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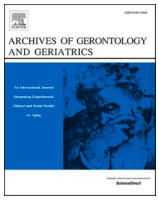

Examination of the relationship between participation in salons aimed at care prevention through the promotion of social participation and the subsequent cost of care: A 3-year prospective follow-up study in JAGES[1]

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HIGHLIGHTS

- Participants in salon projects aimed at preventing nursing care had lower subsequent nursing care costs than non-participants.
- The link between program participation and long-term care costs was also confirmed in an analysis using instrumental variables adjusting for function, health, and prior social participation status.
- The estimated average difference in caregiving costs between participants and non-participants during the first 3 years of follow-up was $40.

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ABSTRACT

Many previous studies have found that social participation improves the health and functional maintenance of older people. However, to determine whether promoting social participation can prevent functional decline in the elderly, it is necessary not only to compare the prognosis of those who participate in social activities to those who do not but also to demonstrate that the intervention was effective in promoting social participation. Although the effect of social participation in preventing caregiving has been demonstrated, the key question is whether preventing functional decline through social participation can reduce care costs. This study aims to examine the relationship between participation in salons aimed at care prevention through the promotion of social participation and the subsequent cost of care. We use the Japan Gerontological Evaluation Study (JAGES) dataset to conduct longitudinal, individuallevel analysis. We focus on all residents 65 years and older who did not have a without disability in Taketoyo town and ran three regression analyses. First, a generalized linear model (GLM) with Tweedie distribution and log-link function, as well as robust estimation of variance components was used to estimate the dependent variables. Second, we used an inverse probability weighting (IPW) model to minimize selection bias. Finally, we performed the IV analysis. In this study, the GLM with IPW and IV models revealed link between salon participants and lower caregiving costs. The link between participation and caregiving costs was confirmed in a model with reduced selection bias, rather than in a simple GLM model.

1. Introduction

Almost every country in the world is projected to see a significant increase in the proportion of older adults. As the population ages, medical and long-term care costs rise due to increased care requirements and longer life expectancies.

In Japan, the long-term care insurance(LTCI) system was established in 2000. Long-term care costs, which were $25 billion in 2000, continue

[1] Examination of the relationship between participation in salons aimed at care prevention through the promotion of social participation and the subsequent cost of care: a 3-year prospective follow-up study in JAGES

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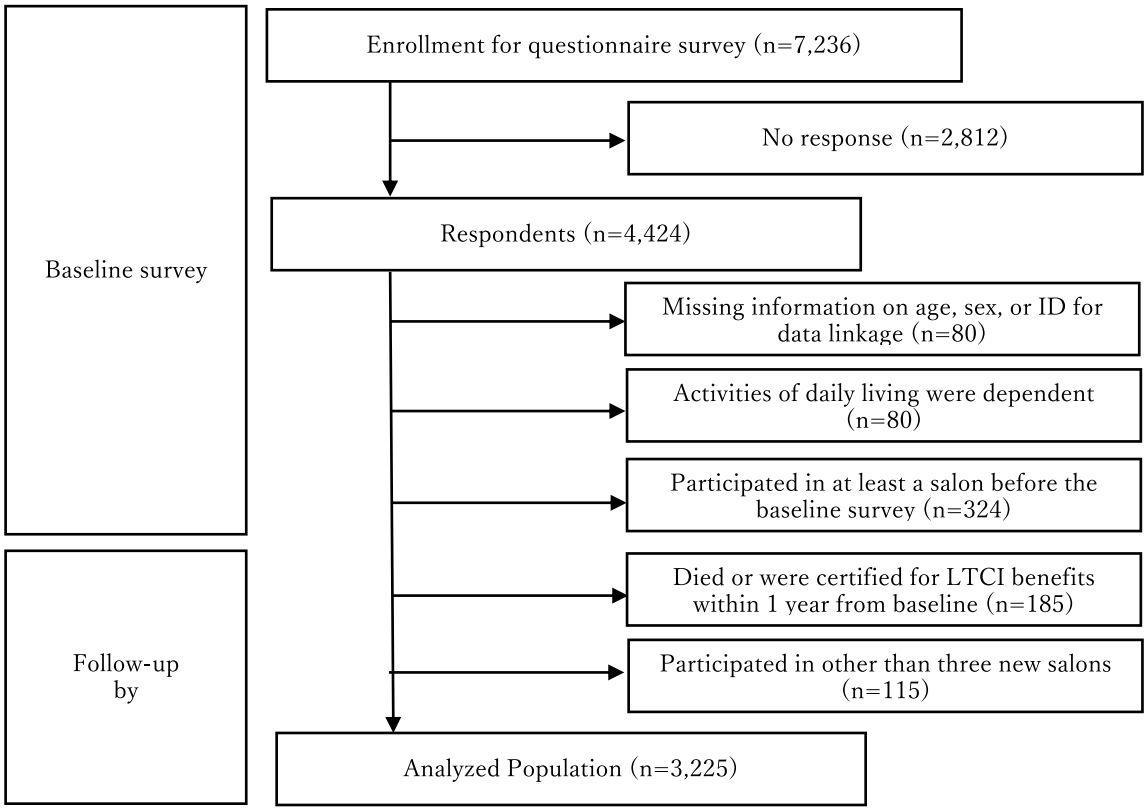

Fig. 1. Flow chart of Subject Selection.

to increase with the aging population and are expected to increase sevenfold to $180 billion by 2040(. Ministry of Health, Labour and, Welfare.,2018). The 2006 reform of the long-term care insurance system strengthened care prevention to reduce rising long-term care costs (Tsutsui & Muramatsu, 2007; Fukutomi et al. , 2013).

The long-term care prevention program began with a high-risk approach, with surveys of health examination participants used to identify and encourage high-risk individuals to participate in the program. However, >90 % of new patients requiring long-term care each year were excluded from this screening, and the overall effectiveness of long-term care prevention was limited (Hirai & Kondo, 2010).

In 2014, the Japanese government changed its policy to focus on population-based projects that target the elderly as a whole and aim to prevent cognitive and functional decline by encouraging social participation(Saito et, al.,2019).

Many previous studies have found that social participation improves the health and functional maintenance of older people(Tomioka et al., 2015; Otsuka et al., 2018; Gao et al., 2018; Lu et, al.,2022; Kanamori et al., 2014; Takeda et al., 2010). However, to determine whether promoting social participation can prevent functional decline in the elderly, it is necessary not only to compare the prognosis of those who participate in social activities to those who do not but also to demonstrate that the intervention was effective in promoting social participation.

When evaluating interventions aimed at increasing social participation, bias caused by differences between participating and nonparticipating groups should be considered. To address this issue, previous research has shown that the intervention group has a lower risk of subjective health, functional decline, and dementia than the control group, using models based on propensity score matching and the instrumental variables method(Ichida et al., 2013; Hikichi et al., 2015). In particular, the instrumental variable method is an analytical method that provides a more accurate estimate of the average population effect obtained from RCTs.(Stukel et al., 2007)

Although the effect of social participation in preventing caregiving has been demonstrated, the key question is whether preventing functional decline through social participation can reduce care costs.

Furthermore, there are few evaluation studies on the extent to which the costs of social participation differ between intervention and control groups. Once the extent to which participation in the project reduces care costs is determined, the project's efficiency relative to its costs can be assessed (Gottlieb et, al.,.2017; Fichtenberg et al., 2019).

The primary research questions for this study are as follows: Whether or not participants in interventions that promote social participation have lower caregiving costs than non-participants, and if so, how much.

2. Materials and methods

2.1. The intervention

Taketoyo Town is located on the eastern coast of the central Chita Peninsula in Aichi Prefecture. It is a nearly rectangular town, measuring 5 km east to west and 6.5 km north to south, with a total area of approximately 26 square kilometers. The project to establish salons to encourage the social participation of the elderly in Taketoyo Town began in 2007.

Each salon meets once or twice a month for about two hours to do exercises, musical performances, and crafts. The salons are intended to foster a network among participants through these activities.

The number of salons increased gradually from 3 at the start to 7 in 2009. At the time, the elderly who lived within 500-m road distance of the salon accounted for 21.8 % of all the elderly. One salon opened in 2011 and two in 2012, with increased attendance near these locations. This study compares the subsequent costs of care for elderly and non-participants who newly joined the salon after the three venues opened in 2011–2012.

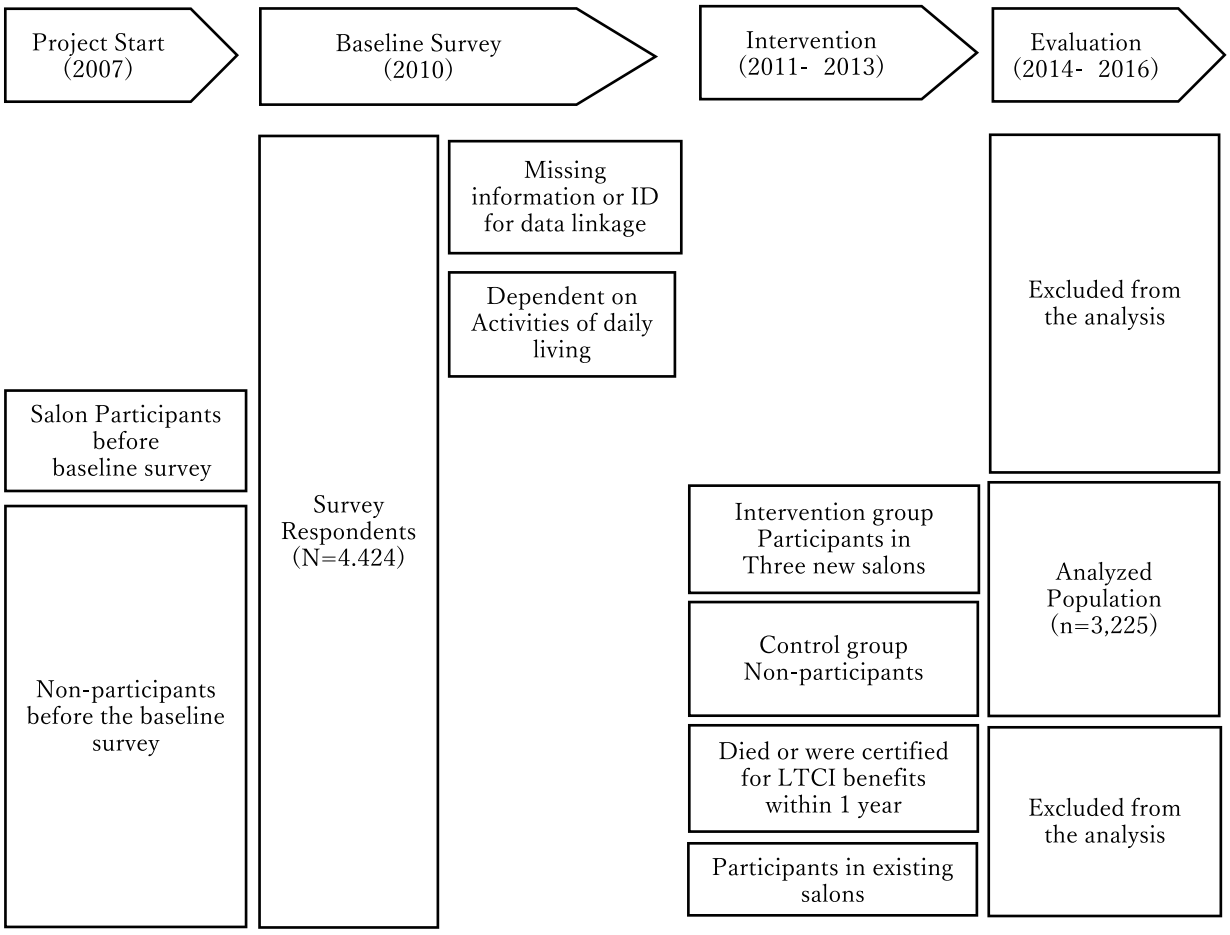

Fig. 2. Intervention and evaluation process.

Table 1
Number and rate of functional limitations and average care cost during the 3-year follow-up period.

		Participants	Non-participants
Number of persons		105	3120
Number of persons certified as requiring long-term care		12	354
Rate of persons certified as requiring long-term care	(%)	11.4	11.3
Average care cost (sd)	(US$)	392.6 (1574.0)	741.6 (4535.1)
Average length of nursing care required (sd)	(days)	58.1 (197.5)	49.9 (177.7)
Those certified as requiring long-term care			
Average care cost (sd)	(US$)	3435.5 (3466.8)	6536.2 (11,989.2)
Average length of nursing care required (sd)	(days)	508.6 (344.5)	440.1 (326.7)

We used a currency exchange rate of JPY 100 to US$1.

2.2. Study subjects

Our data came from the Japan Gerontological Evaluation Study (JAGES) (Nishi et al., 2011), a large-scale cohort study of 65-year-old community residents with no physical or cognitive disabilities who did not receive LTCI. The JAGES was established in 1999 to gather scientific findings that could serve as the foundation for elderly care policies. The project had grown to include 64 municipalities and 260,000 participants as of 2019. The JAGES protocol was authorized by the Ethics Committee on the Research of Human Subjects at Nihon Fukushi University (no. 10–05), the details of which are provided separately (Kondo, 2016). The JAGES questionnaire included baseline items on comprehensive health and socio-demographic information, allowing us to account for various potential confounders.

The data for Wave 3 of the JAGES were gathered primarily through self-administered questionnaires mailed to a random sample of functionally independent individuals aged 65 years or older living in participating municipalities between August 2010 and December 2011. In this study, we used data from Taketoyo town, one of the participating municipalities.

All residents aged 65 and older who did not have a disability were studied in Taketoyo town($n = 7236$). Of the 4424 respondents, 80 were excluded from the analyses due to a lack of information on age, gender, or ID for data linkage. An additional 80 participants were excluded because their daily activities were dependent. Furthermore, we exempted 324 who participated in at least one of the salons before the baseline survey, 185 who died or were certified for LTCI benefits within a year of the baseline survey, and 115 who participated in three other salons, so the sample size in this study was 3225 (Figs. 1 and 2). We followed the respondents of the baseline survey until March 31, 2012, and collected information on their frequency of salon participation.

2.3. Measures

2.3.1. Outcome variable

The outcome variable was the total cost of LTCI services over the follow-up period. JAGES gathered data on the costs of LTCI and deaths

Table 2
Characteristicss of Salon participants and nonparticipants.

		Participants(n = 105)		non-participants(n = 3120)		Effect size
		n	%	n	%	
Age	65-74	78	74.30 %	2266	72.60 %	0.007
	75+	27	25.70 %	854	27.40 %	
Sex	female	71	67.60 %	1444	46.30 %	0.076
	male	34	32.40 %	1676	53.70 %	
Equivalent Income US$1000	40.0+	8	7.60 %	258	8.30 %	0.027
	20.0–39.9	32	30.50 %	1138	36.50 %	
	<20.0	46	43.80 %	1280	41.00 %	
	Missing	19	18.10 %	444	14.20 %	
Years of education	≥13	9	8.60 %	411	13.20 %	0.026
	10–12	41	39.00 %	1133	36.30 %	
	<10	54	51.40 %	1528	49.00 %	
	Missing	1	1.00 %	48	1.50 %	
Arthritis, fracture, and osteoporosis	No	87	82.90 %	2719	87.10 %	0.023
	Yes	18	17.10 %	401	12.90 %	
Heart disease	No	100	95.20 %	2748	88.10 %	0.040
	Yes	5	4.80 %	372	11.90 %	
Stroke	No	104	99.00 %	3089	99.00 %	0.001
	Yes	1	1.00 %	31	1.00 %	
Diabetes mellitus	No	100	95.20 %	2992	95.90 %	0.006
	Yes	5	4.80 %	128	4.10 %	
Visual impairment	No	96	91.40 %	2760	88.50 %	0.017
	Yes	9	8.60 %	360	11.50 %	
Hearing impairment	No	101	96.20 %	2941	94.30 %	0.015
	Yes	4	3.80 %	179	5.70 %	
Urination disorders	No	105	100.00 %	2990	95.80 %	0.038
	Yes	0	0.00 %	130	4.20 %	
Physical function score	0	42	40.00 %	1201	38.50 %	0.022
	1	21	20.00 %	613	19.60 %	
	2–3	15	14.30 %	550	17.60 %	
	4–5	19	18.10 %	472	15.10 %	
	Missing	8	7.60 %	284	9.10 %	
Cognitive function score	0	65	61.90 %	1909	61.20 %	0.014
	1	27	25.70 %	747	23.90 %	
	2–3	7	6.70 %	265	8.50 %	
	Missing	6	5.70 %	199	6.40 %	
Self-rated health	Excellent	12	11.40 %	345	11.10 %	0.044
	Good	82	78.10 %	2175	69.70 %	
	Fair	11	10.50 %	500	16.00 %	
	Poor	0	0.00 %	75	2.40 %	
	Missing	0	0.00 %	25	0.80 %	
Geriatric Depression Scale	No	80	76.20 %	1964	62.90 %	0.049
	mild	11	10.50 %	550	17.60 %	
	Severe	4	3.80 %	165	5.30 %	
	Missing	10	9.50 %	441	14.10 %	
Frequency of participation in Volunteer group	More than once a month	28	26.70 %	270	8.70 %	0.119
	Less than once a month	51	48.60 %	2254	72.20 %	
	Missing	26	24.80 %	596	19.10 %	
Frequency of participation in Sports group or club	More than once a month	35	33.30 %	572	18.30 %	0.080
	Less than once a month	47	44.80 %	2039	65.40 %	
	Missing	23	21.90 %	509	16.30 %	
Frequency of participation in Hobby activities group	More than once a month	42	40.00 %	929	29.80 %	0.056
	Less than once a month	42	40.00 %	1741	55.80 %	
	Missing	21	20.00 %	450	14.40 %	

from municipalities that were also LTCI insurers. We collected long-term care costs for insured services at 35 points per month for 3 years (January 2014–November 2016).

Approximately 85 % of participants were not certified as requiring long-term care during the follow-up period; therefore, approximately 85 % of Cumulative LTCI costs are zero. We added 0.5 to all values of Cumulative LTCI costs. We used a currency exchange rate of JPY 100 to US $1.

2.3.2. Explanatory variables

Participation in the salon was the treatment variable used. 418 people attended at least once during the 36 months from January 2011 to December 2013. The frequency of participation ranged from 1 to 88, with a median of 5. We classified more than three-time visitors (105 people) as 'participants'. Some older people only participate in a popular menu once every few years, and we believed that the salon would be ineffective in preventing functional decline for them.

2.3.3. Covariate

We considered possible confounding factors from the respondents' demographic, socioeconomic, and health status, including age, sex, marital status (married, divorced, widowed, never married),

Table 3
Results of the GLM model.

Variables		Model 1 GLM				Model 2 GLM with IPW			
		coef.	std. error	p		coef.	std. error	p	
Participation in Salons	Yes	−0.065	0.045	0.142		−0.036	0.013	0.006	**
Sex (Reference: Female)	Male	−0.050	0.016	0.002	**	−0.023	0.014	0.092	
Age (Reference: 65–74)	75+	0.237	0.017	<0.001	***	0.205	0.015	<0.001	***
Income US$1000	20.0–39.9	−0.044	0.030	0.137		0.021	0.026	0.406	
(Reference: 40.0 > 0)	<20.0	−0.041	0.030	0.167		0.034	0.026	0.183	
	Missing	0.013	0.034	0.703		0.087	0.030	0.004	**
Education	10–12	−0.045	0.025	0.068		−0.121	0.021	<0.001	***
(Reference: 13>0)	<10	−0.029	0.024	0.231		−0.121	0.020	<0.001	***
	Missing	−0.207	0.068	0.002	**	−0.334	0.060	<0.001	***
Arthritis, fracture, osteoporosis	Yes	−0.001	0.024	0.975		0.063	0.020	0.002	**
Heart disease	Yes	0.005	0.024	0.851		−0.070	0.022	0.001	**
Stroke	Yes	0.071	0.052	0.171		0.007	0.047	0.887	
Diabetes mellitus	Yes	0.004	0.037	0.925		0.082	0.030	0.006	**
Visual impairment	Yes	−0.022	0.025	0.387		−0.042	0.020	0.033	*
Hearing impairment	Yes	−0.016	0.034	0.631		0.056	0.030	0.063	
Urination disorders	Yes	−0.054	0.039	0.170		−0.077	0.040	0.056	
Physical functional disorder	1	−0.014	0.022	0.530		−0.006	0.018	0.740	
(Reference: 0)	2–3	−0.071	0.023	0.002	**	−0.072	0.020	<0.001	***
	4–5	0.158	0.024	<0.001	***	0.121	0.020	<0.001	***
	Missing	−0.095	0.037	0.009	**	−0.028	0.034	0.401	
Cognitive functional disorder	1	−0.022	0.019	0.236		−0.047	0.016	0.002	**
(Reference: 0)	2–3	0.077	0.028	0.007	**	0.108	0.025	<0.001	***
	Missing	0.137	0.040	0.001	**	0.057	0.036	0.110	
Self-rated health	Good	0.025	0.026	0.346		0.006	0.023	0.775	
(Reference: Very good)	Fair	0.136	0.032	<0.001	***	0.152	0.028	<0.001	***
	Poor	0.264	0.054	<0.001	***	0.287	0.055	<0.001	***
	Missing	−0.083	0.094	0.379		−0.108	0.101	0.283	
Geriatric Depression Scale (Reference: No)	mild	−0.010	0.022	0.635		−0.021	0.019	0.279	
	Severe	−0.068	0.037	0.061		−0.170	0.031	<0.001	***
	Missing	0.011	0.023	0.628		−0.032	0.021	0.133	
Frequency of participation in the volunteer group (Reference: More than once a month)	Less than once a month	−0.036	0.029	0.214		0.015	0.023	0.511	
	Missing	−0.019	0.040	0.631		−0.054	0.032	0.086	
Frequency of participation in sports groups or clubs (Reference: More than once a month)	Less than once a month	0.011	0.023	0.621		−0.012	0.018	0.512	
	Missing	0.023	0.040	0.567		0.077	0.031	0.012	*
Frequency of participation in Hobby activities group (Reference: More than once a month)	Less than once a month	0.064	0.020	0.002	**	0.077	0.017	<0.001	***
	Missing	0.082	0.037	0.028	*	0.023	0.029	0.426	
Constant		−0.618	0.047	<0.001	***	−0.612	0.040	<0.001	***
AIC		172.2				322.0			

Outcome variable: Total cost of LTCI services (US$1000).
***,** and * denotes significance at 99 %, 95 %, and 90 % levels, respectively.

educational attainment (<6, 6–9, 10–12, ≥13 years of schooling), household equivalized income (<20, 20–40, and ≥40 thousand dollars), and chronic medical conditions (stroke, heart disease, diabetes mellitus, arthritis, fracture, osteoporosis, visual impairment, hearing impairment, urination disorders), physical function (climbing stairs, rising from chair); cognitive function (forgetfulness, disorientation, looking up a phone number), self-rated health (very good, good, fair, or poor), and 15-item Geriatric Depression Scale (0–4 no depression, 5–10 mild depression, and 11–15 severe depression)(Sugishita et al., 2017).

2.4. Statistical analysis

After calculating the descriptive statistics, we ran three regression analyses. First, a generalized linear model (GLM) with Tweedie distribution and log-link function, as well as robust estimation of variance components was used to estimate the dependent variables.

Predicted value because the cumulative cost of LTCI services has highly skewed, heavy-tailed distributions. Tweedie distributions have been shown to fit cost data well, even with small numbers of nonusers (Kurz, 2017; Liebert et, al.,2017). Second, we used an inverse probability weighting (IPW) model to minimize selection bias. We calculated the propensity scores for salon participation using logistic regression with salon participation as the objective variable and the previously listed covariates as explanatory variables.

Finally, we performed the IV analysis. IV analysis has the potential to eliminate unmeasured confounding, but it requires certain assumptions, such as the fact that IV has no relationship with the outcome. We used the inverse of the distance to the closest salon as the instrument.

The inverse of the distance correlated relatively significantly with participation in the salon programs (Spearman's $\rho = 0.22$). On the other hand, the inverse of distance did not have a significant correlation with any covariate thought to be related to baseline health. Hence, the inverse of distance is unlikely to be associated with care costs. We used a logistic model to estimate salon participation in the first stage. A generalized linear model with a Tweedie distribution was used to estimate care costs in the second stage. IV analyses were carried out with R, version 4.1.3 (R Foundation for Statistical Computing), station, and ivtools.

3. Result

Table 1 displays the number and rate of functional limitations, as well as the average care cost. The proportion of those certified as requiring long-term care during the 3 years was 11.4 % for salon participants and 11.3 % for non-participants, with little difference. The average cost of nursing care was nearly double that of non-participants,

Table 4
Result of the IV model.

Variables		Stage2				Stage1			
		Dependent Variable: care cost				Dependent Variable: participation in Salon			
		coef.	std. error	p		coef.	std. error	p	
Estimated participation in Salons		−1.105	0.455	0.015	*				
1/Distance to Salons						0.013	0.001	<0.001	***
Sex (Reference: Female)	Male	−0.199	0.166	0.231		−0.701	0.223	0.002	***
Age (Reference: 65–74)	75+	0.974	0.161	<0.001	***	−0.054	0.247	0.827	
Income	20.0–39.9	−0.167	0.270	0.535		−0.096	0.404	0.813	
(Reference: 40.0 > 0)	<20.0	−0.146	0.271	0.589		0.315	0.399	0.430	
	Missing	0.055	0.337	0.869		0.271	0.445	0.543	
Education	10–12	−0.160	0.253	0.527		0.331	0.375	0.377	
(Reference: 13>0)	<10	−0.087	0.270	0.746		0.434	0.373	0.245	
	Missing	−0.792	0.353	0.025	*	0.037	1.062	0.972	
Arthritis, fracture, osteoporosis	Yes	0.024	0.247	0.923		0.256	0.286	0.370	
Heart disease	Yes	−0.094	0.250	0.708		−0.620	0.485	0.201	
Stroke	Yes	0.382	0.482	0.427		1.015	0.773	0.189	
Diabetes mellitus	Yes	0.052	0.316	0.869		0.139	0.480	0.772	
Visual impairment	Yes	−0.112	0.248	0.650		−0.057	0.357	0.873	
Hearing impairment	Yes	−0.088	0.330	0.791		0.277	0.505	0.583	
Urination disorders	Yes	−0.204	0.324	0.529		−1.872	1.029	0.069	
Physical function	1	−0.002	0.176	0.992		0.079	0.276	0.774	
(Reference: 0)	2–3	−0.238	0.173	0.169		−0.284	0.327	0.385	
	4–5	0.525	0.274	0.056		0.189	0.297	0.525	
	Missing	−0.083	0.467	0.859		−0.236	0.485	0.627	
cognitive function	1	−0.041	0.187	0.826		0.091	0.243	0.709	
(Reference: 0)	2–3	0.325	0.306	0.289		0.250	0.424	0.556	
	Missing	0.291	0.612	0.634		0.191	0.525	0.716	
self-rated health	Good	0.137	0.125	0.272		0.170	0.320	0.597	
(Reference: Very good)	Fair	0.526	0.249	0.035	*	−0.057	0.454	0.900	
	Poor	0.905	0.684	0.186		–	–	0.981	
	Missing	−0.376	0.274	0.169		–	–	0.988	
Geriatric Depression Scale (Reference: No)	mild	−0.037	0.194	0.848		−0.445	0.337	0.186	
	Severe	−0.158	0.368	0.668		−0.529	0.539	0.327	
	Missing	0.021	0.245	0.932		−0.836	0.351	0.017	*
Frequency of participation in the volunteer group (Reference: More than once a month)	Less than once a month	−0.203	0.166	0.221		−1.043	0.270	<0.001	***
	Missing	−0.294	0.394	0.455		−0.859	0.358	0.016	*
Frequency of participation in sports groups or clubs (Reference: More than once a month)	Less than once a month	0.006	0.173	0.972		−0.854	0.262	0.001	**
	Missing	0.172	0.304	0.572		−0.427	0.410	0.297	
Frequency of participation in Hobby activities group (Reference: More than once a month)	Less than once a month	0.277	0.129	0.031	*	0.076	0.262	0.772	
	Missing	0.287	0.308	0.352		0.084	0.423	0.843	
Constant		−0.191	0.309	0.537		−2.376	0.569	<0.001	***
AIC		850.2							

Outcome variable: Total cost of LTCI services (US$1000).
***,** and * denotes significance at 99 %, 95 %, and 90 % levels, respectively.
The two equations were estimated simultaneously.

$741.6 versus $392.6 for participants, and the average length of nursing care required was longer for participants, 58.1 days versus 49.9 days for nonparticipants. When limited to those who required care, the average cost of care was $3435.5 for participants and $6536.2 for non-participants, with an average duration of 508.6 days for participants and 440.1 days for nonparticipants.

The Baseline Characteristics of the research subjects were compared between participants and nonparticipants (Table 2). There were differences between the participating and nonparticipating groups in terms of sex, age, sports group activities, and volunteer group activities. No significant differences in health or functional status were found between the participating and nonparticipating groups.

Table 3 displays the results of the GLM model. In Model 1, the coefficient for Participation in the Salon was negative, but there was no significant relationship between participation and care cost. In Model 2, Participation in Salon was significantly inversely correlated with care cost. In comparison to non-participants, who participated salon produced a cost containment in US$0.036 thousand, which was lower per person for the total cost of LTCI services over the 3-year period.

Participants who used services only once or twice were not counted as "participants" in this study. We investigate the presence of the effect of lower cost of care for those who participated once or twice compared with those who did not participate. Neither the GLM model (coef. = 0.036, $p = 0.284$) nor the IPW (coef. = 0.016, $p = 0.298$) demonstrated an association between lower care costs for those who participated once or twice.

Table 4 shows the estimation results using the IV model. In Stage 1, Participation was significantly related to the inverse of the distance to Salons(coefficient 0.013. Furthermore, instrumented salon participation was found to be significantly and negatively associated with care costs after controlling for covariates in Stage 2.

Fig. 3 depicts the average cost of care calculated by the GLM model for participants and nonparticipants 1, 2, and three years after the start of follow-up. The estimated average cost of care for participants and nonparticipants over 3 years was $578 and $617, respectively, representing a difference of $40.

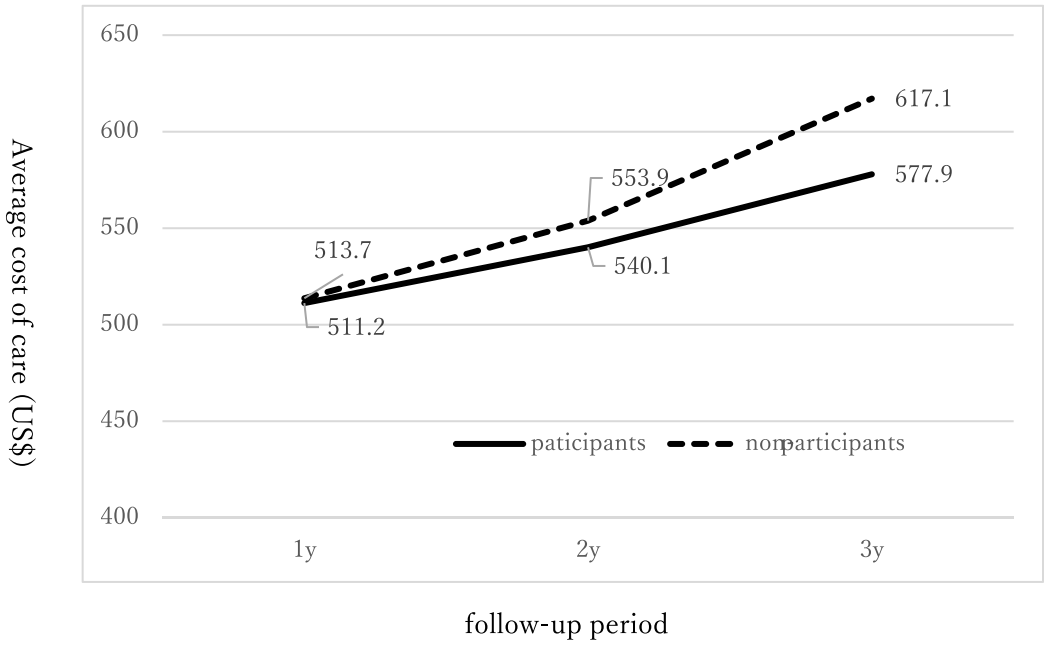

Fig. 3. Average cost of care for participants and nonparticipants.

4. Discussion

In this study, the GLM with IPW and IV models revealed a link between salon participants and lower caregiving costs. The link between participation and caregiving costs was confirmed in a model with reduced selection bias, rather than a simple GLM model.

The effect of social participation on lowering the cost of care was consistent with previous findings. In comparison to these studies, this study has the advantage of being an intervention study aimed at promoting new social participation, implying that caregiving costs can be controlled by intentionally increasing social participation.

Hikichi et al. conducted an intervention study to determine whether or not the subjects required long-term care, but the study did not follow the subjects' progress after they required long-term care(Hikichi et al., 2015). This study follows subjects after they are certified for long-term care and aims to determine whether social participation can reduce the cost of long-term care services.

There are two reasons to consider the cost of long-term care as an outcome. First, the catalyst for the strengthening of long-term care prevention in 2006 was the soaring cost of long-term care (Tsutsui & Muramatsu, 2007), and it is critical to determine whether long-term care costs can be reduced through long-term care prevention initiatives. Second, the cost of long-term care evaluation differs from the evaluation by Hikichi et al. on whether or not a person requires long-term care, but it also allows for the assessment of functional decline aftercare is required.

As shown in Table 1, the percentage of certified participants is similar between salon participants and non-participants, but the cost of care for salon participants is lower, implying that they are only mildly frail after requiring nursing care.

To determine whether salon participation is sufficient to reduce the cost of care, one must compare it to the cost of the salon project. The town spends about $2500 per year per salon, or $7500 per salon over three years, for a total of $225,000 across three locations.

The total number of participants at the three venues was approximately 130, and if all participants received $40 over three years, the total cost would be $5200, which is roughly one-quarter of the cost of the salon project; thus, the effect is insufficient to justify the cost.

The gap between the average cost of care for participants and non-participants grows wider with each passing year. It cannot be ruled out that the longer the follow-up period, the greater the effect of lowering the cost of care, and that the effect will be proportionate to the cost of care.

The study's limitations include the fact that the focus was on a salon project in a single municipality in Japan, and it is unclear whether similar results can be obtained in the many salon projects for the elderly across Japan. Second, the baseline survey in this study had a response rate of 61.1 %, and both participants and nonparticipants were excluded from the analysis. However, the intervention's effect is likely to be overestimated because salon participants are more likely to be interested in and respond to the survey than the slightly frail elderly group, where the response rate is expected to be lower. The response rate was higher than that of previour studies in the same area(Ichida et al., 2013; Hikichi et al., 2015), indicating that selection bias is likely to be low. Finally, this analysis did not explain how salon participation results in lower nursing care costs. Previous research has found that salon participation correlates with participation in other groups (Hirai, 2010) and that those who are highly active have lower nursing care costs (Hirai et al., 2021).

5. Conclusion

Several cross-sectional and longitudinal observational studies have found a link between social participation and health. Furthermore, the effect of social participation promoted by intervention studies on preventing functional decline was investigated using a statistically rigorous approach. The current study, which used an intervention study design and methods that control for confounding factors, found that promoting social participation not only prevents functional decline but may also lower the cost of long-term care.

The reduced cost of care did not exceed the operating cost of the salon 3 years after starting the follow-up period. However, the cost of care increased over time, indicating that the cost of care expected to be reduced may exceed the operation cost if the follow-up period is extended.

Informed consent statement

Potential participants received written information on the purpose and significance of the JAGES study; the burden, expected risks, and possible benefits of study participation; voluntary consent and

withdrawal of consent; and handling of personal information and privacy protection, and that the submission of the completed survey form would be regarded as their consent for study participation.

CRediT authorship contribution statement

Hiroshi Hirai: Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Masashige Saito:** Writing – review & editing, Funding acquisition, Data curation. **Tokunori Takeda:** Writing – review & editing, Funding acquisition. **Katsunori Kondo:** Writing – review & editing, Supervision, Project administration, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data Availability Statement

Data are not open for public due to ethical concerns. Data are from the JAGES study whose authors may be contacted at data management committee: dataadmin@ jages. net. The data set has ethical or legal restrictions because it includes human participants.

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