



## Association between social participation and incident risk of functional disability in elderly Japanese: The Ohsaki Cohort 2006

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### ABSTRACT

**Background:** Although several longitudinal studies have examined the relationship between social participation and incident functional disability, the related mechanisms have remained unclear. The aim of this study was to examine the mechanisms linking social participation to incident functional disability.

**Methods:** We analyzed follow-up data for 11,992 older adults ( $\geq 65$  years) participating in a community-based, prospective cohort study covering a 9-year period. At the baseline, the subjects were asked about three types of participation in community activities (volunteering, hobbies, and neighborhood associations) and the frequency of their participation. Data on incident functional disability were retrieved from the public Long-term Care Insurance database. The Cox model was used to estimate the multivariate-adjusted hazard ratios of incident functional disability. We then conducted mediation analysis to assess the magnitude of the mediating effect.

**Results:** Among 84,760 person-years of follow-up, there were 3,984 cases of incident functional disability. The hazard ratio was 0.79 (95% CI: 0.73–0.86) for participating in one type of activity, 0.82 (95% CI: 0.74–0.90) for two types of activity and 0.70 (95% CI: 0.64–0.77) for three types of activity in comparison with no participation in any activity. Among the estimated mediating effects, cognitive activity accounted for 9.3%, time spent walking for 8.3%, psychological state for 4.6%, and social support for 2.8% of the reduced risk of incident functional disability.

**Conclusion:** The results of this population-based cohort study indicate that cognitive activity and time spent walking are important mechanisms linking social participation to incident functional disability.

### 1. Introduction

As the number of older people requiring long-term care is increasing, prevention of functional disability is becoming a socially important issue [1]. For individuals as well as society as a whole, factors that can help to prevent functional disability are of interest. Social participation has been shown to be a factor that can help to protect against health problems (assessed in terms of mortality [2], morbidity [3] and self-reported health [4]), and may have beneficial effects in reducing the risk of functional disability.

Several longitudinal studies have examined the relationship between social participation and incident functional disability [5–7]. These showed that greater social participation was related to a lower risk of incident functional disability [5,6]. In terms of the type of social participation, the results for each of “hobby”, “sports” and “volunteering” were consistent, but this was not the case for other types of

activity (e.g. political organizations or groups, industrial or trade associations, religious organizations or groups, citizen or consumer groups and senior citizen clubs) [6,7]. Although, overall, these longitudinal studies have indicated that social participation may help to reduce the risk of incident functional disability, more studies are needed to confirm these findings [5–7].

Moreover, no previous study has investigated the variables that link social participation to functional disability. Some physical and psychosocial pathways have been discussed in previous studies [5–7]. With regard to the physical pathway, physical activities inherent to social participation reinforce the motor function required to maintain functional independence. In terms of psychosocial pathway, social participation allows individuals to develop social relationships, which leads to acquisition of social support and recognition of social roles, and may even act as a buffer against stress. Previous studies have not addressed cognitive aspects of the relationship between social participation and

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incident functional disability. Since an association between social activity and cognitive decline has been reported [8–11], and the level of cognitive function may predict functional disability in later life [12], it may be one of the factors playing an important role in the relationship between social participation and incident functional disability.

The purpose of this study was to examine whether physical activity, psychosocial aspects and cognitive activity might play an intermediate role in the relationship between social participation and incident functional disability.

## 2. Methods

### 2.1. Study Cohort

The design of the Ohsaki Cohort 2006 Study has been described in detail elsewhere [13]. In brief, the source population for the baseline survey comprised all older citizens resident in Ohsaki City, Miyagi Prefecture, northeastern Japan, on December 1, 2006, i.e. 31,694 men and women aged  $\geq 65$  years. The survey included questions about recent participation in community activities, as well as items on history of disease, physical pain, blood pressure, smoking, alcohol drinking, body weight, height, job status, education level, psychological distress score, social support, time spent walking per day, cognitive activity, physical activity, and the motor and cognitive function scores of the Kihon Checklist.

The baseline survey was conducted between December 1, 2006, and December 15, 2006, and the follow-up survey was conducted between December 16, 2006, and November 30, 2015. A questionnaire was distributed by the heads of individual administrative districts, and then collected by mail. For this analysis, 23,091 individuals who provided valid responses formed the study cohort. We excluded 6,333 individuals who did not provide written consent for review of their Long-term Care Insurance (LTCI) information, 1,979 persons who had already been certified as having a disability by the LTCI before the starting date of follow-up (March 30, 2007), 5 persons who had died or moved before the starting date of follow-up, and 2,782 persons for whom the information about social participation had been unavailable. Thus 11,992 responses were analyzed for the purpose of this study.

### 2.2. Incident functional disability

The endpoint of this study was incident functional disability, which was defined as LTCI certification. The primary outcome was LTCI certification (Support Level 1 or higher), in which deaths without LTCI certification were treated as censored.

We obtained a data set that included information on the date of LTCI certification, death, or emigration from Ohsaki City Government based on an agreement about the secondary use of data. With regard to LTCI certification, information on care level was also provided. All data were transferred from the Ohsaki City Government under the agreement related to Epidemiologic Research and Privacy Protection yearly each December.

### 2.3. LTCI system in Japan

In this study, we defined incident functional disability as certification for LTCI in Japan, which uses a nationally uniform standard of functional disability. LTCI is a mandatory form of social insurance to assist the daily activity of frail elderly individuals [1,14–18]. Everyone aged  $\geq 40$  years pays premiums, and everyone aged  $\geq 65$  years is eligible for formal caregiving services. When a person applies to the municipal government for benefits, a care manager visits his or her home and assesses the degree of functional disability using a questionnaire developed by the Ministry of Health, Labor, and Welfare. Then, the municipal government calculates the standardized scores for physical and mental function on the basis of the questionnaire and

assesses whether the applicant is eligible for LTCI benefits (certification). There are a total of 74 items in the questionnaire, and these are classified into six dimensions: motor function (13 items), activity of daily living (12 items), cognitive function (9 items), mental and behavioral disorders (15 items), adaptation to social life (6 items), and use of medical procedures (12 items). If a person is judged to be thus eligible, the Municipal Certification Committee decides on one of seven levels of support, ranging from Support Level 1 to Support Level 2, and from Care Level 1 to Care Level 5. In brief, LTCI certification levels are defined as follows. Support Level 1: “limited in instrumental activities of daily living but independent in basic activities of daily living (ADLs)”; Care Level 2: “requiring assistance in at least one basic ADL task”; Care Level 5: “requiring care in all ADL tasks”. A community-based study has shown that levels of LTCI certification are well correlated with ability to perform activities of daily living, and with Mini-Mental State Examination scores [19]. LTCI certification has already been used as a measure of incident functional disability in elderly individuals [20–22]. In the follow-up survey, we used the information on the date of LTCI certification in this analysis.

### 2.4. Social Participation

At the baseline, subjects were asked about current social participation, which was classified into three categories: “Volunteering”, “Hobby activities” and “Activities in neighborhood associations”. We asked subjects “How often do you participate in community activities?” and gave them some instruction about the types of such activities. Volunteering includes community service activities, beautification activities, crime prevention, teaching for children, providing support for child care, and so on. Hobby activities include gateball, karaoke, life-long learning, and so on. Activity in neighborhood associations includes residents associations, senior clubs, associations for children and women, and so on. In each category, subjects were also asked about their frequency of participation: “do not participate”, “less than once per month”, “1–3 times per month” or “more than once per week”. After we had collected the information about participation in social activities, we established the “number of types of social participation” as a parameter to indicate how many of the socialization categories (“Volunteering”, “Hobby activities” and “Activities in neighborhood associations”) the subjects were participating in, and categorized the responses as “none”, “one activity”, “two activities” or “three activities”.

### 2.5. Covariates

Body mass index was calculated as the self-reported body weight (kg) divided by the square of the self-reported body height (m).

The Kessler Psychological Distress Scale (K6) was used as an indicator of psychological distress [23,24]. Respondents were asked about their mental status over the last month by using six questions. Total point scores ranged from 0 to 24. As the optimal cutoff point for mental illness in the validation study, we classified individuals with scores of  $\geq 13$  as having psychological distress [24].

The Kihon Checklist was developed by the Ministry of Health, Labor, and Welfare of Japan to predict functional decline in community-dwelling elderly individuals. With regard to the motor function score in the Kihon Checklist, respondents were asked about their current motor function status by using five binary questions yielding total point scores ranging from 0 to 5. As the optimal cutoff point for functional decline suggested in the validation study, we classified individuals with scores of  $< 3$  as having better motor function [25]. Regarding the cognitive function score in the Kihon Checklist, respondents were asked about their current cognitive function status by using three binary questions yielding total points scores ranging from 0 to 3. The validity of the cognitive function score in the Kihon Checklist had been confirmed in a previous study using the Clinical Dementia Rating as a

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