanese community-dwelling older people. Furthermore, our findings suggest that the effect of social relationships on IADL decline might differ by age among older people, which emphasizes the importance of age-tailored preventative care. As the number of older people increases, efforts to improve community development and facilitate social relationships among older people are increasingly necessary to prevent IADL decline.

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Declaration of conflict of interest

There are no potential conflicts of interest.

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Supplement

Supplement 1

Index of Social Interaction.

Items	Choices
1. Do you often communicate with your family members?	1) every day 2) twice a week 3) once a week 4) rare
2. Do you communicate with non-family persons regularly?	1) every day 2) twice a week 3) once a week 4) rare
3. Do you interact with non-family persons regularly?	1) every day 2) twice a week 3) once a week 4) rare
4. Do you have chance to participate in social groups?	1) every day 2) once a week 3) once a month 4) rare
5. Do you have chance to participate in your neighborhood affairs?	1) always 2) often 3) sometimes 4) rare
6. Do you watch television?	1) every day 2) twice a week 3) once a week 4) rare
7. Do you have an active role in the society or social affairs?	1) every day 2) once a week 3) once a month 4) rare
8. Do you read newspapers regularly?	1) every day 2) twice a week 3) once a week 4) less than one month 5) never
9. Do you read books or magazines regularly?	1) every day 2) twice a week 3) once a week 4) less than one month 5) never
10. Do you try to use new equipments like a video?	1) always 2) often 3) sometimes 4) rare
11. Do you have any hobby?	1) always 2) often 3) sometimes 4) rare
12. Do you have feeling of importance in the society?	1) always 2) often 3) sometimes 4) rare
13. Do you have someone to counsel with in difficult situation?	1) always 2) often 3) sometimes 4) rare
14. Do you have someone to support you in emergency?	1) always 2) often 3) sometimes 4) rare
15. Do you have motivation to live an active lifestyle?	1) always 2) often 3) sometimes 4) rare
16. Do you take an active approach towards your life?	1) always 2) often 3) sometimes 4) rare
17. Are you motivated to live a healthy life?	1) always 2) often 3) sometimes 4) rare
18. Do you have a regular or routine lifestyle?	1) always 2) often 3) sometimes 4) rare