

A Study of the Relationship between Social Interaction and Dementia in Older Adults

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Abstract The population of dementia patients is increasing rapidly and an effective treatment is yet to be developed. Thus, the prevention of dementia is necessary and the role of social interaction in preventing dementia needs to be highlighted. The current study aims to clarify the relationship between social interaction and symptoms of dementia. This was a three-year longitudinal prospective cohort study called “Community Empowerment and Care for Well-being and Healthy Longevity,” using data from a project of a suburban area. The current study used the data from 2008 to 2011 and focused on older adults aged 60 years and above. The Index of Social Interaction was used to measure social interaction, and data on dementia was taken from the Health and Welfare Center of the local government. Demographic background was also considered. A chi-square test and a logistical regression analysis were used to examine the relationship between changes in social interaction and dementia. Participants in the study were 315 men ($M = 73$ years) and 377 women ($M = 74$ years) with healthy cognitive functioning participated in the current study. The chi-square test showed a positive association between social interaction and dementia risk. Furthermore, the multiple logistic analysis revealed that the items of “Interaction with non-family persons” ($OR = 3.36$) and “Reading newspapers” ($OR = 2.25$) were significantly related to symptoms of dementia after three years. The current study clarified the relationship between social interaction and the incidence of dementia symptoms. It indicated that participating in social interactions can prevent dementia.

Keywords Social interaction, Dementia, Cognitive function, Longitudinal study

1. Introduction

The challenge of an aging population, along with its expected attendant problem, is a growing concern across the world [1]. In 2012 in Japan, the number of older adults who were diagnosed with dementia was 4,620,000 and the number of older adults who had mild cognitive impairment was about 4,000,000. Therefore, it can be said that among adults over 65 years, 25% have dementia or are at a risk of dementia [2]. More and more people are beginning to recognize the importance of preventing dementia. This can be seen in group homes for dementia patients, which have become an important part of long-term care insurance [3].

Dementia is a degenerative disease that has a series of symptoms, such as cognitive decline, memory loss,

perceptual problems, and apraxia [4]. According to previous studies, rapid cognitive decline in adults aged 65 years and above poses a higher risk of falling and earlier loss of autonomy [5]. Functional loss always leads to older adults needing to be taken care of. Although many previous studies have found some treatments for dementia, a complete cure is difficult to discover at present. For example, McKeith’s study proved the efficacy of rivastigmine in dementia [6], but Viña’s review mentioned that in dementia such as Alzheimer’s disease therapeutics, only prevention makes sense [7]. Therefore, early prevention of dementia has been proposed to be the most important for older adults.

Researchers have identified the risk factors for the prevention of dementia. These include hypertension, diabetes, and low metabolism [8, 9]. However, prior to these findings, cognitive decline was considered as a general risk to dementia, leading to cognitive impairment in the early stage of aging [10]. Epidemiologic studies have demonstrated that a reduction in social, physical, and cognitive activity is directly related to cognitive decline and dementia. For example, previous studies demonstrated that

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the people do physical activity at midlife at least twice a week would have reduced risk of dementia [11], and the participants in intervention group with better education behavior and physical activity could have higher score of ADAS-Cog [12]. Social activity contains many aspects (leisure activity, social engagement et al.) and previous studies have demonstrated its influence on the prevention of dementia [13]. Sandhu demonstrated that social relationships can influence physical and mental well-being in later life, while other studies have also shown an important relationship between social interaction and dementia [14, 15]. According to Pillai's review, an active and socially integrated lifestyle in later life can protect against dementia [16].

Although social interaction has proven to be an important factor in the status of dementia, few studies have used specific assessments to measure and assess social interaction in detail. Given that the exact relationship between social interaction and dementia is not clear, the current study aims to clarify this relationship.

2. Methods

2.1. Participants

This was a three-year longitudinal prospective cohort study called "Community Empowerment and Care for Well-being and Healthy Longevity," using data from a project of a suburban area. The project started in 1991 and all residents of the area participated in it every three years.

The current study used the data from 2008 to 2011 and focused on older adults in order to clarify the relationship between social interaction and dementia. There were 692 cognitively healthy older adults who participated in 2008 and were followed until 2011. All of the participants were older than 65 years.

2.2. Measures

In the current study used 3 main measures. Social interaction was evaluated using the Index of Social Interaction (ISI), a self-reported questionnaire developed for assessing social interaction of various types among Japanese people. The ISI contains 5 subscales, which consist of 18 items. Cronbach's alpha for the subscales ranged from .78 to .81, and its validity and availability were also demonstrated [17]. The score on each item in the ISI was determined through the frequency indicated on the items (S1 Appendix). (1) the "Independence" subscale had 4 items ("Motivation to live an active lifestyle," "Taking an active approach," "Being motivated to live a healthy life," and "Having a regular lifestyle"), (2) the "Social curiosity" subscale contained 5 items ("Reading newspapers," "Reading books or magazines," "Trying to use new equipment," "Having a hobby," and "Feeling of important"), (3) the "Interaction" subscale comprised three 3 items ("Communication within the family," "Communication

with non-family people," and "Interactions with non-family people". In this study, "Communication with" emphasizes "talking with", and "Interaction with" emphasizes "visiting or meeting"), (4) the "Participation in society" subscale consisted of 4 items ("Participation in social groups," "Participation in neighborhood affairs," "Watching television," and "Having an active role in society"), and (5) the "Feelings of safety" subscale was composed of 2 items ("Having counsel" and "Having someone to give support in an emergency"). The items in the "Independence," "Social curiosity" and "Feelings of safety" subscales were scored by frequency (1 = rare, 2 = sometimes, 3 = often, 4 = always); likewise, the items in the "Interaction" and "Participation in society" subscales were scored by their frequency (1 = rare, 2 = once a week, 3 = twice a week, 4 = every day).

The status of dementia was determined through a clinical diagnosis by medical doctors and an examination by professionals. Data on dementia was from the Health and Welfare Center in the local government (including AD, cardiovascular dementia, Lewy bodies, Parkinson, Higher Brain dysfunction).

Age, gender, and status of diseases were obtained through a self-reported questionnaire. For the status of diseases, the question was "Are you hospitalized in the recent 1 year or do you have any diseases that need to be treated for more than 2 weeks continually?" Participants were then classified into a "Diseases group" or a "No diseases group" according to their answers ("yes" or "no").

2.3. Data Analysis

A chi-square test and multiple logistical regression analysis were used to examine the relationship between social interaction and status of dementia.

The independent variable was the social interaction in baseline year (2008). The social interaction was considered "High frequency" if the selection was "always," "every day," "often," or "twice a week" and was considered "Low frequency" if the selection was "sometimes," "rare," or "once a week." The dependent variable was dementia status. If participants were diagnosed as "having dementia" or "having symptoms of dementia", they were classified into the "dementia group." Otherwise, they were assigned to the "normal group." Given that previous studies have found that age, gender, and status of diseases might influence ability of daily living and dementia, age (60 to 74 years old = 0, older than 75 years old = 1), gender (Man = 0, Woman = 1) and status of diseases (no = 0, yes = 1) were analyzed as control variables.

All procedures were conducted using the Windows SAS 9.3 program, and $p < 0.05$ was used as the significance level for all statistical tests.

2.4. Ethical Considerations

All participants signed a consent form and were informed that they could withdraw from the study after learning the

objective and processes of this study. Additionally, data were collected anonymously and all personal information was protected by a personal identification system. This study was conducted after being approved by the ethics committee of the University of Tsukuba.

3. Results

Table 1 shows that the study population was composed of 692 participants. There were 315 men with a mean age of 73 years ($SD: \pm 6.1$) and 377 women with a mean age of 74 years ($SD: \pm 6.5$). In addition, 394 participants (56.9%) presented with disease in baseline year. Table 2 shows the relationship between the characteristics of participants in

baseline year and the incidence of dementia symptoms after three years. The incidence of dementia was associated with age ($p < 0.05$).

Table 1. Characteristics of participants

N=692			
Items	Category	n	%
Age	65-74	404	58.4
	Older than 75	288	41.6
Gender	Male	315	45.5
	Female	377	54.5
Diseases	No	298	43.1
	Yes	394	56.9

Table 2. The association between age, gender, disease, and dementia

N=692								
Item	Category	Dementia (2011)				n	χ^2	p
		No		Yes				
		n	%	n	%			
Age (2008)	65-74	361	89.4	43	10.6	404	25.009	<.0001
	Older than 75	216	75.0	72	25.0	288		
Gender (2008)	Male	261	82.9	54	17.1	315	0.115	0.735
	Female	316	83.8	61	16.2	377		
Diseases (2008)	No	244	81.9	54	18.1	298	0.853	0.356
	Yes	333	84.5	61	15.5	394		
P:Chi-square test								

Table 3. The association between social interaction and dementia

Item	Frequency	Dementia (2011)						χ^2	p
		Yes		No		n			
		n	%	n	%				
Independence									
Motivation to live n=619	High	81	15.2	452	84.8	533	4.576	0.032	
	Low	21	24.4	65	75.6	86			
Taking an active approach n=614	High	70	14.2	423	85.8	493	9.221	0.002	
	Low	31	25.6	90	74.4	121			
Being motivated to live a healthy live n=626	High	91	16.0	479	84.0	570	1.107	0.293	
	Low	12	21.4	44	78.6	56			
Having regular lifestyle n=618	High	97	16.3	497	83.7	594	1.249	0.264	
	Low	6	25.0	18	75.0	24			
Social curiosity									
Reading newspapers n=622	High	85	15.0	486	85.0	571	9.356	0.002	
	Low	16	28.6	35	71.4	51			
Reading books n=583	High	37	13.6	236	86.5	273	2.508	0.113	
	Low	57	18.4	253	81.6	310			
Try to use new equipments n=611	High	27	12.6	187	87.4	214	3.656	0.056	
	Low	74	18.6	323	81.4	397			
Having a hobby n=610	High	63	13.4	407	86.6	470	8.409	0.004	
	Low	33	23.6	107	76.4	140			
Feeling of importance n=615	High	50	13.9	311	86.2	361	4.214	0.040	
	Low	51	20.1	203	79.9	254			

Item	Frequency	Dementia (2011)				n	χ^2	p
		Yes		No				
		n	%	n	%			
Interaction								
Communication within the family n=608	High	97	16.4	495	83.6	592	0.835	0.361
	Low	4	30.3	12	69.7	16		
Communication with non-family persons n=592	High	94	16.3	482	83.7	576	0.337	0.562
	Low	4	25.0	12	75.0	16		
Interaction with non-family persons n=571	High	82	15.1	462	84.9	544	16.135	<.0001
	Low	12	44.4	15	55.6	27		
Participation in the society								
Participation in social groups n=489	High	53	14.6	311	85.4	364	3.370	0.066
	Low	27	21.6	98	78.4	125		
Participation in neighborhood affairs n=590	High	75	15.8	401	84.2	476	4.043	0.044
	Low	27	23.7	87	76.3	114		
Watching television n=623	High	100	16.2	516	83.8	616	0.019	0.889
	Low	1	14.3	6	85.7	7		
Having an active role in society n=618	High	86	15.9	454	84.1	540	1.690	0.194
	Low	17	21.8	68	78.2	78		
Feeling of safety								
Having counsel n=100	High	12	26.1	34	73.9	46	1.973	0.160
	Low	8	14.8	46	85.2	54		
Having someone to give support in emergency n=619	High	95	16.3	487	83.7	582	0.000	0.986
	Low	6	16.2	31	83.8	37		
P: Chi-square test(Fisher test)								

3.1. Chi-square Test for ISI and Dementia

All The chi-square for the items “Motivation to live,” “Taking an active approach,” and symptoms of dementia of the Independence subscale were found to be significant after three years ($\chi^2 = 4.58, p < 0.05$; $\chi^2 = 9.22, p < 0.01$; Table 3). The items “Reading newspapers,” “Having a hobby,” and “Feeling of importance” of the Social Curiosity subscale, as well as symptoms of dementia were significant ($\chi^2 = 9.36, p < 0.01$; $\chi^2 = 8.41, p < 0.01$; $\chi^2 = 4.21, p < 0.05$). The item “Interaction with non-family persons” of the Interaction subscale and symptoms of dementia were significant ($\chi^2 = 16.14, p < 0.01$). Lastly, the item “Participation in neighborhood affairs” in the Participant in the society subscale and symptoms of dementia were significant ($\chi^2 = 4.04, p < 0.05$).

3.2. Multidimensional Analysis for ISI and Dementia

After controlling for age, gender, and diseases, multiple logistic regression analysis was performed to predict symptoms of dementia after three years using the ISI items from 2008. As seen in Table 4, the items of “Interaction with non-family persons” (OR = 3.36) and “Reading newspapers” (OR = 2.25) were significantly related to symptoms of dementia after three years.

Table 4. Significant result of Multiple Logistic analysis for Dementia

Variables	OR	95% CI		P
Interaction with non-family persons	3.36	1.35	8.34	0.009
Reading newspapers	2.25	1.04	4.87	0.040
Age	2.66	1.60	4.42	0.000
Diseases	0.93	0.56	1.54	0.776
Gender	1.17	0.70	1.94	0.557

Note. Multiple Logistic analysis

Interaction with non-family persons: Contrast= High frequency

Reading newspapers: Contrast= High frequency

Age: Contrast =65-74

Gender: Contrast=Male

Diseases: Contrast=No diseases

Control variables: Age, Gender, Diseases

4. Discussion

The current study found a relationship between social interaction and dementia through a community-based cohort study. None of the participants in the baseline year had dementia. However, after three years, symptoms of dementia

were present in some older adults, especially those who had little social interaction. The results suggest that frequent social interaction is associated with a lower risk of dementia in older adults. In addition, the current study also examined the effects of older adults' characteristics such as age, gender, and status of diseases on dementia status.

In the current study, most of the participants belonged to the "High frequency group." Most participants had positive social interactions in the studied suburban area. This finding suggests that, even though aging is inevitable, social interaction can be maintained by engaging in social environments.

Previous cohort studies have shown that positive social interaction is related to the prevention of dementia [18]. For example, Mortimer's trial demonstrated that better social interaction can maintain cognitive abilities while Bennett's research indicated that an extended social network is beneficial for maintaining cognitive function. The current study also revealed that taking part in positive social interactions has a positive effect on preventing dementia [19, 20].

The current study showed that "independence" is beneficial for preventing dementia. The results of the chi-square tests suggest that "taking an active approach" is also beneficial for preventing dementia. Previous studies have suggested that, even for older adults who need care and have a positive mindset, the risk of dementia can be decreased [21]. Other studies have also demonstrated that either depression or anxiety is directly associated with cognition [22]. Taking an active approach means older adults have positive consideration and are likely to engage in social interaction. Thus, maintaining mental health and keeping a positive mindset are very important in old age.

The current study also showed that "social curiosity" is beneficial for preventing dementia. The multiple logistic analysis indicated that participants who had a high frequency of reading newspapers were at a lower risk for dementia. Some studies have demonstrated that "reading newspapers" is not only a way to get information but also a mental activity [23, 13]. With the development of the Internet, more people have been getting information through devices such as their personal computers and smartphones. However, most older adults like to read and get information from newspapers. In addition, novel intellectual and cognitive stimulations have been pointed out as effective at reducing the risk of dementia in older adults [24]. For example, frequency of reading is related to cognitive function, and older adults with high frequency of reading had less cognitive decline [25]. The findings of the current study suggest that reading is beneficial for cognition. Although there was no significant result for the item of "Having a hobby" in multiple logistic analysis, the chi-square test indicated that having a hobby is related to dementia risk. Hobbies contain many types of activity, such as physical, social, and leisurely [26]. Several studies have indicated that intense physical activity, such as aerobics, sports, running, and bicycling, can reduce dementia risk [27, 28]. Other studies have demonstrated that leisurely

activities such as board games, crafts, crossword puzzles, musical instruments, and card games can also prevent dementia [29]. It is likely that having hobbies that involve physical and cognitive activity is beneficial for the prevention of dementia.

Many previous studies have demonstrated the importance of "Interaction" in the prevention of dementia. Fabrigoule's and Carlson's studies indicated that visiting and interacting with friends can reduce the risk of dementia [30, 24]. On the other hand, individuals who lived alone and had no friends or relatives had an increased risk of developing dementia [31]. After controlling for age, gender, and diseases, the current study found that the risk of dementia was high for older adults who rarely interact with non-family persons. This result supports the finding reviewed by Seeman that having connections with family, friends, and neighbors or engaging in social activities contributes to cognitive functioning [32].

"Participation in society" was also correlated with dementia risk. For example, Cohen *et al.* (2006) demonstrated that social participation has a positive influence on mental health [33]. Helmer *et al.* and Saczynski *et al.* concluded that social disengagement is a risk factor for cognitive impairment among older adults [34, 35]. This finding confirms the results of previous studies showing that participating in society, such as participating in neighborhood affairs, is beneficial for cognitive functioning and is significantly associated with symptoms of dementia.

In this study, there was no significant result for "Feeling safe." Only 100 participants responded to the item of "Having counsel," and there was no significant result; meanwhile, there was no significant relation between "Having someone to give support in emergency" and dementia risk. Many previous studies have explained the importance of social support in dementia [36]. However, another study indicated that the association between social support and dementia is not obvious [37]. When considering the local culture of this area, it is important to note that older adults are cautious in complaining about their troubles to others to maintain privacy. An advanced welfare system in this area and more evidence are necessary to examine whether "Feeling safe" is effective in preventing dementia.

Additionally, a significant association between age and symptoms of dementia was found in the current study. Recent studies have demonstrated that dementia risk increases with age [38]. The current study also supported the view that aging is closely associated with the status of dementia. Regarding gender, some studies, such as Dannhauser's study, have found that there was no significant association between gender and dementia risk [39]. The current study also suggests that the effect of gender is not apparent. Epidemiological studies have pointed out that diseases are related to cognitive decline [40]; likewise, some chronic diseases, such as diabetes, hypertension, and cardiovascular diseases, are important risk factors for dementia [41]. The analysis in the current study did not specify which diseases the participants had. This made it difficult to examine the effect of status of disease on the risk

of dementia. Thus, the role of specified diseases will be examined further in a future study.

There were three original aspects of the current study. First, the study used a longitudinal design that focused on the frequency of social interaction from a longitudinal perspective. Thus, it can add evidence to support the association between social interaction and dementia. Second, social interaction was measured in a multidimensional manner, which provided multiple aspects of stimulation from the social environment.

The limitations of the study are as follows: First, only one suburban area was investigated. Second, some potential factors related to the risk of dementia, such as education level [42], specific diseases [8, 9], and alcohol consumption [43], were not carefully considered.

The current study focused on the effects of social interaction on dementia symptoms and found that positive social interaction can provide protection from dementia. It indicated that engaging older adults in more active social interactions can effectively prevent dementia.

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Appendix 1. Index of Social Interaction (ISI)

1. Independence				
Motivation to live an active lifestyle	"Do you have motivation to live an active lifestyle?"	1) always	2) often	3) sometimes 4) rare
Taking an active approach	"Do you take an active approach towards your life?"	1) always	2) often	3) sometimes 4) rare
Being motivated to live a healthy life	"Are you motivated to live a healthy life?"	1) always	2) often	3) sometimes 4) rare
Having regular lifestyle	"Do you have a regular or routine lifestyle?"	1) always	2) often	3) sometimes 4) rare
2. Social curiosity				
Reading newspapers	"Do you read newspapers regularly?"	1) every day	2) twice a week	3) once a week 4) rare
Reading books	"Do you read books or magazines regularly?"	1) every day	2) twice a week	3) once a week 4) rare
Try to use new equipments	"Do you try to use new equipments like a video?"	1) always	2) often	3) sometimes 4) rare
Having a hobby	"Do you have any hobby?"	1) always	2) often	3) sometimes 4) rare
Feeling of importance	"Do you have feeling of importance in the society?"	1) always	2) often	3) sometimes 4) rare
3. Interaction				
Communication within the family	"Do you often communicate with your family members?"	1) every day	2) twice a week	3) once a week 4) rare
Communication with non-family persons	"Do you communicate with non-family persons regularly?"	1) every day	2) twice a week	3) once a week 4) rare
Interaction with non-family persons	"Do you interact with non-family persons regularly?"	1) every day	2) twice a week	3) once a week 4) rare
4. Participation in the society				
Participation in social groups	"Do you have chance to participate in social groups?"	1) every day	2) twice a week	3) once a week 4) rare
Participation in neighborhood affairs	"Do you have chance to participate in your neighborhood affairs?"	1) always	2) often	3) sometimes 4) rare
Watching television	"Do you watch television?"	1) every day	2) twice a week	3) once a week 4) rare
Having an active role in society	"Do you have an active role in the society or social affairs?"	1) always	2) often	3) sometimes 4) rare
5. Feeling of safety				
Having counsel	"Do you have someone to counsel with in difficult situation?"	1) always	2) often	3) sometimes 4) rare
Having someone to give support in emergency	"Do you have someone to support you in emergency?"	1) always	2) often	3) sometimes 4) rare

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