

Association between Social Relationships and Cognitive Function among the Elderly

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Abstract **Aim:** While numerous studies suggest that social relationships affect cognitive functioning, the specific aspects of social relationships that are associated with maintaining cognitive functioning are still unknown. This study clarified what aspects of social relationships are significantly associated with the maintenance of cognitive functioning among elderly individuals. **Method:** Baseline data were collected in 2011, and follow-up surveys were conducted 3 years later. Of the participants surveyed, 505 were included in the analyses. Participants were aged 65 years or older and lived in a suburban community in central Japan. Social relationships were evaluated using the Index of Social Interaction measure. Cognitive status was evaluated using the Cognitive Performance Scale. We used multiple logistic regression analyses to examine the association of each aspect of social relationships with cognitive functioning. **Results:** The social relationships subscales of independence, social curiosity, and interaction were significantly associated with cognitive functioning after controlling for age, sex, disease status, and instrumental activities of daily living in 2011. **Conclusions:** Social control, interaction with the social environment, and interaction with other people were significantly associated with cognitive functioning.

Keywords Ageing, Elderly, Cognitive Function, Prevention, Social Relationships

1. Introduction

Cognitive disorders such as dementia and cognitive impairment are major causes of mortality and functional dependence, and addressing cognitive dysfunction plays an important role in the promotion of longevity and prevention of both long-term care [1], [2], and nursing facility admission [3]. As the aging population is rapidly increasing in Japan, prevention of cognitive dysfunction among the elderly is an important issue that requires urgent attention.

Strong social relationships play a protective role against several adverse health indicators such as depression [4], functional status [5], and even mortality [6]. Therefore, social relationships may be effective in maintaining good health and promoting longevity. Moreover, there is growing evidence suggesting that social relationships prevent cognitive decline and dementia. A review of the association between cognitive functioning and social lifestyle reported that social relationships including social engagement, social

activity, and social networking help to prevent cognitive impairment and occurrences of dementia [7]. In addition, a recent population-based prospective study in France reported that reciprocity in social exchanges and satisfaction in relationships were both protective against dementia [8]. Further, a recent meta-analysis showed that social participation, social contact, and loneliness were significantly associated with dementia [9]. These empirical studies suggest that promoting social relationships may help to maintain cognitive functioning among elderly.

Previous studies have focused on only limited aspects of social relationships. As few studies have examined multiple aspects of social relationships, particular aspects of social relationships that are effective on cognitive functioning have not yet been determined. Considering the limited evidence in this regard, further research is needed to identify the effectiveness of social relationships on cognitive functioning among the elderly. Identifying the specific aspects of social relationships that are effective against cognitive dysfunction can inform health care interventions.

To address this issue, this study determined the factors that affect the maintenance of cognitive function among Japanese community-dwelling elderly people, using scales that can evaluate various aspects of social relationships.

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Published online at <http://journal.sapub.org/phr>

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2. Methods

2.1. Participants

The data were from a cohort study including all the residents of a suburban community with a population of 4,539 in central Japan. This survey has been conducted annually since 1991 to examine factors related to longevity.

In the 2011 sample, 1,085 individuals responded to the baseline survey (response rate = 96.7%) and 733 participants provided valid responses (no missing data with respect to age, sex, self-reported disease status, instrumental activities of daily living (IADL), and cognitive functioning). In addition, 36 participants were excluded because they already showed cognitive impairment at baseline. At the 3-year follow-up period, 505 participants without missing data were included, and were observed for new occurrences of declining cognitive impairment. The follow-up rate was 68.9%.

2.2. Instruments

2.2.1. Measure of Cognitive Function

Cognitive functioning was evaluated using the Cognitive Performance Scale (CPS). This scale evaluates cognitive functioning using 4 items: decision making, understood, short-term memory, and procedural memory [10]. This scale is used in the questionnaire survey of needs in spheres of daily life promoted by the Japanese Ministry of Health, Labour and Welfare and is broadly used in Japan. In the existing evaluation method, CPS defines 7 levels of cognitive functioning: level 0, intact; level 1, borderline intact; level 2, mild impairment; level 3, moderate impairment; level 4, moderately-severe impairment; level 5, severe impairment; and level 6, very severe impairment. In this study, those who were intact (level 0 and level 1) after 3 years were defined as the steady group and those who had mild to very severe impairment (levels 2–6) were defined as the declining group.

2.2.2. Measure of Social Relationships

Social relationships were evaluated using the Index of Social Interaction (ISI), which can evaluate various aspects of social relationships. The ISI includes 18 items classified into 5 subscales: “independence,” “social curiosity,” “interaction,” “participation,” and “feeling of safety.” “Independence” comprises motivation to live an active life, taking an active approach toward life, motivation to live a healthy life, and having a regular or routine lifestyle. “Social curiosity” evaluates reading newspapers, books, or magazines, trying to use new equipment, having a hobby, and having a feeling of importance. “Interaction” includes family communication, non-family communication, and interactions with non-family persons. “Participation” measures social group participation, neighborhood activity participation, watching television, and having an active role in society. “Feeling of safety” evaluates having counseling facility and having someone who will provide support in an

emergency. Each item of the ISI is scored as 1 point for a positive response and 0 points for a negative response. Subscale scores are calculated by summing the scores of each item. The validity and reliability of the ISI have been established in previous studies among Japanese community-dwelling elderly people [11]. In the current study, subscale scores were used as continuous variables. High scores indicate positive social relationships.

2.3. Covariates

Age, sex, self-reported disease status, and IADL were considered potential confounding factors. Age was treated as a continuous variable. With respect to self-reported disease status, participants were defined as having a disease if they answered “yes” to having a medical condition (diabetes, heart disease, vascular brain disease, cancer, and bone and joint diseases). The TMIG Index of Competence [12], developed to measure competence levels, was used to evaluate IADL. This 13-item index has three subscales: IADL, Intellectual Activity, and Social Role. The responses for each item were “able to do” (1 point) and “unable” (0 points). This study used the IADL subscale, with scoring from 0 to 5. IADL scores were treated as continuous variables.

2.4. Statistical Analysis

We examined the association between a drop in ISI scores and decline in cognitive functioning after 3 years. A t-test was conducted to examine the difference of age, and Wilcoxon rank sum test was used to examine the differences in IADL score and ISI score between the declining group and steady group. A chi-square test was introduced to examine the bivariate association between categorical variables (sex and self-reported disease status) and cognitive functioning. A multiple logistic regression analysis was used to clarify what ISI subscales had associations with cognitive functional decline by controlling for confounding factors such as age, sex, self-reported disease status, and IADL. The effect of each ISI subscale was examined in separate models to avoid multicollinearity.

The analyses were conducted using SAS University Edition, and p-values of less than 0.05 were accepted as being statistically significant.

2.5. Ethical Considerations

The Ethics Committee of the University of Tsukuba approved this study (840-1). All the participants provided written consent prior to participation.

3. Results

First, we examined the bivariate association between participants’ characteristics and cognitive functioning after 3 years (Table 1). Participants who showed decline in cognitive functioning after 3 years were more likely to be

older than those did not show decline, and have had lower IADL score at baseline. However, sex and self-reported chronic disease status did not show significant association. Regarding the bivariate association between ISI score and cognitive function, the subscales of independence, social curiosity, and interaction were significantly associated with cognitive functioning after 3 years.

We calculated the odds ratio (OR) for cognitive impairment for each ISI subscale (Table 2). A multiple logistic regression analysis showed that independence, social curiosity, and interaction were significantly associated. However, social participation and feeling of safety were non-significant. Age was significant in all the models except independence. IADL scores were also significant except for the model in social curiosity and participation. Sex and self-reported disease status did not significantly affect cognitive functioning.

4. Discussion

This study determined the aspects of social relationships that are associated with cognitive functional decline among community-dwelling elderly individuals living in a suburban area in Japan. The results revealed that the subscales of independence, social curiosity, and interaction were significant factors for cognitive functional status, which indicates that good social relationships may contribute to the prevention of decline in cognitive functioning.

The independence subscale of ISI denotes social control such as motivation to live an active and healthy life and having a regular or routine lifestyle. While perceived control is essential for successful aging [13], empirical studies reported that it was associated with health outcomes such as

incidents of long-term care and mortality [14]. Regarding the effect on cognitive functioning, low perceived control was associated with low memory performance when evaluated in cognitive testing [15]. Our results supported the results of these studies. One possible interpretation is that health behavior, motivation, and stress buffering may play a role in linking perceived control and health [16].

The subscale of social curiosity denotes interaction with the social environment including intellectual activities. Previous studies have reported that intellectual activities such as reading newspapers and magazines were associated with cognitive functioning [17]. Further, in interaction with the environment, including during leisure activities, intellectual engagement may contribute to the maintenance of cognitive functioning due to brain stimulation [18]. The results of this study supported these notions. The findings suggest that interaction with the social environment is effective for maintaining cognitive functioning among the elderly due to cognitive stimulation.

Regarding contact with others, which was evaluated by the subscale of interaction in this study, a prospective study showed that having a bigger network of family members and having a high frequency of contact were associated with a high cognitive status score among older women [19]. Further, a longitudinal study reported that high frequency of contact with relatives and engagement with friends were both associated with cognitive decline after 4 years [20]. Consistent with these studies, the results of this study showed an association between interaction with others and cognitive functioning. As social isolation is reported to be increasing in the Japanese society, interaction with others is essential not only for prevention of isolation, but also for the maintenance of cognitive functioning in the elderly.

Table 1. The Bivariate Association between Characteristic, ISI, and Cognitive Functioning after 3 Years

		Steady		Decline		P
		N	%	N	%	
Age, Mean (\pm SD)		72.5 (\pm 6.2)		75.7 (\pm 6.9)		< 0.01
Sex	Male	206	92.0	18	8.0	0.43
	Female	256	93.8	17	6.2	
Chronic disease	Yes	132	90.4	14	9.6	0.17
	No	337	93.9	22	6.1	
IADL, Mean (\pm SD)		4.9 (\pm 0.5)		4.6 (\pm 0.7)		< 0.01
ISI, Mean (\pm SD)	Independence (n= 467)	3.9 (\pm 0.3)		3.6 (\pm 1.0)		< 0.01
	Social curiosity (n= 446)	4.2 (\pm 1.0)		3.4 (\pm 1.4)		< 0.01
	Interaction (n = 455)	2.9 (\pm 0.3)		2.6 (\pm 0.9)		< 0.01
	Participation (n = 408)	3.6 (\pm 0.6)		3.4 (\pm 1.0)		0.28
	Feeling of safety (n = 466)	1.9 (\pm 0.4)		1.8 (\pm 0.6)		0.33

Table 2. Odds ratios (ORs) for Cognitive Decline by Each Index of Social Interaction (ISI) Subscales

	ORs	95% CI	P
Independence	2.14	1.28–3.59	<0.01
Social curiosity	1.69	1.21–2.36	<0.01
Interaction	2.75	1.58–4.78	<0.01
Social participation	1.44	0.81–2.56	0.21
Feeling of safety	1.44	0.71–2.93	0.31

The subscales of independence, social curiosity, and interaction showed significant association with cognitive functional decline after 3 years, while the subscales of participation and feeling of safety did not show any significant association. However, some studies have reported that these aspects, which did not show significant association in this study, have significant effects on cognitive functioning [21], [22]. This may be due to the difference in definitions of social relationships between previous studies and this study, as social relationships can be evaluated through various definitions. Therefore, further accumulation of evidence is needed to identify the effect of social relationships in this regard.

The strength of this study is its use of a scale that can evaluate various aspects of social relationships among the elderly in daily life. In addition, the baseline survey response rate was considerably high (96.7%) due to the use of both mailed surveys and personal interviews. Further, the data for this study came from a comprehensive survey of a suburban area. This enhanced the representativeness of the study population. However, this study covered only a single area, and the generalizability of the findings needs to be tested further.

This study clarified that social control, interaction with the social environment, and interaction with other people was associated with cognitive functional decline 3 years following baseline. These results can inform the development of interventions to prevent cognitive decline in elderly adults through social relationships.

ACKNOWLEDGEMENTS

We are deeply grateful to Mr. Takayama (Principal investigator), Mr. Kuno (Mayor of Tobishima), Mr. Hattori (Deputy Mayor of Tobishima), and all the study participants and staff. This research was supported by the Grants-in-Aid for Scientific Research (26285130, 26590107).

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