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Community social support and onset of dementia in older Japanese individuals: a multilevel analysis using the JAGES cohort data

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ABSTRACT

Objective Recently, there has been an increase in the number of people with dementia. However, no study has examined the association between community-level social support and the onset of incident dementia using multilevel survival analysis.

Design A prospective cohort study.

Participants and setting We analysed data pertaining to 15 313 (7381 men and 7932 women) community-dwelling adults aged 65 years or older who had not accessed long-term care insurance and were living in Aichi Prefecture (seven municipalities) in Japan.

Primary and secondary outcome measures The association between community-level social support and onset of incident dementia was examined using the Japan Gerontological Evaluation Study, a prospective cohort study introduced in Japan in 2003. Incident dementia was assessed using Long-term Care Insurance records spanning 3436 days from the baseline survey.

Results During the 10-year follow-up, the onset of incident dementia occurred in 1776 adults. Among older people, a 1% increase in community-level social support (in the form of receiving emotional support) was associated with an approximately 4% reduction in the risk of developing dementia, regardless of socio-demographic variables and health conditions (HR=0.96; 95% CI=0.94 to 0.99).

Conclusions Receiving community-level social support in the form of emotional support is associated with a lower risk of developing incident dementia.

Strengths and limitations of this study

- ► To date, no study has examined the association between community-level social support and the onset of incident dementia using multilevel survival analysis.
- ► This is a long-term follow-up study that followed older adults in Japan for about 10 years.
- ► The sample does not fully reflect the older population in Japan because the study subjects were recruited from a single prefecture.

INTRODUCTION

Dementia constitutes a pressing health challenge, especially among the older population. The incidence of dementia worldwide is projected to rise to 66 and 131 million by 2030 and 2050, respectively.[1] In Japan alone, it is predicted that there will be 4.62 and 7 million people affected by 2012 and 2025, respectively. These rates suggest that about one in seven Japanese people aged 65 years or above may develop dementia.[2]

Currently, no effective therapeutic intervention for dementia has been determined. As such, identifying adjustable risks and preventive measures is essential for slowing down or preventing the onset of dementia.[3] Previous studies have identified genetic, vascular and lifestyle-related factors,[4–9] such as advanced age, being female, having a low education level, being in poor health, smoking and heavy drinking, as being associated with a higher risk of developing dementia. An additional significantly adjustable risk factor is the lack of positive social networks and influences. A previous study suggested that engagement in social activities, and having a rich network of activities within close relationships, confers some protection against dementia among older people.[4]

The definition and the attendant use of the notion of social relationships vary among researchers. The concept may encompass factors such as social participation, social networks and social support. Social support can be defined as aid and assistance exchanged through social relationships and interpersonal transactions,[10] and it might be a significant protective factor for cognitive ageing.[11] A previous systematic review paper indicated that people with social support had 50% lower mortality than those without it.[12] Social support has been categorised into four types—giving and receiving support

at an emotional level and at an instrumental level[13] — all of which occur at an individual level and have been associated with improved health. For example, providing emotional and instrumental social support to non-family members leads to fewer depressive symptoms.[13] Providing emotional support to the spouse, and instrumental support to relatives, friends and neighbours, further lowers the risk of mortality.[14] Receiving emotional support is associated with improved cognitive function.[11] In addition, diverse social relationships, including social support from family members, are associated with a lower incidence of dementia.[15]

Besides individual-level social factors, social networks and relationships at the community level have been investigated to understand its association with moderating the risk of functional disability. Such studies investigate 'social capital,' which has been defined as the 'resources that are accessed by individuals as a result of their membership of a network or a group.'[16] A previous study found that lower social capital at the community-level is associated with an increased rate of functional disability among older women.[17] Moreover, there are reports of research on community social capital and cognitive decline.[18] However, because these studies are cross-sectional ones, longitudinal studies are needed. Nevertheless, no study has examined how community-level social support influences the risk of dementia. Therefore, this study seeks to evaluate the relationship between social support at the community level and the onset of dementia.

METHODS

Sample

Data for this study were accessed via the Japan Gerontological Evaluation Study (JAGES). Set up in Aichi in 2003, this was a prospective cohort study of the Center for Well-being and Society of the Nihon Fukushi University.[19] The research was carried out in seven—three larger (Handa, Tokoname and Chita Hokubu) and four smaller (Agui, Mihama, Minamichita and Taketoyo)—municipalities that encompass the entire southern region of the Chita peninsula and the Aichi Prefecture. In October 2003, an estimated 276 208 people resided in these locations where 18.0% were aged 65 years or above.[17] On average, the data of 6300 residents in the 44 school districts were analysed in this study. From the three larger municipalities, 5000 survey candidates were randomly selected from the list of persons insured by long-term care insurance who were not certified as requiring long-term care. In the four smaller municipalities, candidates were randomly selected from those not receiving public long-term care insurance benefits due to a physical or cognitive disability. Of the 33 152 people selected, 15 313 individuals answered the baseline survey (response rate=52.1%).[15] The exclusion criteria were: (1) people who had difficulty in performing activities of daily living as a result of disabilities; (2) people who did not provide baseline information (n=579); (3) people who did not provide social support information (n=1359); and (4) people who did not provide a school district code (n=2343). Ultimately, 11 032 subjects (5627 women and 5405 men) were included in this analysis.

Follow-up

The evaluation parameters of the JAGES Project included health status, functional deterioration and mental impairment among older Japanese people who were not institutionalised. In Japan, there is a long-term care insurance system that covers both institutional and community-based caregiving. Individuals aged 65 years or above qualify to receive benefits on the strict basis of physical and cognitive disability. The follow-up began on 1 November 2003. Dementia-associated data from the six municipalities (specifically in terms of the onset) were assessed until 28 March 2013.

Outcome variables

Dementia was graded on a scale that includes categories from I to IV and Medical (M based on the Activities of Daily Living Independence Assessment Criteria for Older Individuals with Dementia. The Degree of Autonomy in the Daily Lives of Older Individuals with Dementia Scale, created by the Ministry of Health, Labor, and Welfare of Japan, evaluates an individual's ability to carry out daily tasks associated with living on a scale that includes categories from I to IV and M (online supplemental table 1).

This scale was validated based on its high association with the Mini-Mental State Examination.[20] It has been reported that dementia symptoms indices are strongly correlated with Mini-Mental State Examination. (Spearman's rank correlation $\rho=-0.73$, $p<0.001$). Scores I, II, III and IV on the dementia scale are equivalent to 22, 16, 13 and 6 points on the Mini-Mental State Examination, respectively.[20] A score of I indicates that the patient suffers from some level of cognitive decline but remains able to perform domestic and social tasks nearly independently. A score of II indicates that the patient has certain symptoms or behaviours indicative of cognitive impairment and challenges in communication that may hamper the performance of daily tasks, although some amount of external assistance is needed to facilitate routine function. A score of III indicates that the patient periodically exhibits symptoms indicating communication challenges or symptoms/behaviours, which may interfere with the performance of daily tasks, necessitating external assistance. A score of IV indicates that the patient usually shows communication or behavioural challenges, which hampers performing daily tasks, necessitating frequent care. Finally, a score of M (M=Medical, requires specialised medical care) is used when the patient shows significant cognitive impairment, displays difficult behaviour or has a serious physical illness, requiring expert medical intervention. Symptoms and behaviours seen in the M rank include delirium, paranoia, agitation, self-injury and harm and other psychiatric symptoms, as well as ongoing problem behaviours caused by psychiatric symptoms.

Explanatory variables

An aggregate of individual-level background data were acquired for the 44 school-based districts to evaluate community social support. An aggregate of responses for individual-level social support among the school districts was used as an indicator of community social support. Within the Japanese context, school districts (or primary schools) are primary residential units of individuals within rural zones. Generally, school districts comprise geographical settings where older individuals may readily travel via foot or bicycle.[21]

Individual-level social support was assessed based on four dimensions of the Two-Way Social Support Scale.[13] The four types of support included: (1) receiving support at the emotional level, (2) providing support at the emotional level, (3) receiving support at the instrumental level and (4) providing support at the instrumental level (online supplemental table 2).

A single item measured each support, 'If you or others required additional daily assistance, who would you depend on to assist or to be assisted by?' Receiving emotional support was conceptualised as the perception of the respondent's complaints or fears by an individual (eg, 'Do you have someone who listens to your concerns and complaints? Circle all that apply. Options included family living together, separated children and relatives, acquaintance/friends/neighbours'). Providing emotional support was conceptualised as the expression of complaints or fears by an individual to the respondents (eg, 'Do you listen to someone's concerns or complaints? Circle the numbers of all the answers that apply. Options include family living together, separated children and relatives, acquaintances/friends/ neighbours'). Receiving instrumental support was conceived as the rendering of care to the respondent by an individual, if the respondent was ill for many days (eg, 'Do you have someone who looks after you when you are sick and confined to bed for a few days? Circle the numbers of all the answers that apply. Options include family living together, separated children and relatives, acquaintance/friends/neighbours'). Providing instrumental support was defined as nursing of an individual by the respondent if they were ill for many days (eg, 'Do you look after someone when he/she is sick and confined to bed for a few days? Circle the numbers of all the answers that apply. Options include family living together, separated children and relatives, acquaintance/friends/neighbours').

The percentage of people who responded to each item was considered while determining the level of social support. An aggregation of the responses to the survey items, apropos the four dimensions of social support, was performed for the 44 local districts and further, considered community social support indicators.

Covariates

Other explanatory variables included: gender (female, male), age (65–69, 70–74, 75–79, 80–84 and 85 years or older), living conditions (accompanied/unaccompanied), marital status (married, never married, divorced, widowed and other/missing), education (≥13 years, 10–12 years, 6–9 years, <6 years and other/missing), present illness (no, yes and missing), depressive symptoms evaluated by the Geriatric Depression Scale-15 (GDS-15: no depression 0–4 points, mild depression 5–9 points, depression 10–15 points, missing), smoking status (never, former, current and missing), alcohol consumption (no, do not drink every day, drink every day ≤35 g/day, drink every day >35 g/day and missing) and individual social support.

Statistical analysis

This prospective study employed multilevel survival analysis. The data of 11 032 people living in 44 local districts were used in this study. The multilevel analysis framework relied on the assumption that the health outcome of individuals is partially affected by the district in which they live. The multilevel model evaluated the change in outcome across districts (random effects) and the influences of community-level factors on the outcome, accounting for specific constituent features (fixed effects). Multilevel survival analysis was employed to compute the HR and 95% CI for the onset of dementia at follow-up. The HR of the social support variable was determined as the 1% variation in the proportion of aggregated social support. For the analyses, all four social support indicators at the community level and sociodemographic factors were concurrently adjusted. Furthermore, three sensitivity analyses were conducted, excluding (1) 1 year, (2) 2 years and (3) 3 years after baseline. The STATA SE V.13 (Stata Corp, College Station, Texas, USA) was used for the analysis, and the 'stmixed' command was used (the 'mestreg' command has become a standard feature in STATA V.14).

Patient and public involvement

The patients and public were not involved in the design, conduct, reporting or dissemination plans of our research.

RESULTS

During the 9.4-year follow-up period (87 232 person-years), dementia onset was observed in 1776 (16.1%) individuals. Online supplemental table 3 shows the baseline characteristics and incidence rate of dementia per 1000 person-years. The incidence rate of dementia was higher in those who were female, older, living alone, widowed or divorced, those having less than 6 years of education with an existing illness and with a higher score on GDS-15. It was also higher for those who did not consume alcohol, did not get support at the emotional level, did not offer support at the emotional level and did not receive help at the instrumental level, compared with each counterpart category.

Table 1 shows the mean, range, median, correlation matrix and SD of the community-level social support indicators in the 44 districts. Spearman's correlation coefficients ranged from −0.11 to 0.44. The average proportion

Table 1 Characteristics and Spearman's correlation coefficient matrices for community-level social support indicators (N=44 school districts)

	Mean	SD	Minimum	Maximum	Spearman's rank correlation coefficient 1	2	3
1. Community-level receiving emotional support	89.9	2.0	82.7	93.5	–		
2. Community-level providing emotional support	83.1	2.2	76.1	88.6	−0.11*	–	
3. Community-level receiving instrumental support	94.0	1.6	91.3	97.6	0.44*	0.08*	–
4. Community-level providing instrumental support	91.9	2.1	85.6	97.9	−0.01	0.41*	0.26*

*P<0.05

of people receiving community level emotional support was 89.9%, with a range of 82.7%–93.5%. The proportion of people receiving community-level emotional support was moderately correlated with the proportion of people receiving instrumental support (ρ=0.44).

The results of the multilevel survival analyses (Model 1) for the onset of incident dementia with three sensitivity analyses models (Model 2, 3 and 4) are shown in table 2 and online supplemental table 4.

Regarding community-level social support, in Model 1, a significant association was observed between the onset of incident dementia and the proportion of people receiving community-level emotional support (HR=0.96; 95% CI=0.94 to 0.99). On the contrary, significant correlations or relationship between the onset of incident dementia and other community-level social support were absent. In Model 2 of a sensitivity analysis (excluding 1 year after baseline), significant correlations between the onset of incident dementia and receiving community-level emotional support (HR=0.97; 95% CI=0.94 to 0.99) remained. Model 3 (excluding 2 years after baseline) and Model 4 (excluding 3 years after baseline) showed similar results to Models 1 and 2 (online supplemental table 4). Regarding individual-level social support, in Model 1, the incidence of dementia was significantly associated with receiving individual-level emotional support (HR=0.83; 95% CI=0.73 to 0.94) as well as providing individual-level instrumental support (HR=0.76; 95% CI=0.66 to 0.89).

DISCUSSION

To our knowledge, this is the first study to evaluate community-level social support using multilevel survival analysis to investigate the onset of dementia in a large sample of older community-dwelling individuals. There was a prospective association between living in a community with a higher level of social support and a lower occurrence of dementia during the 10-year study period. However, only one of the community-level social support indicators was significantly associated with dementia onset. The outcome of this research may have significant implications for public health, that is, by suggesting potential practical implications useful for policymakers, family members and medical staff. Because previous intervention research indicated that promoting community through salon activity increased social support in the community,[22] providing such activities may be a practical

Table 2 Results of multilevel survival analyses for onset of incident dementia

	Model 1	Model 2 (1 year)
	n=11 032	n=10 780
Fixed effect	HR (95% CI)	HR (95% CI)
Community-level variables		
Rate of receiving emotional support*	0.96 (0.94 to 0.99)	0.97 (0.94 to 0.99)
Rate of providing emotional support*	0.99 (0.96 to 1.01)	0.99 (0.96 to 1.01)
Rate of receiving instrumental support*	1.01 (0.97 to 1.04)	1.01 (0.97 to 1.04)
Rate of providing instrumental support*	1.00 (0.97 to 1.03)	1.00 (0.97 to 1.02)
Random effects		
Community-level variance (SE)	0.06 (0.05)	0.04 (0.06)

HR adjusted for sex, age, living alone, marital status, education, present illness, GDS, smoking status, alcohol consumption, receiving emotional support, providing emotional support, receiving instrumental support and providing instrumental support. (The full version, including individual-level results, is shown in online supplemental table 4).
*HR for one-point increment of community-level social support (range: 0–100).
GDS, Geriatric Depression Scale.

solution to prevent the onset of dementia. Among older people, a 1% rise in receiving community-level emotional support correlated with an approximately 4% decrease in the incidence of dementia, irrespective of socio-demographic factors and health circumstances.

For individual-level social support, providing social support was significantly correlated with a lower risk for dementia. A previous study indicated that providing emotional and instrumental support at the individual level might be a risk factor for the onset of depression.[13] A previous study by Murata and colleagues[23] examined the association between individual-level social support and dementia development in a 10-year cohort. The results showed that receipt of support from friends and neighbours was associated with a lower risk of developing dementia for both men and women. Nonetheless, people who were providing social support might be less likely to develop dementia.

In the present study, among the four kinds of community social support, only community-level emotional support affected the onset of incident dementia, even after adjustment for individual-level social support. Two reasons might contribute to this finding. First, a community where people receive high emotional support from each other might be a place where older people are less likely to feel lonely. Indeed, loneliness was found to predict dementia in a previous study.[24] Second, because depression was a risk factor for developing dementia,[25] abundant community-level emotional support may mitigate the risk of depression, thereby decreasing the incidence of dementia.[26]Therefore, a community-level indicator of receiving emotional support may be associated with the onset of dementia.

Community social support may be an element of social capital or community-level social relationships. For this reason, several plausible pathways between receiving community-level emotional support and onset of incident dementia were found in the current study. First, community-level social support may influence people's health by shaping health-associated behaviours. This may be done through faster dissemination of health-related information or by increasing the probability of people taking up healthy standards of behaviour and moderating behaviours that have negative effects on health. Second, social support may shape health by enhancing the accessibility of local services and facilities. Social involvement of older people may be fostered by accessing services, including transportation, recreational spaces, and community hubs may foster, thus, restricting or arresting the development of dementia. Third, community social support has the potential to foster good cognitive health by minimising psychological distress. Fourth, places with higher social support at the community level generate greater egalitarian political involvement trends. This may lead to the execution of policies that ensure the safety of community members. In addition, according to a systematic review of social capital including studies mainly conducted in western countries, most of the intervention studies in the last two decades have focused on individual-level changes, with a dearth of studies examining community-level changes.[27] Furthermore, there are few longitudinal studies, even observational studies, that have produced dementia outcomes. Therefore, the results of this study can contribute to the social capital research agenda for developing intervention research at the community level.

It is critical to mention the possible limitations associated with the present study. First, the response rate to the survey (52.1%) could affect the generalisability of the results. However, this response rate was higher than the census conducted by the government (41.8% response rate in the postal survey 2020).[28] Second, the dementia outcome is a nationally standardised scale used by public long-term care insurance, but it is not a clinical diagnosis. Third, there was no information about the type of dementia diagnoses (for instance, Alzheimer's disease, cerebrovascular dementia, or dementia with Lewy bodies). Fourth, the sample did not fully reflect the older population in Japan because the study subjects were recruited from a single prefecture. Therefore, the findings cannot be generalised to urban areas or places where the population has distinct characteristics. Finally, other community-level social relationships, including social capital, were not evaluated. However, we plan to assess a wider range of community-level factors in subsequent studies.

CONCLUSIONS

The results of this study showed that a higher level of social support at the community level is related to a lower incidence of dementia after adjusting for individual-level social support among older individuals. A community-level social support indicator (an aggregated value of receiving emotional support) showed a significant association with dementia onset. The present prospective study suggests that receiving emotional support at the community level may result in a lower level of incident dementia among community-dwelling older individuals in Japan.

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TTa developed the research idea, participated in the study design, cooperated in the statistical analysis and revised the manuscript. JA and MS assisted in the data analysis and reviewed the manuscript. TTs and YS acquired data, collaborated in statistical analysis and revised the manuscript. As the lead researcher of the JAGES project, KK helped to conceptualise the study. The final manuscript was read and approved by all authors.

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