SSM - Population Health 22 (2023) 101410

Contents lists available at ScienceDirect

SSM - Population Health

journal homepage: www.elsevier.com/locate/ssmph

Does social participation foster social support among the older population in Japan? A three-year follow-up study from the Japan gerontological evaluation study

Gemmei Iizuka [a,b,c,*], Taishi Tsuji [c,d], Kazushige Ide [c], Ryota Watanabe [c,e,f], Katsunori Kondo [a,c,e]

[a] Advanced Preventive Medical Sciences, Chiba University Graduate School of Medical and Pharmaceutical Sciences, 1-33, Yayoicho, Inage-ku, Chiba-shi, Chiba, 263-8522, Japan
[b] Seibo International Catholic Hospital Family Medicine Residency, 2-5-1, Nakaochiai, Shinjuku-ku, Tokyo, 161-8521, Japan
[c] Center for Preventive Medical Sciences, Chiba University, 1-33, Yayoicho, Inage-ku, Chiba-shi, Chiba, 263-8522, Japan
[d] Faculty of Health and Sport Sciences, University of Tsukuba, 3-29-1, Otsuka, Bunkyo-ku, Tokyo, 112-0012, Japan
[e] Center for Gerontology and Social Science, Research Institute, National Center for Geriatrics and Gerontology, 7-430, Morioka-cho, Obu-shi, Aichi, 474-8511, Japan
[f] Center for Well-being Society, Nihon Fukushi University, 5-22-35, Chiyoda, Naka-ku, Nagoya-shi, Aichi, 460-0012, Japan

1. Introduction

Social support, which refers to a broad construct that describes the network of social resources that an individual perceives (Zhou, 2014), has been reported as protective for health outcomes, such as mortality, decline in cognitive function, and depression, in many systematic reviews of cohort studies (Holt-Lunstad et al., 2010; Kelly et al., 2017; Wang et al., 2018). Regardless of the type of social support, people who perceived social support had less likelihood of mortality than those who did not (Holt-Lunstad et al., 2010). As for cognitive function, there was a significant association between emotional support and improved outcomes on global cognition, which was measured using global or composite measures of cognitive function (Kelly et al., 2017). Furthermore, people with depression who perceived their social support as poorer had worse outcomes in terms of symptoms, recovery, and social functioning (Wang et al., 2018). Thus, fostering social support is regarded as beneficial for health.

Social support is typically divided into subtypes, such as emotional support, instrumental support, appraisal support, and informational support (Berkman et al., 2000). Emotional support is related to the amount of "love and caring, sympathy and understanding, or esteem and value available from others (Thoits, 1995)." Instrumental support refers to the provision of financial aid, tangible goods, or services (Berkman et al., 2000). Emotional support, appraisal support, and informational support are often challenging to disaggregate (Berkman et al., 2000). Thus, in the previous study, social support was divided into two broad types, emotional sustenance and active coping assistance, or emotional support and instrumental support (Shiba et al., 2020; Thoits, 2011).

Globally, older people are likely to lose their spouses and their family members and get socially isolated (World Health Organization, 2007). The number of older people living alone is increasing and will certainly continue to increase in the future (Snell, 2017). In Japan, living alone is the most common household type for older people in 2020 (National Institute of Population and Social Security Research, 2018). Thus, promoting social support, particularly among outside families in older people, is substantial for their health, and measures and policies on how to foster social support should be developed. Some studies focused on social support with outside family among older people to assess whether it was beneficial for health outcomes. Receiving emotional support from friends or neighbors was protective against dementia, and providing emotional support to friends or neighbors was also protective for men (Murata et al., 2019). Furthermore, giving social support to outside families, emotional or instrumental, was associated with fewer depressive symptoms (Tsuboi et al., 2016). Emotional support could more strongly affect health outcomes such as cognitive function than instrumental support (Kelly et al., 2017). Although encouraging social support with outside family is significant for older people, how to do it has been unclear.

To foster social support, it can be significant to encourage participation in social activities. Social participation is one of the core indicators of "age-friendly cities" and is considered necessary for the promotion of "Healthy Aging" by the World Health Organization in recent years (World Health Organization, 2007). Many cross-sectional studies have revealed that social participation was positively

* Corresponding author. Advanced Preventive Medical Sciences, Chiba University Graduate School of Medical and Pharmaceutical Sciences, 1-33, Yayoicho, Inage-ku, Chiba-shi, Chiba, 263-8522, Japan.
E-mail addresses: genmei0330@gmail.com (G. Iizuka), tsuji.taishi.gn@u.tsukuba.ac.jp (T. Tsuji), ide.k@chiba-u.jp (K. Ide), watanabe-r@n-fukushi.ac.jp (R. Watanabe), kkondo@chiba-u.jp (K. Kondo).

https://doi.org/10.1016/j.ssmph.2023.101410
Received 29 September 2022; Received in revised form 27 March 2023; Accepted 22 April 2023
Available online 24 April 2023

associated with social support (Amirkhosravi et al., 2015; He et al., 2017; Hosseingholizadeh et al., 2019). In addition, two scoping reviews have been published. One is about children and youth with disabilities, and it includes cross-sectional and qualitative descriptive studies. However, it did not examine longitudinal studies or older people (Anaby et al., 2013). The other examined the association of neighborhood environment between mobility and social participation and included several cross-sectional, qualitative studies and one longitudinal study (Levasseur et al., 2015). This longitudinal study evaluated 283 patients discharged from acute care and inpatient rehabilitation hospitals. Results showed that a higher social support was associated with social participation after 6 months of adjusting for age, sex, race, educational attainment, disease severity, functional activity, and applied cognition (Keysor et al., 2006).

Previous studies have shown that social participation is commonly affected by the surrounding people and neighborhood environmental factors, including social support, distance to the location of participation, and neighborhood safety (Levasseur et al., 2015). However, there can be an opposing oriented association. Face-to-face contact with kin living apart, friends, and neighbors is likely associated with social support (Kobayashi et al., 2011). Moreover, various types of social participation may provide support that is exchanged with others (Levasseur et al., 2010). Three studies have supported the possibility that social participation fostered social support. First, the population-based cohort study indicated that social participation could increase social support, which in turn decreased the risk of functional disability in a longitudinal study (Otsuka et al., 2018). Second, in a town in Japan, more than the half of people who participated in salons, where the town's senior residents could congregate and participate in social activities, stated that each social support they perceived increased after they began to participate in them (Takeda et al., 2009). Third, the proportion of older people with social support increased by supporting the establishment and operation of community gathering places in 16 junior high school districts in one city in Japan (Tsuji et al., 2022).

However, the three previous studies did not consider social support at baseline and include many with social support at baseline (Otsuka et al., 2018; Takeda et al., 2009; Tsuji et al., 2022). It is also unclear what type and frequency of social participation are beneficial to foster social support. The relationship between social participation and functional decline depended on the type of organization they participated in and on the frequency of participation (Ide et al., 2020; Kanamori et al., 2014; Otsuka et al., 2018), and emotional support had a stronger relationship with health outcomes, such as cognitive function and dementia, than instrumental support (Kelly et al., 2017; Murata et al., 2019). Therefore, this longitudinal study aimed to clarify whether social participation fostered social support among older people who lack social

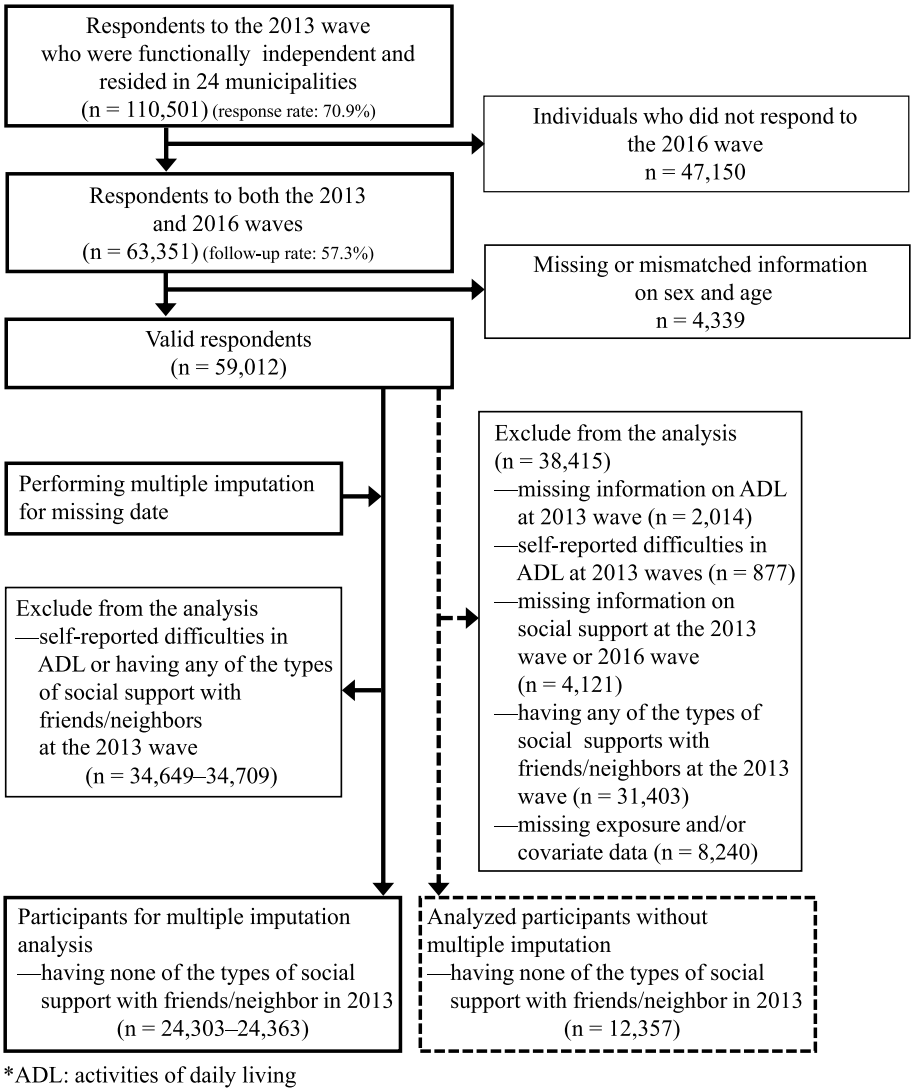

Fig. 1. Flowchart of analyzed participants
*ADL: activities of daily living.

support from their friends or neighbors compared with nonparticipation, taking into account the ways of social participation and types of social support. This study clarifies whether the promotion of social participation is beneficial in older people as a measure to enrich social support, which have been revealed as beneficial for health outcomes.

2. Materials and methods

2.1. Study participants

We analyzed the 3-year prospective cohort data from the Japan Gerontological Evaluation Study (JAGES). JAGES is one of the few population-based gerontological repeated surveys and follow-up studies investigating the effect of social determinants of health and social environment among older people in Japan (Kondo, 2016; Kondo & Rosenberg, 2018). Participants were not provided with a certificate regarding eligibility to receive the benefit of public long-term care insurance services. For the present study, we used a longitudinal data from the 2013 and 2016 waves and indicated a flowchart of analyzed participants in Fig. 1. Among 110,501 individuals (response rate, 70.9%) who responded to the 2013 wave out of 155,759 individuals, data were collected from 63,351 people (follow-up rate, 57.3%) aged ≥65 years who resided in 24 municipalities across Japan. In the survey, complete enumeration was conducted in 12 smaller municipalities, and a random sampling method was used in 12 larger municipalities. Of the total of 59,012 valid respondents whose sex and age are clear, we selected participants based on the following inclusion criteria: no limitations in activities of daily living (ADL; i.e., walking, toileting, and bathing) and no social support, emotional and instrumental support, from friends or neighbors at the 2013 wave, and no missing exposure and/or covariate data.

2.2. Outcome

The dependent variables were the following four types of social support with friends or neighbors at the 2016 wave: receiving emotional support, providing emotional support, receiving instrumental support, and providing instrumental support (Murata et al., 2019; Tsuboi et al., 2016). We focused on respondents obtaining new social support from friends or neighbors although they did not have it in 2013. Because this study focused on social support, which is a possible intervention, among neighbors and friends, we did not include a measure of social support comprising 16 questions (MOS-SSS) that have been validated in previous studies (Sherbourne & Stewart, 1991). The questionnaire in this study asked the following questions regarding receiving emotional support: "Do you have someone who listens to your concerns and complaints? Circle all that apply." Respondents were given the following seven choices: "Spouse; " "Children living together; " "Children or relatives living apart; " "Brothers/sisters, relatives, parents, grandchildren; " "Neighbors; " "Friends; " and "Others." We regard respondents who have circle of friends or neighbors as receiving emotional support from friends or neighbors. We checked the questionnaires to determine if the respondents provided instrumental support: "Do you look after someone when he/she is sick and confined to a bed for a few days?" Similarly, we evaluated the four types of social support using the questionnaires. Each of these four questions in the questionnaires are associated with dementia and depression based on previous reports (Murata et al., 2019; Tsuboi et al., 2016). In addition, they are used to confirm the status of mutual aid via the Public Survey of Long-Term Care Prevention and Needs in Spheres of Daily Life (the Needs Survey) conducted by the Ministry of Health, Labour and Welfare in Japan (Ministry of Health Labour and Welfare, 2016a).

Answers to the categories for social support were coded dichotomously as "social support available with friends or neighbors (having any of these four social support types)" (coded as 1) and "no social support available with friends or neighbors (having none of these four social support types)" (coded as 0) (Murata et al., 2019; Tsuboi et al., 2016). For the analysis by type of social support, the gain for each of the four social support was used as the dependent variable. To validate the quantity–response association, we assessed the number of available social support among the four types of social support and created a variable from 0 to 4 (Murata et al., 2019).

2.3. Independent variable

We defined 'social participation' as taking part in community activities (World Health Organization, 2007) focusing on the type and frequency of social participation. The independent variable was social participation at the 2013 wave. For this study, social participation was defined as participation in community organizations and classified into eight types: sports groups or clubs (sports groups), hobby activity groups (hobby activities), volunteer groups, neighborhood associations or residents' associations (community associations), senior citizen clubs, study or cultural groups (study groups), long-term care prevention or health-promoting activities (prevention activities), and activities to teach skills or pass on experiences to others (teaching activities). Senior citizen clubs are peculiar to Japan and offer various activities, including group activities, such as sports, hobbies, cultural activities, and performing arts. Prevention activities are facilitated by the Ministry of Health, Labour and Welfare in Japan for healthy living at home without nursing care (Ministry of Health Labour and Welfare, 2016b).

Participation in these activities was assessed using the following question: "How often do you participate in the following clubs and groups?" Respondents were given the following six choices: "almost every day," "twice or thrice a week," "once a week," "once or twice a month," "a few times a year," and "never." The response was categorized as "participants" if individuals selected any of the five options from "a few times a year" to "almost every day" and "nonparticipants" if they chose "never" (Ide et al., 2020).

The total number of types of organizations each respondent participated in was tallied and categorized as 0 (nonparticipants), 1, 2, or ≥3 organizations (Ide et al., 2020).

The frequency of social participation was categorized as "A few times a year" if individuals selected "a few times a year," "once or twice a month" if they selected "once or twice a month," and "more than once a week" if they selected "almost every day," "twice or thrice a week," or "once a week."

2.4. Confounders

Based on previous studies on social support and health outcomes (Murata et al., 2019; Tsuboi et al., 2016), 11 factors, that is, age, sex, annual equivalized income, educational attainment, marital status, occupational status, self-reported medical conditions, smoking, alcohol consumption, instrumental ADL (IADL), and depression, at the 2013 wave were used as confounders that may be correlated with social participation and social support. IADL was measured using the five-item Tokyo Metropolitan Institute of Gerontology Index of Competence (Koyano et al., 1991). Respondents whose total IADL score was ≤4 were defined as dependent, and those with a total score of 5 as independent (Fujihara et al., 2019). Depression was assessed by the 15-item geriatric depression scale (GDS-15), an instrument to screen depression among community-living older persons (Yesavage et al., 1982).

We considered the influence of the total number of types of other groups not focused on in the analysis (Hikichi et al., 2017). For example, when we conducted the analysis focusing on participants in sports groups, we considered the total number of types of groups (0–7) that each respondent participated in among the seven types of groups other than sports groups. When older people participated in one group, they would also participate in another group (Hayashi et al., 2019), and further social participation could be related to the likelihood of obtaining social support. Therefore, the total number of types of other

groups (0–7) was regarded as both the confounder and intermediate variable between social participation and social support.

2.5. Statistical analysis

Potential bias due to missing data should be addressed. We assumed that data were missing at random. That is, the missing mechanism depends on the observed data, and multiple imputation was performed to impute incomplete variables (van Ginkel et al., 2020). We created 20 imputed datasets and combined the following effect estimates using Rubin's rule (Rubin, 1996).

First, we compared the respondents' characteristics between correspondents before multiple imputation (n = 24,303–24,363) after excluding those with ADL impairments and social support with friends or neighbors versus those with ADL impairments and/or social support with friends or neighbors or missing on it at baseline. Continuous and categorical variables were assessed using t-tests and chi-squared tests, respectively. We additionally present the characteristics of complete cases (i.e., without missing data and/or ADL impairments and/or social support) at baseline.

Second, we employed three different Poisson regression models (the total number of types of organizations, each type of social participation, and the frequency of each social participation) to calculate the risk ratios (RRs) and 95% confidence intervals (CIs) of obtaining social support with friends or neighbors after 3 years. Because more than 10% of the subjects fell into the dependent variable of obtaining social support, a generalized linear model with a log link and a Poisson distribution and with robust standard errors was used for multivariate analysis to avoid overestimating the relative risk (Knol et al., 2012). We employed the analysis for the total number of types of organizations each respondent participated in and conducted a trend test and set zero as the reference category, calculating p for trend, which indicates that the fostering of social support increases monotonically with the number of social participation. Further, we conducted a linear regression analysis to examine the quantity–response association from multiple perspectives, with the total number of the four types of social support used as the objective variable. In the analysis of each type of groups they participated in and the frequency of each type of social participation, we introduced the eight types of social participation separately, and the reference category was set to "never."

Finally, to examine which type of social support was enriched by social participation, we employed a Poisson regression model to calculate RRs and 95% CIs of obtaining receiving/providing emotional social support and receiving/providing instrumental social support. In this model, nonparticipation in the organization was set as the reference category.

In the abovementioned Poisson regression analysis, we performed with the simultaneous forced entry of sex, age, equivalent income, educational attainment, marital status, self-reported medical conditions, smoking, alcohol consumption, IADL, and depression as covariates (Model 1). We adjusted for the total number of types (0–7) of organizations each respondent participated in, excluding the group we focused on in the analysis (Model 2). Stata 16.0 software (Stata Corp. LLC, College Station, TX, USA) was used in the statistical analysis with a significance level of 5%.

Ethical approval

Ethical approval for the study was obtained from XXX (anonymization). JAGES participants were informed that participation in the study was voluntary and fulfilling and returning the questionnaire via mail implied their consent to participate in the study.

3. Results

The number of samples meeting criteria for analysis varied from 24,303 to 24,363 in each multiple imputation dataset. Table 1 presents the respondents' characteristics (n = 24,936) before multiple imputation, and after excluding those with ADL impairments and social support at baseline from the total of 59,012 valid respondents versus the respondents with ADL impairments and/or social support or missing on it at baseline (n = 34,076). We identified respondents with missing data for types of social participation (21.2%), annual equivalized income (17.0%), geriatric depression scale (15.4%), employment status (8.5%), social support in 2013 (4.3%) and 2016 (4.3%). Respondents without ADL impairments and social support at baseline (n = 24,936) were more likely to be male, be older, be married, be smokers, be drinkers, have a lower annual equivalized income and educational attainment, and a lower IADL scale, a higher geriatric depression scale, tended to participate in fewer groups. Of the 24,936 the correspondents before multiple imputation, 29.6% had obtained social support after 3 years. As for each type of social support, 22.6% of the analyzed participants received emotional support, 24.3% provided emotional support, 1.2% received instrumental support, and 1.7% provided instrumental support after 3 years. Supplementary Table 1 shows the characteristics of the complete case sample (n = 12,357) used for the sensitivity analysis.

The following tables are all based on the multiply imputed datasets considering potential bias due to missing data, and a complete case analysis was performed as a sensitive analysis. Table 2 presents the results of the Poisson regression model analysis of the total number of types of organizations each respondent participated in and obtained social support, by analyzing multiply imputed data sets (n = 24,303–24,363). In Model 1, which we adjusted for confounding factors, a dose–response relationship was noted with progressively higher RRs as the number of different types of organizations increased from 1 for reference to 1.74 for ≥3 (p for trend <0.001). Even participating in just one group made older people have a significantly higher possibility to obtain social support. As shown in Supplementary Table 2, a linear regression analysis of the degree to which social support by analyzing multiply imputed data (n = 24,303–24,363) was obtained also showed a dose–response association.

As shown in Table 3, the association between the type of groups attended and acquisition of social support by analyzing multiply imputed data sets (n = 24,303–24,363) is shown. In all types of the eight groups, participants were related to the higher acquisition of social support compared to nonparticipants in Model 1. Our results indicated that social support was fostered among older people regardless of the type of organization they participated in. Even after adjustment for the total number of other groups they participated in, participation in sports groups (RR, 1.12), hobby activities (1.23), volunteer groups (1.13), community associations (1.13), and teaching activities (1.09) was significantly associated with obtaining social support.

Supplementary Table 3 shows the results of the Poisson regression model analysis on the frequency of social participation in each of the eight groups and acquisition of social support after 3 years, by analyzing multiply imputed data sets (n = 24,303–24,363). In Model 1, participation with any frequency in each type of the eight groups had a higher possibility to obtain social support than nonparticipation. In Model 2, participation with any frequency in hobby activities and community associations showed a higher possibility of obtaining social support. In these groups, even those with infrequent participation, only a few times a year, had a higher chance to obtain social support regardless of their participation in other groups.

In Table 4 and Supplementary Table 4, the association between each type of group they participated in and each type of social support obtained by analyzing multiply imputed data sets (n = 24,303–24,363) is shown. In Table 4, although 5 of 8 organizations were related to the acquisition of both receiving/providing instrumental social support, 8 of 8 organizations were related to the acquisition of both receiving/providing emotional social support.

These abovementioned relationships were similar and augmented when using the complete case analysis (n = 12,357).

Table 1
Respondents' characteristics at baseline.

Variable	Total (n = 59,012)			Respondents without ADL impairment and social support at baseline a) (n = 24,936)			Respondents with ADL impairment and/or social support or missing on it at baseline (n = 34,076)			p-Value
	Number of valid respondents	Mean/n	SD/%	n	Mean/n	SD/%	n	Mean/n	SD/%	
Female, n (%)	59,012	32,228	54.6	24,936	9792	39.3	34,076	22,436	69.6	<0.001
Age (years)	59,012	73.1	5.6	24,936	73.6	5.9	34,076	72.7	5.4	<0.001
Annual equivalized income (million yen)	48,994	2.41	1.59	20,590	2.34	1.56	28,404	2.47	1.62	<0.001
Educational attainment (years), n (%)										
<10	58,061	23,318	40.2	24,482	10,391	42.4	33,579	12,927	38.5	<0.001
10-12		22,396	38.6		8935	36.5		13,461	40.1	
≥13		12,347	21.3		5156	21.1		7191	21.4	
Marital status, n (%)										
Married	57,435	43,158	75.1	24,164	19,432	80.4	33,271	23,726	71.3	<0.001
Single		14,277	24.9		4732	19.6		9545	28.7	
Employed, n (%)	54,024	13,942	25.8	22,757	5890	25.9	31,267	8052	25.8	0.734
Self-reported illness-conditions, n (%)	55,362	46,259	83.6	23,335	19,543	83.8	32,027	26,716	83.4	0.297
Smoking, n (%)										
Never smoked	58,201	43,695	75.1	24,549	16,849	68.6	33,652	26,846	79.8	<0.001
Past smoker		9075	15.6		4990	20.3		4005	12.1	
Current smoker		5431	9.3		2710	11.0		2721	8.1	
Alcohol consumption, n (%)										
Never drank	58,284	34,978	60.0	24,601	13,372	54.4	33,683	21,606	64.2	<0.001
Past drinker		2535	4.4		1361	5.5		1174	3.5	
Current drinker		20,771	35.6		9868	40.1		10,903	32.4	
IADL scale (score)	57,623	4.78	0.63	24,192	4.68	0.73	33,431	4.84	0.52	<0.001
Geriatric depression scale (score)	49,901	2.93	3.02	20,906	3.29	3.17	28,995	2.67	2.89	<0.001
Number of types of social participation (0–8)	46,500	1.93	1.94	19,909	1.42	1.65	26,591	2.31	2.05	<0.001
Participation in sports groups, n (%)	50,499	17,078	33.8	21,236	5437	25.6	29,263	11,641	39.8	<0.001
Participation in hobby activities, n (%)	51,092	22,998	45.0	21,326	6989	32.8	29,766	16,009	53.8	<0.001
Participation in volunteer groups, n (%)	49,833	11,207	22.5	21,011	3158	15.0	28,822	8049	27.9	<0.001
Participation in senior citizen clubs, n (%)	51,201	11,299	22.1	21,482	3957	18.4	29,719	7342	24.7	<0.001
Participation in community associations, n (%)	50,791	21,669	42.7	21,337	7966	37.3	29,454	13,703	46.5	<0.001
Participation in study groups, n (%)	50,152	8313	16.6	21,073	2034	9.7	29,079	6279	21.6	<0.001
Participation in prevention activities, n (%)	50,414	7982	15.8	21,152	2004	9.9	29,262	5898	20.2	<0.001
Participation in teaching activities, n (%)	50,163	6008	12.0	21,072	1493	7.1	29,091	4515	15.5	<0.001

IADL, instrumental activity of daily living.
a) Multiple imputation was performed in the main regression analysis to impute incomplete variables.

Table 2
Total number of types of social participation and obtaining social support by analyzing multiply imputed data sets (n = 24,303–24,363).

Total number of types of organizations	Crude		Model 1 a)	
	RR	95% CI	RR	95% CI
0	1.00 Ref.		1.00 Ref.	
1	1.30**	1.23–1.39	1.29**	1.21–1.37
2	1.47**	1.38–1.57	1.46**	1.37–1.56
≥3	1.77**	1.68–1.87	1.74**	1.65–1.84
Trend p	p < 0.001		p < 0.001	

RR, risk ratio; CI, confidence interval; Ref, reference; *p < 0.05, **p < 0.001.
Note: Estimated sample varies across imputations.
a) Model 1 is adjusted for sex, age, annual equivalized income, educational attainment, marital status, occupational status, self-reported medical conditions, smoking and alcohol consumption, and instrumental activities of daily living and depression.

4. Discussion

To the best of our knowledge, this is the first longitudinal study to indicate that older people who had no social support from friends or neighbors are more likely to subsequently increase in social support if they participate in some groups. In this study, we examined the relationship between obtaining social support and social participation from the perspective of the number of types, type, and frequency of social participation in a prospective cohort study. First, a dose–response relationship was seen with a progressively higher possibility of increasing social support as the number of different types of social participation increased, implying that social participation was beneficial to foster social support. As for the type of social participation, it had the advantage of increasing social support to participate in any of the eight organizations and even once a year. Second, more types of social participation were found to be increased in emotional support than in instrumental support.

4.1. Number of types and types of social participation

Isolated older people, who contacted people other than cohabitant families less frequently, were less likely to have social support (Kobayashi et al., 2011). Participation in groups where diverse people come would provide older people opportunities to meet someone and have acquaintance with him/her, which is called weak ties (Granovetter, 1973). Furthermore, group-based interventions for alleviating social isolation are more effective than one-to-one interventions (Dickens et al., 2011). Thus, older people could have opportunities to gain weak ties and even social support from friends or neighbors as they participated in any of the eight groups in this study. By participating in various types of groups, older people were probably able to meet a diverse range of people. In the previous study, it is indicated that social support could be an important mechanism linking social participation to incident functional disability (Otsuka et al., 2018). This study, which showed a dose–response relationship between social participation and social support, provided new evidence for the previous study.

Regarding the type of organization, even though we adjusted for the number of organizations in which older people participated, which is considered as the intermediate variable and confounder (Hayashi et al., 2019), 5 of 8 organizations influenced the acquisition of social support; participating in sports groups, hobby activities, volunteer groups,

Table 3
Type of social participation and obtaining social support by analyzing multiply imputed data sets (n = 24,303–24,363; reference, non-participation in each organization).

Type of groups	Crude		Model 1 a)		Model 2 b)	
	RR	95% CI	RR	95% CI	RR	95% CI
Sports groups	1.38**	1.32–1.44	1.34**	1.29–1.40	1.12**	1.06–1.17
Hobby activities	1.47**	1.41–1.54	1.43**	1.37–1.49	1.23**	1.17–1.30
Volunteer groups	1.39**	1.33–1.45	1.39**	1.33–1.45	1.13**	1.08–1.20
Senior citizen clubs	1.26**	1.20–1.33	1.30**	1.23–1.36	1.05	0.99–1.11
Community associations	1.26**	1.21–1.31	1.28**	1.23–1.33	1.13**	1.09–1.18
Study groups	1.35**	1.35–1.42	1.27**	1.21–1.34	1.01	0.95–1.07
Prevention activites	1.35**	1.28–1.42	1.30**	1.23–1.36	1.02	0.96–1.08
Teaching activities	1.35**	1.28–1.43	1.34**	1.28–1.42	1.09*	1.03–1.16

RR, risk ratio; CI, confidence interval; *p < 0.05, **p < 0.001.
Note: Estimated sample varies across imputations.
a) Model 1 is adjusted for sex, age, annual equivalized income, educational attainment, marital status, occupational status, self-reported medical conditions, smoking and alcohol consumption, instrumental activities of daily living, and depression.
b) Model 2 is adjusted for the covariates in Model 1 plus number of types of social participation.

Table 4
Type of social participation and obtaining each type of social support (Model 1 a)) by analyzing multiply imputed data sets (n = 24,303–24,363; reference: non-participation in each organization).

Type of groups	Receiving emotional support		Providing emotional support		Receiving instrumental support		Providing instrumental support	
	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI
Sports groups	1.37**	1.30–1.44	1.37**	1.30–1.43	1.38*	1.07–1.79	1.48**	1.21–1.82
Hobby activities	1.46**	1.39–1.54	1.47**	1.40–1.55	1.53**	1.20–1.96	1.48**	1.21–1.82
Volunteer groups	1.41**	1.33–1.48	1.42**	1.35–1.50	1.30	0.97–1.73	1.76**	1.39–2.22
Senior citizen clubs	1.30**	1.23–1.38	1.29**	1.22–1.37	1.32*	1.003–1.75	1.46**	1.16–1.83
Community associations	1.28**	1.22–1.34	1.31**	1.25–1.37	1.30	0.995–1.71	1.50**	1.21–1.85
Study groups	1.27**	1.19–1.35	1.34**	1.26–1.42	1.27	0.89–1.82	1.34	0.999–1.81
Prevention activities	1.31**	1.23–1.39	1.31**	1.24–1.39	1.45*	1.03–2.04	1.59**	1.25–2.02
Teaching activities	1.37**	1.28–1.47	1.38**	1.30–1.47	1.85**	1.36–2.52	2.05**	1.59–2.64

RR, risk ratio; CI, confidence interval; *p < 0.05, **p < 0.001.
Note: Estimated sample varies across imputations.
a) Adjusted for sex, age, annual equivalized income, educational attainment, marital status, occupational status, self-reported medical conditions, smoking, alcohol consumption, instrumental activities of daily living, and depression.

community associations, or teaching activities influenced the acquisition of social support. Thus, in these five groups, participating in the group itself fostered social support.

When older people participated in prevention activities, they were more likely to participate in other groups (Hayashi et al., 2019), and further social participation was also associated with the likelihood of obtaining social support. The present results showed that RR decreased from Model 1 to Model 2 in all eight organizations in which each respondent participated. Particularly, senior citizen clubs, study groups, and prevention activities showed a significant decrease in RR from Model 1 to Model 2, which was significant in Model 1 but not in Model 2. Considering the spreading effect that participation in one group led to participation in other groups, participation in any of the eight groups was effective in gaining social support (Table 3, Model 1).

4.2. Frequency of each type of social participation

Older people are likely to lose their spouses and family members and be socially isolated (World Health Organization, 2007). Older people also tended to spend most of their leisure time alone, whereas younger people had a higher likelihood to be around others without regard to activity type (Marcum, 2013). Thus, social participation, even with low frequency, gives valuable opportunities of making social support for older people, who were more likely to be alone than younger people. Even if the frequency of participation itself is low, social support may have been extended compared to those who did not participate at all because of increased involvement with various people in preparation for the event and expansion of the social network that was triggered by participation. This study suggested that social support was fostered even when participation occurred a few times a year in all organizations, and this finding is consistent with previous studies that showed a preventive effect of social participation more than a few times a year on functional decline (Hikichi et al., 2015; Ide et al., 2020).

4.3. Emotional and instrumental support

The possibility that social participation fosters social support has been previously studied, and this study supported previous research and further showed that more types of social participation were found to be significantly more likely to be increased in emotional support than in instrumental support. In this study, although the percentage of those who received/provided emotional social support was 25.2%/23.3%, that of those who received/provided instrumental support was only 1.8%/1.2%. Because emotional support was reported as strongly related to improved global cognition and prevention of dementia (Kelly et al., 2017; Murata et al., 2019), it would be important to encourage emotional support through social participation. Instrumental support, which is receiving or providing care when sick in bed in this survey, is assumed to be first and foremost provided by family members rather than friends or neighbors, and obtaining instrumental support is considered a higher barrier than emotional support.

4.4. Strengths and limitations

This is the first longitudinal study to clarify the association between the type of social participation and subsequent social support after 3 years for people who had no social support from friends or neighbors at baseline in multiple municipalities. This study can provide a scientific

basis for recommending measures to promote social participation for healthy aging. This study focused on social support for social participation. Thus, this study did not examine the contribution of social support to social participation. In light of previous studies, it is reasonable to assume that there is an association in both directions (Keysor et al., 2006; Levasseur et al., 2015). Several limitations of this study need to be mentioned.

First, in the current longitudinal study, social participation preceded social support in time, and a quantity–response association was found. However, unmeasured confounders were not considered, and causal relationships could not be identified. Previous studies have reported increased social support for participants and their community as a whole after an initiative to promote social participation in a single city or town (Takeda et al., 2009; Tsuji et al., 2022). Therefore, further research using a complex theoretical model can evaluate whether social support is fostered after new initiatives that can promote social participation are launched.

Second, the questionnaires used to identify social support varied across studies, and comparison across studies need to be made with caution. Furthermore, the questionnaire in this study may not identify all aspects of social support. The use of MOS-SSS for evaluating social support as a whole, which comprised 16 items, has been validated (Sherbourne & Stewart, 1991). However, providing social support to others also contributes to health outcomes (Murata et al., 2019), and its impact on health varies based on the person with whom the support is exchanged (Tsuboi et al., 2016). Thus, it is insufficient in some aspects. The questionnaires used to identify social support from friends or neighbors in this study were similar to those associated with fewer depressive symptoms and the reduced risk of dementia for each question (Murata et al., 2019; Tsuboi et al., 2016). Further, they were uitlized in the Needs Survey conducted by the Ministry of Health, Labour and Welfare in Japan (Ministry of Health Labour and Welfare, 2016a). For a multifaceted study, the total number of the four types of social support was evaluated (Murata et al., 2019).

Third, our follow-up invitation was 57.3%, and we did not have details of the nonrespondents. However, nonrespondents have been reported to be at higher risk of functional decline than respondents (Hirai et al., 2009), and they are likely to be frail, be at risk of functional decline, not participate in groups, and thus lack social support. If these nonresponders were to complete the questionnaires, we would expect a more pronounced finding that social support is difficult to foster in those who do not participate in groups.

5. Conclusions

The present study found that the proportion of older people who participated in groups and who increased social support was higher than that of older people who did not participate. Social support was found to be increased by participating in some type of group at any frequency. Particularly, even low-frequency social participation itself, such as hobby activities and community associations a few times a year, leads to a higher chance of increasing social support. Emotional support, which had a strong association with health outcomes, was increased more by social participation compared to instrumental support. As a measure to enhance social support for older people who lack it, support to encourage social participation even if the participation is infrequent may be effective for healthy aging.

Ethical approval

Ethical approval for the study was obtained from the Nihon Fukushi University Ethics Committee (Approval number: 10-05) for 2013, the National Center for Geriatrics and Gerontology (Application number: 992-2), and the Chiba University Ethics Committee (Approval number: 2493) for 2016. JAGES participants were informed that participation in the study was voluntary and fulfilling and returning the questionnaire via mail implied their consent to participate in the study.

CRediT authorship contribution statement

Gemmei Iizuka: Formal analysis, Conceptualization, Methodology, Writing - original draft. **Taishi Tsuji:** Writing – review & editing. **Kazushige Ide:** Writing – review & editing. **Ryota Watanabe:** Writing – review & editing. **Katsunori Kondo:** Investigation, Resources, Writing – review & editing, Funding acquisition.

Data availability

Data are from the JAGES study. All enquiries are to be addressed at the data management committee via e-mail: dataadmin.ml@jages.net. All JAGES datasets have ethical or legal restrictions for public deposition due to inclusion of sensitive information from the human participants. Following the regulation of local governments which cooperated on our survey, the JAGES data management committee has imposed the restrictions upon the data.

Acknowledgements

This study used data from JAGES (the Japan Gerontological Evaluation Study). This study was supported by (a) JSPS (Japan Society for the Promotion of Science), KAKENHI Grant Number (JP15H01972, JP20H00557), (b) Health Labour Sciences Research Grant (H28-Choju-Ippan-002, 22FA1010, 22FA2001), (c) Japan Agency for Medical Research and Development (AMED) (JP18dk0110027, JP18ls0110002, JP18le0110009, JP20dk0110034, JP21lk0310073, JP21dk0110037, JP22lk0310087), (d) Open Innovation Platform with Enterprises, Research Institute and Academia (OPERA, JPMJOP1831) from the Japan Science and Technology (JST), and (e) the Research Funding for Longevity Sciences from National Center for Geriatrics and Gerontology (29–42, 30-22, 20-19, 21-20). The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the respective funding organizations and other organizations to which the authors belong.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmph.2023.101410.

References

Amirkhosravi, N., Adib-Hajbaghery, M., Lotfi, M. S., & Hosseinian, M. (2015). The correlation of social support and social participation of older adults in Bandar Abbas, Iran. *Journal of Gerontological Nursing, 41*, 39–47.

Anaby, D., Hand, C., Bradley, L., DiRezze, B., Forhan, M., DiGiacomo, A., et al. (2013). The effect of the environment on participation of children and youth with disabilities: A scoping review. *Disability & Rehabilitation, 35*, 1589–1598.

Berkman, L. F., Glass, T., Brissette, I., & Seeman, T. E. (2000). From social integration to health: Durkheim in the new millennium. *Social Science & Medicine, 51*, 843–857.

Dickens, A. P., Richards, S. H., Greaves, C. J., & Campbell, J. L. (2011). Interventions targeting social isolation in older people: A systematic review. *BMC Public Health, 11*, 647.

Fujihara, S., Tsuji, T., Miyaguni, Y., Aida, J., Saito, M., Koyama, S., et al. (2019). Does community-level social capital predict decline in instrumental activities of daily living? A JAGES prospective cohort study. *International Journal of Environmental Research and Public Health, 16*, 828.

van Ginkel, J. R., Linting, M., Rippe, R. C., & van der Voort, A. (2020). Rebutting existing misconceptions about multiple imputation as a method for handling missing data. *Journal of Personality Assessment, 102*, 297–308.

Granovetter, M. S. (1973). The strength of weak ties. *American Journal of Sociology, 78*, 1360–1380.

Hayashi, T., Takeda, T., Kato, K., & Kondo, K. (2019). Association between subjective changes in social participation and those in the health information they receive and health awareness among participants in "kayoino-Ba": JAGES survey of participants in "kayoino-Ba". *Sogo Rehabilitation, 47*, 1109–1115 (In Japanese).

He, Q., Cui, Y., Liang, L., Zhong, Q., Li, J., Li, Y., et al. (2017). Social participation, willingness and quality of life: A population-based study among older adults in rural areas of China. *Geriatrics and Gerontology International, 17*, 1593–1602.

Hikichi, H., Kondo, N., Kondo, K., Aida, J., Takeda, T., & Kawachi, I. (2015). Effect of a community intervention programme promoting social interactions on functional disability prevention for older adults: Propensity score matching and instrumental variable analyses, JAGES taketoyo study. *Journal of Epidemiology & Community Health, 69*, 905–910.

Hikichi, H., Kondo, K., Takeda, T., & Kawachi, I. (2017). Social interaction and cognitive decline: Results of a 7-year community intervention. *Alzheimers Dement (N Y), 3*, 23–32.

Hirai, H., Kondo, K., Ojima, T., & Murata, C. (2009). Examination of risk factors for onset of certification of long-term care insurance in community-dwelling older people: AGES project 3-year follow-up study. *Nihon Koshu Eisei Zasshi, 56*, 501–512 (In Japanese).

Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010). Social relationships and mortality risk: A meta-analytic review. *PLoS Medicine, 7*, Article e1000316.

Hosseingholizadeh, N., Sadeghi, R., Ardebili, H. E., Foroushani, A. R., & Taghdisi, M. H. (2019). The correlation of self-efficacy and social support with social participation: A cross sectional study among the elderly. *J Med Life, 12*, 239–246.

Ide, K., Tsuji, T., Kanamori, S., Jeong, S., Nagamine, Y., & Kondo, K. (2020). Social participation and functional decline: A comparative study of rural and urban older people, using Japan gerontological evaluation study longitudinal data. *International Journal of Environmental Research and Public Health, 17*.

Kanamori, S., Kai, Y., Aida, J., Kondo, K., Kawachi, I., Hirai, H., et al. (2014). Social participation and the prevention of functional disability in older Japanese: The JAGES cohort study. *PLoS One, 9*, Article e99638.

Kelly, M. E., Duff, H., Kelly, S., McHugh Power, J. E., Brennan, S., Lawlor, B. A., et al. (2017). The impact of social activities, social networks, social support and social relationships on the cognitive functioning of healthy older adults: A systematic review. *Systematic Reviews, 6*, 259.

Keysor, J. J., Jette, A. M., Coster, M., Bettger, J. P., & Haley, S. M. (2006). Association of environmental factors with levels of home and community participation in an adult rehabilitation cohort. *Archives of Physical Medicine and Rehabilitation, 87*, 1566–1575.

Knol, M. J., Le Cessie, S., Algra, A., Vandenbroucke, J. P., & Groenwold, R. H. H. (2012). Overestimation of risk ratios by odds ratios in trials and cohort studies: Alternatives to logistic regression. *Canadian Medical Association Journal, 184*, 895–899.

Kobayashi, E., Fujiwara, Y., Fukaya, T., Nishi, M., Saito, M., & Shinkai, S. (2011). Social support availability and psychological well-being among the socially isolated elderly. Differences by living arrangement and gender. *Nihon Koshu Eisei Zasshi, 58*, 446–456 (In Japanese).

Kondo, K. (2016). Progress in aging epidemiology in Japan: The JAGES project. *Journal of Epidemiology, 26*, 331–336.

Kondo, K., & Rosenberg, M. (2018). *Advancing universal health coverage through knowledge translation for healthy ageing: Lessons learnt from the Japan gerontological evaluation study*. Geneva: World Health Organization.

Koyano, W., Shibata, H., Nakazato, K., Haga, H., & Suyama, Y. (1991). Measurement of competence: Reliability and validity of the TMIG Index of competence. *Archives of Gerontology and Geriatrics, 13*, 103–116.

Levasseur, M., Généreux, M., Bruneau, J. F., Vanasse, A., Chabot, É., Beaulac, C., et al. (2015). Importance of proximity to resources, social support, transportation and neighborhood security for mobility and social participation in older adults: Results from a scoping study. *BMC Public Health, 15*, 503.

Levasseur, M., Richard, L., Gauvin, L., & Raymond, E. (2010). Inventory and analysis of definitions of social participation found in the aging literature: Proposed taxonomy of social activities. *Social Science & Medicine, 71*, 2141–2149.

Marcum, C. S. (2013). Age differences in daily social activities. *Research on Aging, 35*, 612–640.

Ministry of Health, Labour and Welfare. (2016a). *Long-term care insurance system of Japan*. https://www.mhlw.go.jp/english/policy/care-welfare/care-welfare-elderly/dl/ltcisj_e.pdf. (Accessed 29 January 2023).

Ministry of Health, Labour and Welfare. (2016b). *Instructions of conducting the public survey of long-term care prevention and needs in Spheres of daily Life*. https://www.mhlw.go.jp/file/05-Shingikai-12301000-Roukenkyoku-Soumuka/0000138620.pdf. (Accessed 29 January 2023).

Murata, C., Saito, T., Saito, M., & Kondo, K. (2019). The association between social support and incident dementia: A 10-year follow-up study in Japan. *International Journal of Environmental Research and Public Health, 16*, 239.

National Institute of Population and Social Security Research. (2018). *Household projections for Japan 2015-2040 outline of results and methods*. https://www.ipss.go.jp/pp-ajsetai/e/hhprj2018/hhprj2018_DL.pdf. (Accessed 29 January 2023).

Otsuka, T., Tomata, Y., Zhang, S., Sugiyama, K., Tanji, F., Sugawara, Y., et al. (2018). Association between social participation and incident risk of functional disability in elderly Japanese: The ohsaki cohort 2006. *Journal of Psychosomatic Research, 111*, 36–41.

Rubin, D. B. (1996). Multiple imputation after 18+ years. *Journal of the American Statistical Association, 91*, 473–489.

Sherbourne, C. D., & Stewart, A. L. (1991). The MOS social support survey. *Social Science & Medicine, 32*, 705–714.

Shiba, K., Yazawa, A., Kino, S., Kondo, K., Aida, J., & Kawachi, I. (2020). Depressive symptoms in the aftermath of major disaster: Empirical test of the social support deterioration model using natural experiment. *Wellbeing Space Soc, 1*, Article 100006.

Snell, K. D. M. (2017). The rise of living alone and loneliness in history. *Social History, 42*, 2–28.

Takeda, T., Kondo, K., & Hirai, H. (2009). Preventive intervention of senile dementia focusing on psychosocial factors: Intervention theory based on the population health approach and its evaluation of midterm outcomes. *Sagyou Ryouhou, 28*, 178–186 (In Japanese).

Thoits, P. A. (1995). Stress, coping, and social support processes: Where are we? What next? *J Health Soc Behav, Spec No*, 53–79.

Thoits, P. A. (2011). Mechanisms linking social ties and support to physical and mental health. *Journal of Health and Social Behavior, 52*, 145–161.

Tsuboi, H., Hirai, H., & Kondo, K. (2016). Giving social support to outside family may be a desirable buffer against depressive symptoms in community-dwelling older adults: Japan gerontological evaluation study. *BioPsychoSocial Medicine, 10*, 18.

Tsuji, T., Takagi, D., Kondo, N., Maruyama, Y., Ide, K., & LINGLING. (2022). Promoting community gathering places ''Kayoinoba'' for healthy aging reduce health inequalities among communities: An eight-year ecological study. *Nihon Koshu Eisei Zasshi, 69*, 383–393 (In Japanese).

Wang, J., Mann, F., Lloyd-Evans, B., Ma, R., & Johnson, S. (2018). Associations between loneliness and perceived social support and outcomes of mental health problems: A systematic review. *BMC Psychiatry, 18*, 156.

World Health Organization. (2007). *Global age-friendly cities: A guide*. https://apps.who.int/iris/bitstream/handle/10665/43755/9789241547307_eng.pdf?sequence=1&isAllowed=y. (Accessed 29 January 2023).

Yesavage, J. A., Brink, T. L., Rose, T. L., Lum, O., Huang, V., Adey, M., et al. (1982). Development and validation of a geriatric depression screening scale: A preliminary report. *Journal of Psychiatric Research, 17*, 37–49.

Zhou, E. S. (2014). Social support. In A. C. Michalos (Ed.), *Encyclopedia of quality of Life and well-being research* (pp. 6161–6164). Dordrecht: Springer.