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Effectiveness of a community organizing intervention on mortality and its equity among older residents in Japan: A JAGES quasi-experimental study

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ABSTRACT

Interventions that involve key aspects of community organizing, such as quantitative community assessments and organizational partnership support for the community, may promote residents' health. We evaluated the effectiveness of this form of intervention on mortality and its variability across individual-level household equivalized income tertiles, comparing 52,858 residents aged 65 and above in 12 intervention municipalities to 39,006 residents in nine control municipalities in Japan. During 1,166 days of follow-up, the adjusted hazard ratio for cumulative mortality among men in the intervention municipalities was 0.92 (95% confidence interval: 0.86, 0.99) compared to those in the control group, with similar results being observed across all income levels. Active utilization of data to evaluate communities and building intersectoral partnerships might lower older male residents' mortality risk, regardless of their income status.

1. Introduction

The growing number of disabled older adults is a major public health issue in an era of global population aging (World Health Organization, 2017). Reoccurring global health crises, including natural disasters and infectious disease outbreaks, heighten the importance of creating resilient communities that provide the opportunity for primary health and social care for older adults (Goldman et al., 2014; Hikichi et al., 2015; Holt-Lunstad et al., 2010; World Health Organization and the United Nations Children's Fund, 2020). To do this, interventions that empower communities, strengthening organizational partnerships with multiple public and private sector bodies, as well as with civic organizations, are required (Ministry of Health, Labour and Welfare, 2012; Naidoo and Wills, 2016; World Health Organization, 2017, 2008). Minkler defined community organizing as "the process by which community groups are helped to identify common problems or change targets, mobilize resources, and develop and implement strategies to reach their collective goals" (Minkler, 2012). A community organizing approach is useful in meeting residential intervention needs, creating networks and dialogue with various stakeholders to provide support to residents (Minkler, 2012).

To carry out community organizing, community assessment and intersectoral partnership building are fundamental skills for practitioners in local public health sectors (Ståhl et al., 2006). However, as there is evidence that local public health staff often have insufficient skills and resources to use epidemiological data or collaborate with other sectors or organizations, supportive frameworks for staff members may be required (Larsen et al., 2014; Morikawa et al., 2016; Ollila, 2011). Recent studies have suggested that broad cooperation among indigenous social agents and grassroots organizations is associated with residents' better health, improved control of chronic diseases, self-efficacy, and public health emergency preparedness (DeCoster and George, 2005; Gil-Rivas and Kilmer, 2016; Jung and Viswanath, 2013; Larsen et al., 2014; Lawn et al., 2008). However, to the best of our knowledge, as yet, few studies have assessed the effectiveness of community organizing interventions aimed at older adults, and most of them have been small, involving only a few communities (Shearer et al., 2012).

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Community organizing has been advocated as a valuable intervention to address health inequalities (Artazcoz and Rueda, 2007; Wallerstein et al., 2017; Wallerstein and Duran, 2006). Although equity is the key dimension of evaluating any public health measure, most health-promoting programs have failed to assess possible differential health impacts across socioeconomic groups (Donabedian, 1990; Whitehead, 2007).

In an earlier study, community organizing interventions were associated with increased participation in social activities among men regardless of their income levels (Haseda et al., 2019). Using a longitudinal quasi-experimental design, the current study builds on and extends this previous research by examining whether this form of intervention is also associated with mortality and its differential impact by income in Japan, the country with the world's most aged population.

2. Methods

2.1. Data

The Japan Gerontological Evaluation Study (JAGES) is an ongoing large-scale, population-based research program in Japan (Kondo and Rosenberg, 2018). Baseline data were drawn from the 2013 wave of the JAGES survey. In October to December of that year self-administered questionnaires were mailed to 193,694 community-dwelling individuals aged 65 years and above who were functionally independent in their daily lives living in 32 municipalities which voluntarily participated in the program. In large municipalities, multistage random sampling methodology based on the official residential registers was used to select respondents, while in small municipalities all eligible residents were included. Completed questionnaires were received from 137,736 individuals (response rate: 71.1%). From the 32 participating municipalities, 21 that included 91,864 (men: 42,833, women; 49,031) respondents, provided public long-term care insurance data for approximately three years (the exact period varied across the municipalities).

2.2. The JAGES program of supporting municipalities

A detailed description of JAGES activities has been provided elsewhere (Haseda et al., 2019 Kondo, 2019; Kondo and Rosenberg, 2018). To support participating municipalities, the JAGES research team has used the JAGES Health Equity Assessment and Response Tool (JAGES-HEART), developed with the World Health Organization (Ojima, 2014; World Health Organization, 2010). The components of JAGES-HEART consist of assessment, response, policy, and program (Table 1). More specifically, after every survey, the JAGES research team created community assessment sheets. These sheets provided within- and between-municipality comparisons on regional health status for specific subpopulations, as determined by age group, gender, and income levels. JAGES researchers provided these sheets to members working in the municipality health sector. Each year, researchers held group sessions using JAGES-HEART for community health promotion and to highlight the importance of social determinants of health.

2.2.1. Intervention

Among the 32 municipalities that participated in the 2013 JAGES survey, JAGES researchers established partnerships in 16 municipalities. We selected these municipalities as the intervention group while the remaining 16 municipalities served as the control group. The intervention group consisted of municipalities where researchers had already established good working relationships with staff members or where they thought these relationships could be developed and thus believed that these municipalities would be good candidates to work with on community organizing using the JAGES-HEART framework. The intervention started when the baseline (2013) survey was completed, and the survey data became available.

Table 1
Components of the planning cycle of JAGES-HEART.

Steps -Brief description	Overall program	Additional support for intervention municipalities
Assessment -Defining the problem	JAGES researchers aggregated individual responses from every survey by municipalities or subpopulations and created community assessment sheets. These sheets help with the identification and monitoring of health issues in each municipality. They provide within and between-municipality comparisons on health status by subpopulations.	(Community assessment sheets provided by researchers are basically the same in both intervention and control municipalities. This phase includes the evaluation of the impact of the program.)
Response -Setting the agenda	JAGES researchers provided these sheets to members working in the municipality health sector. Each year, researchers hold group sessions with municipality staff members where workshops are run on how to use data for community health promotion and to highlight the importance of social determinants of health. Based on this information, staff members set their own targets to achieve active aging among older residents for the next three years. The targets are included in each municipality's plan for the prevention of frailty in older people.	JAGES researchers coached staff members on how to utilize community assessment sheets more effectively in the specific municipality during consultations. Staff members are also instructed on decision making, health promotion and long-term care measures, with relevant epidemiological information or successful examples of activities in other municipalities being given. Stakeholders in the municipalities involved in community organizing activities such as non-profit organizations or private sector companies were also identified and invited to use their technology and/or resources in a socially responsible way to help implement a multifaceted approach to achieve healthy aging in these communities.
Policy -Developing policy	Determined by municipality staff members.	Researchers coached staff members on how to conduct meetings with potential partners. Staff members were expected to utilize community assessment data and resources to make policies. In intersectoral meetings that involved municipality staff members from a wide range of sectors and other local stakeholders, epidemiologic evidence and community assessment sheets were utilized when discussing actions and policies to be prioritized in order to improve older people's health and well-being.
Program -Implementing the program	Determined by municipality staff members.	Examples of collaborative data-oriented actions aimed at improving older people's health include launching community places-to-go (e.g., recreational/socializing salons) and increasing regular participation in these salons and in other existing social activities.

These components are based on Urban-HEART developed by World Health Organization (World Health Organization & WHO Centre for Health Development ⁽Kobe, Japan⁾, 2010).

In the intervention municipalities, researchers provided advice on how to utilize community assessment data effectively and how to facilitate intersectoral meetings. In addition, they also supported municipality staff members through one-to-one consultations several times per year. This continuing support included coaching on agenda setting, developing policy, and implementing the steps in the JAGES-HEART program (Table 1), while these things were determined only by staff members in the control municipalities. Specifically, researchers provided advice on how to utilize community assessment data more effectively and how to facilitate intersectoral meetings In the community care and intersectoral meetings in the intervention municipalities, epidemiologic evidence and the community assessment sheets that were based on the survey data were utilized when discussing issues to be prioritized and effective intersectoral policies to improve the health and well-being of local older people.

Most of the implemented programs were designed to expedite municipalities' community-based long-term care prevention plans, as recommended by the central government: launching community places-to-go and increasing regular participation in social activities. Thus, we could assume that municipal staff members would come into contact with all functionally independent older people in their municipalities through various activities. The specific intervention approaches depended on the individual context and characteristics within the municipality, and the health-related issues or vulnerable subpopulations to be prioritized (see Table 1, Supplementary Table 1).

2.3. Measurements

2.3.1. Primary outcome

In the current study our primary outcome was the occurrence of death, which was identified with public long-term care insurance payment data as these data include the date of death. A secondary outcome was the onset of functional impairment, which was categorized as qualifying to use public long-term care insurance services. Qualifying was based on a nationally standardized process, with seven ranks for the level of care service needs. Details of the Japanese long-term care insurance (LTCI) system have been provided elsewhere (Ministry of Health, Labour and Welfare, 2002; Tamiya et al., 2011). We determined that reaching level 2 or above was a marker for the onset of functional decline. Level 2 relates to individuals who need long-term care for activities of daily living.

2.3.2. Other explanatory variables

As the municipalities were not randomly assigned to the intervention and control groups, our analysis may have been potentially biased. To minimize this risk, we also used information on the characteristics of participating municipalities. We gathered data on the municipalities' characteristics from data sources published by the central government, including the proportion of the population aged 65 and above, population density, the proportion of those who qualified for long-term care, the incidence of new long-term care need cases in the previous year, the standardized mortality ratio (SMR) of those aged 65 years and above, a financial capability index, and the number of "community salon" activities per 10 thousand residents aged 65 and above (Ministry of Health, Labour and Welfare, 2014, Ministry of Health, Labour and Welfare, 2013; Statistics Bureau and Ministry of Internal Affairs and Communications, 2013). The financial capability index shows the fiscal resources available to the local government. It is an average of the value obtained by dividing base fiscal revenue by base fiscal demand over the previous three years. The higher the value, the more financial resources are available (Ministry of Internal Affairs and Communications, 2014).

Assuming that the characteristics of the municipality staff members might also be important when it comes to forming close partnerships with JAGES researchers, we also used data from a questionnaire survey with staff, including the number of years since the municipality's initial participation in the JAGES program, the number of municipality staff members involved in JAGES work by their specialty/job types (public health nurses, clerical worker or other) and the longest number of years of working for the health sector among all municipality staff members. We calculated the averages of multiple members' responses by municipality and assigned them to each municipality as the representative values of the municipality.

Using previous research as a guide, as potential confounders we also considered study participants' age (categorized in 5-year age groups), household equivalized income (tertiles categorized as low, middle, and high), years of educational attainment (9 or less/10 or more), living alone or not, marital status (married or other), depressive symptoms, any health conditions (currently receiving treatment for/experiencing the after-effects of any disease or not), and instrumental activities of daily living (IADL) (Holt-Lunstad et al., 2010; Kagamimori et al., 2009; Wulsin et al., 1999). Household equivalized income was calculated by dividing each response to a question asking about annual income by the square root of the number of household members. We further divided the calculated household equivalized income into tertiles. Depressive symptoms were evaluated using the 15-item version of the Geriatric Depression Scale We set a score of 5 or above as signifying the presence of at least mild depressive symptoms (Niino et al., 1991; Nyunt et al., 2009; Yesavage and Sheikh, 1986). To assess IADL we used a validated scale: the Tokyo Metropolitan Institute of Gerontology Index of Competence (TMIG-IC) that has a 5-item IADL component. If a respondent answered "no" to two or more items, he/she was categorized as having low IADL (Koyano et al., 1991).

2.4. Statistical analysis

We used survival analysis to model the length of days until the onset of an outcome between the intervention and control groups. Fine and Gray's subdistribution hazard model was used to examine the competing risks between mortality and the onset of functional decline (Fine and Gray, 1999). We considered the occurrence of death, onset of functional decline and residential mobility (moving out to another municipality) as competing risks for one another. We calculated robust standard errors to control for data clustering within the elementary school district, the smallest identified geographical unit available in the dataset. We confirmed the proportionality in survival between the two groups by including log-transformed time interactions on all covariates. The analysis was stratified by gender and adjusted for the explanatory variables described above. Since recent studies have shown that community factors may have a different impact according to gender, we modeled men and women separately (Eriksson et al., 2011; Haseda et al., 2019; Pattyn et al., 2011). We also examined the interaction between income level and the intervention and performed stratified analyses by income level. This is because community interventions may have different effects in terms of socioeconomic status, as represented by income, and monitoring health status by socioeconomic status is necessary to assess the effectiveness or fairness of interventions (Frohlich and Potvin, 2008; World Health Organization, 2008, World Health Organization & WHO Centre for Health Development ⁽Kobe, Japan⁾, 2010). Missing information was modeled by creating a missing category for each variable.

We balanced the sample characteristics of the two groups using stabilized inverse probability of treatment weighting (IPTW) techniques, calculating the propensity scores of participating municipalities that were selected to be in the intervention group. We used stabilized weights to weight the samples by the inverse of the propensity scores multiplied by the proportion of the sample observed as intervention and control, respectively (Xu et al., 2010). We calculated the propensity scores by applying a logit model using a baseline (2013) municipality characteristics variable that might have influenced the selection, as described

above.

We performed our primary analysis on an intention-to-treat basis. However, we also performed a sensitivity per-protocol analysis using the frequency of face-to-face meetings between JAGES researchers and municipality staff members as a proxy for the strength of the intervention instead of the original intervention and control group's allocation. We assumed that the more frequently those meetings were held, the more collaborative the relationships would be that were established and that this would result in more community organizing actions being implemented (Cross et al., 2002). We divided the municipalities by the frequency of meetings into three categories: more than twice per year (representing a continuous intervention using JAGES-HEART), once or twice per year (likely to have provided a one-sided lecture on the community assessment data by JAGES researchers), and less than once a year (no consultation or tailor-made feedback). We consulted with researchers to decide the cut-off points for the content validity. For the sensitivity analyses, we simply adjusted for theoretically important municipality-level covariates instead of employing the propensity score because of the difficulty in calculating the scores due to strong correlations between the variables. The adjusted variables included the

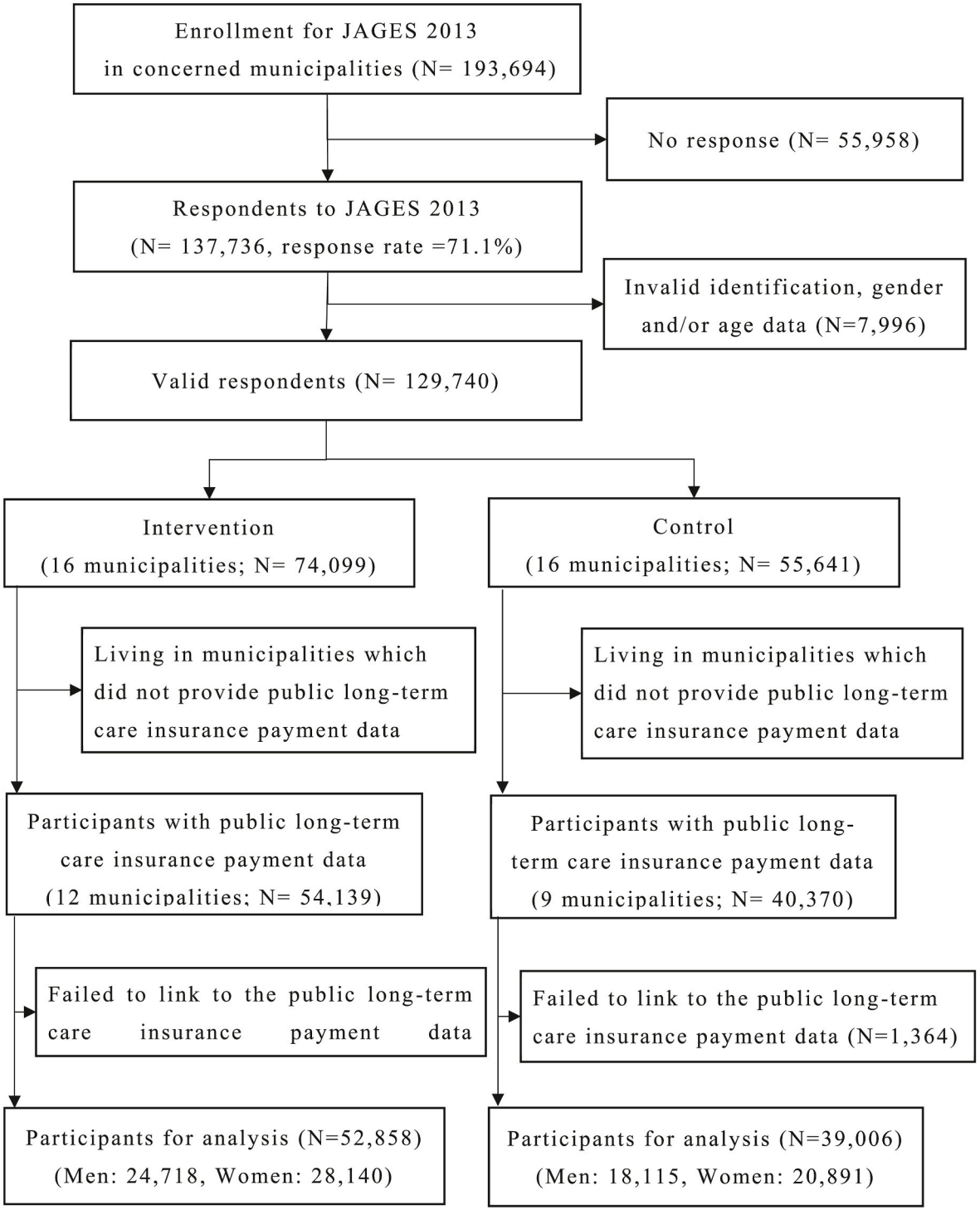

Fig. 1. Flowchart of participants.

proportion of those aged 65 or above, population density, the incidence of receiving LTCI benefits, the SMR of those aged 65 or above, and the number of places-to-go operated by residents.

All analyses were performed with Stata MP, version 15.1 (Stata corp. Texas, USA). The results are presented as hazard ratios (HR) with 95% confidence intervals (CI).

3. Results

Among the 32 participating municipalities, 12 intervention and 9 control municipalities provided follow-up data. We thus analyzed data from 91,864 individuals (24,718 men and 28,140 women in the intervention group, 18,115 men and 20,891 women in the control group) (Fig. 1, Table 2). The mean follow-up period was 1,166 days with a maximum period of 1,287 days. During the 277,749 person-years of follow-up, 3,029 men (1,646 in the intervention group and 1,383 in the control group) and 1,562 women (836 in the intervention group and 726 in the control group) died. Meanwhile, 2,246 men (1,300 in the intervention group and 946 in the control group) and 2,122 women (1,159 in the intervention group and 963 in the control group) developed functional impairment. After the IPTW process, all municipality characteristics were well-balanced between the intervention and control groups: the standardized differences of all variables were less than 0.1 (Table 3) and the c statistic was 0.762.

The results of the survival analysis showed that among men, the adjusted mortality HR for older people in the intervention group was 0.92 (95% CI: 0.86, 0.99), which was lower than in the control group (the P-value for the between group difference = 0.026) (Fig. 2, Supplementary Table 2). Among women, no association was observed between the intervention and mortality. The mortality HR of women in the intervention group was 1.02 (95% CI: 0.92, 1.12) compared to those in the control group.

In an analysis stratified by income level, among men, the mortality risk was marginally lower in the intervention group for both the low- and high-income groups (Fig. 3). Interactions between the intervention and income levels were not observed for either men (p = 0.998) or women (p = 0.596).

The risk for the onset of functional disability was not different between the two groups for either men or women: the adjusted HR for individuals in the intervention group was 1.06 (95% CI: 0.96, 1.17) for men and 0.99 (95% CI: 0.87, 1.12) for women (Fig. 4, Supplementary Table 3).

The per-protocol sensitivity analyses showed similar results, though they were not statistically significant. Men and women who lived in municipalities where JAGES-municipality staff meetings were held more than twice per year both had HRs below 1compared to the residents in municipalities where meetings were held less than once per year. Specifically, the HR was 0.96 (95% CI: 0.87, 1.05) for men and 0.98 (95% CI: 0.86, 1.12) for women (Supplementary Table 4).

Table 2
Baseline characteristics and observed outcomes of the community-dwelling older adults.

	Men				Women			
	Intervention (n = 24,718)		Control (n = 18,115)		Intervention (n = 28,140)		Control (n = 20,891)	
	n	(%)	n	(%)	n	(%)	n	(%)
Deaths	1,646		1,383		836		726	
Moved out*	272		109		351		153	
Person-years	77,635		57,955		89,847		68,097	
Functional disabilities	1,300		946		1,159		963	
Person-years	73,340		54,977		85,018		64,414	
Age								
65–69	6,802	(27.5)	5,415	(29.9)	7,455	(26.5)	5,697	(27.3)
70–74	7,481	(30.3)	5,473	(30.2)	8,704	(30.9)	6,177	(29.6)
75–79	5,633	(22.8)	3,803	(21.0)	6,431	(22.9)	4,639	(22.2)
80–84	3,348	(13.5)	2,309	(12.8)	3,761	(13.4)	2,828	(13.5)
85-	1,454	(5.9)	1,115	(6.2)	1,789	(6.4)	1,550	(7.4)
Equivalent household income tertiles								
Low-income (<1.58 million yen)	5,769	(23.3)	4,434	(24.5)	7,253	(25.8)	5,497	(26.3)
Middle-income (1.58–2.46 million yen)	6,227	(25.2)	4,395	(24.3)	5,961	(21.2)	3,865	(18.5)
High-income (>2.46 million yen)	9,503	(38.5)	6,362	(35.1)	8,594	(30.5)	5,904	(28.3)
Missing	3,219	(13.0)	2,924	(16.1)	6,332	(22.5)	5,625	(26.9)
Education								
<10 years	8,355	(33.8)	8,102	(44.7)	11,058	(39.3)	11,172	(53.5)
Missing	457	(1.9)	327	(1.8)	717	(2.6)	545	(2.6)
Family								
Living alone	2,403	(9.7)	1,183	(6.5)	5,315	(18.9)	2,882	(13.8)
Missing	1,031	(4.2)	810	(4.5)	1,485	(5.3)	1,274	(6.1)
Marital status								
No spouse	3,571	(14.5)	2,200	(12.1)	10,873	(38.6)	7,660	(36.7)
Missing	459	(1.9)	421	(2.3)	816	(2.9)	814	(3.9)
Health status								
Any health conditions**	17,938	(72.6)	13,102	(72.3)	20,260	(72.0)	15,273	(73.1)
Missing	3,038	(12.3)	2,288	(12.6)	3,650	(13.0)	2,762	(13.2)
Physical function								
Declining IADL	1,872	(7.6)	1,845	(10.2)	1,254	(4.5)	1,400	(6.7)
Missing	629	(2.5)	565	(3.1)	659	(2.3)	765	(3.7)
Mental health status								
Having depressive symptoms	6,521	(26.4)	4,878	(26.9)	7,092	(25.2)	5,326	(25.5)
Missing	2,328	(9.4)	1,847	(10.2)	4,367	(15.5)	3,363	(16.1)

Abbreviations: IADL, Instrumental Activities of Daily Living.
* Moved out: lost to follow-up after moving to another municipality.
**Any health conditions: currently receiving treatment for, or experiencing the after-effects of cancer, stroke, heart disease, hypertension, diabetes mellitus, dyslipidemia, respiratory disease, gastrointestinal disease or liver disease, kidney or prostate gland disease, musculoskeletal disease, traumatic injury, blood or immune system disease, psychiatric disease, dementia, Parkinson's disease, visual impairment, hearing impairment, and others.

Table 3
Baseline characteristics of the 21 municipalities.

	Intervention (n = 12)		Control (n = 9)		Standardized Difference	
	mean	[SD]			Raw	Weighted
Demographic						
Proportion of adults aged ≥65, %	24.5	[5.2]	23.1	[2.5]	−0.24	−0.05
Proportion of older people using LTCI, %	16.9	[2.6]	15.3	[1.5]	−0.05	−0.02
Incidence of certified LTCI, %	4.6	[0.6]	5.4	[4.4]	−0.06	−0.03
Standardized Mortality Ratio (aged ≥65)	0.97	[0.06]	1.07	[0.08]	−0.607	−0.086
Financial Capability Index	1.8	[1.8]	4.4	[5.8]	0.254	0.076
City Index [a]	0.7	[0.3]	0.8	[0.2]	0.3	0.03
Number of community salons (/10,000 aged ≥65)	1.7	[0.8]	1.8	[0.4]	0.09	−0.09
Years since participating in JAGES	5.3	[3.6]	6.8	[4.1]	−0.22	−0.02
Characteristics of municipality staff						
Proportion of office workers	0.3	[0.3]	0.2	[0.3]	−0.03	0.02
Longest years in service	7.9	[7.2]	6.5	[5.1]	0.1	−0.03

Abbreviations: SD, standard deviation; LTCI, Long-Term Care Insurance.
[a] City Index = Categories of residential population density (1: <1000/km^2,2: 1000–4000/km^2, 3: >4000/km^2).

4. Discussion

The results of survival analyses showed that the mortality risk was lower among older men living in municipalities where JAGES researchers actively supported municipality staff members for community organizing actions. This result was similar across all income levels. However, the intervention was not associated with the risk for the onset of functional disability.

Our findings are in line with an earlier observational study in Sweden that evaluated a "safe-community" program through intersectoral actions that had taken place in a municipality, which reported reduced falls and injuries in adults aged 65–79 years (Lindqvist et al., 2001). Using more data and a more rigorous analytic approach (IPTW), we have added new evidence by showing that community organizing interventions might even reduce mortality.

Several potential mechanisms may explain our findings. The intervention might have developed the capacity of local staff members to plan and practice health-promoting activities targeting social determinants of health. Such interventions may foster individual-level social capital in local staff members which can lead to collaborative synergy and the better governance of municipalities. In turn, this may facilitate the planning and implementation of health-promoting strategies matched with each community context, and in this way, enable older adults to enhance their mental health and functional abilities for basic, instrumental, and social activities of daily living, thus alleviating the risk of premature mortality (Haseda, 2018; Haseda et al., 2019; Takahashi et al., 2019; Watanabe et al., 2019; World Health Organization, 2015). This is in line with the process described in the community coalition action theory, a practical framework for community organizing (Butterfoss, 2013). Another possibility is that the partnership with academic human resources in a community health promoting program had an additive effect. Empirical evidence suggests that community-academic partnerships that incorporate the same components as the JAGES program may result in beneficial outcomes such as trusted and respectful interpersonal relationships, that can lead to data-oriented actions, etc (Cargo and Mercer, 2008; Drahota et al., 2016; Kondo and Rosenberg, 2018).

We can only speculate why the intervention was beneficial for men but not women. First, men might have more room to improve in terms of their functional ability. A previous study found that a 3-year intervention increased the participation of men in the community more than women (while women did not show a large improvement perhaps due to a ceiling effect) (Haseda et al., 2019). Second, our intervention succeeded in identifying and targeting a priority subpopulation (older men). Many local practitioners seem to understand the less socially active status of older men than women in the community (based on our personal communications). Therefore, data showing that status in a quantitative manner may be a powerful motivating factor that pushes practitioners to target this specific subpopulation. Indeed, in some municipalities, staff members have already started recruiting volunteers by targeting retired men with special calls to participate as steering committee members in neighborhood residential associations and other informal activity groups (Hikichi et al., 2015; Kondo and Rosenberg, 2018).

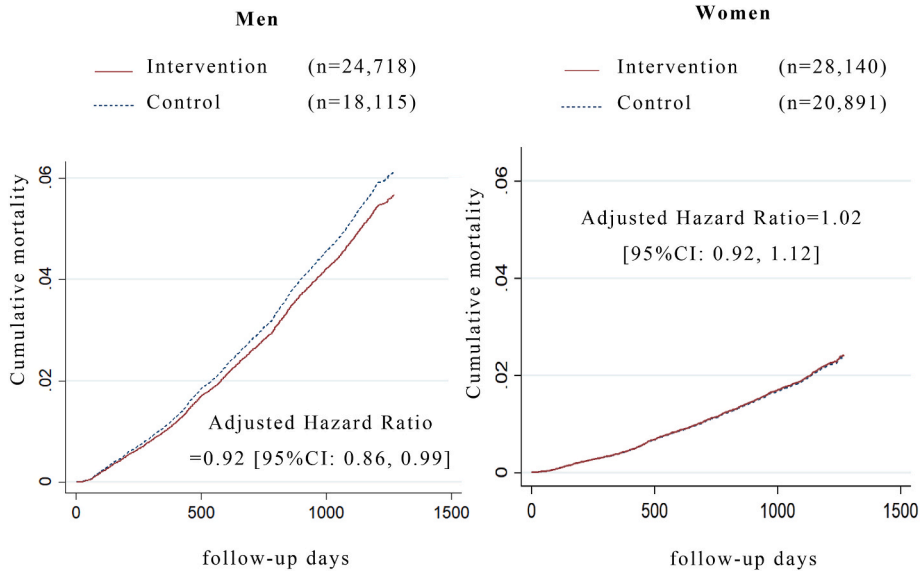

Fig. 2. Cumulative mortality: results of proportional hazard model analyses.

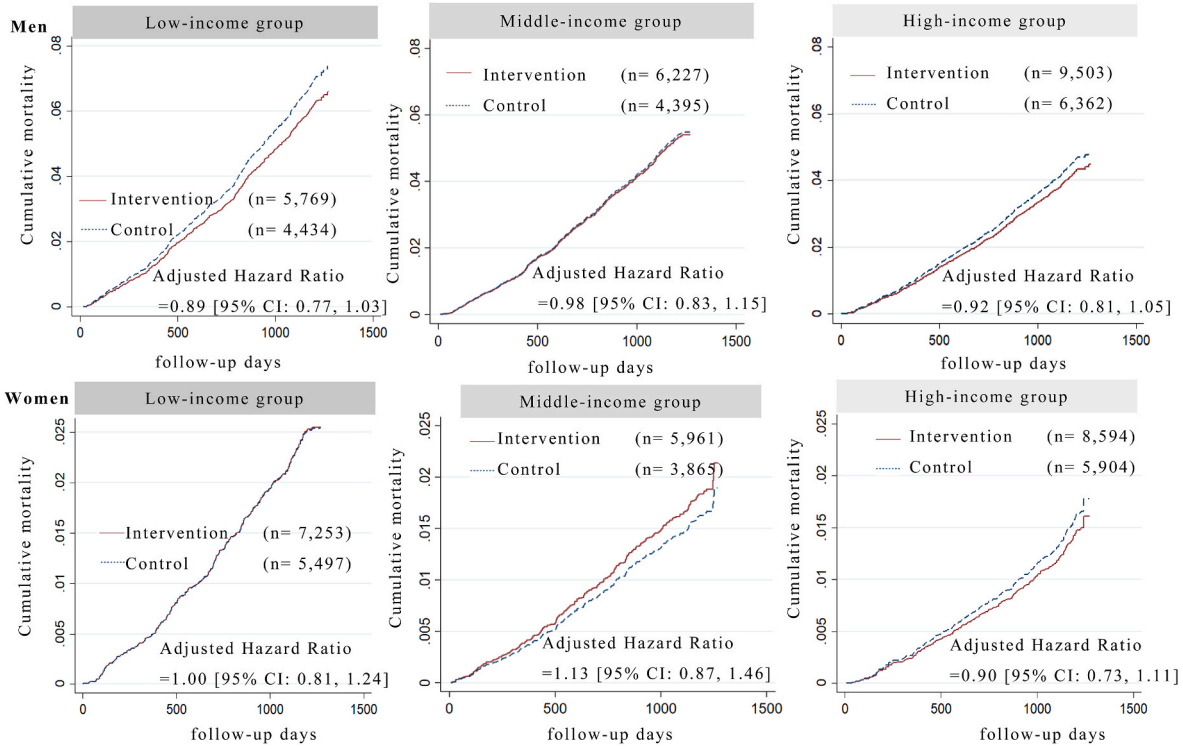

Fig. 3. Cumulative mortality by gender and income levels.

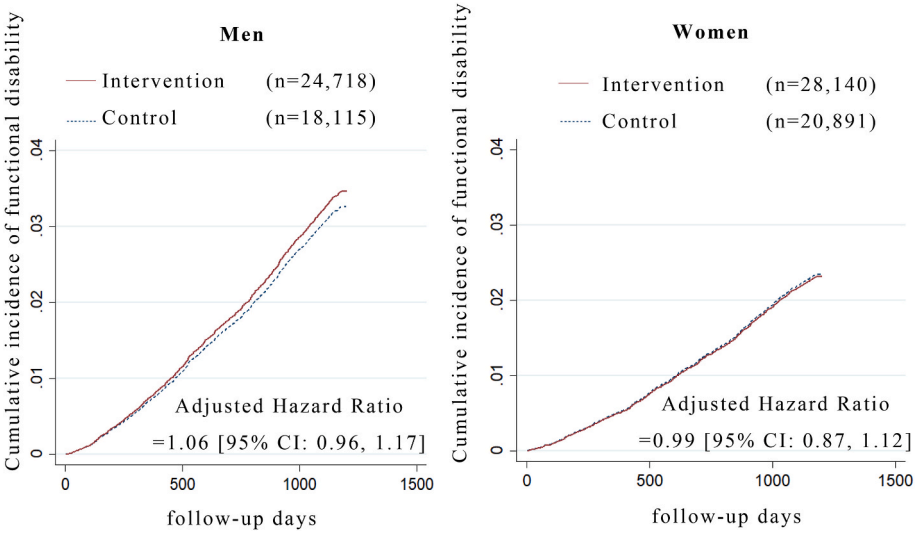

Fig. 4. Cumulative incidence of functional disability by gender: results of proportional hazard model analyses.

The possibly beneficial effects of the intervention were observed regardless of individual income levels, i.e., we did not find evidence of any modification by income of the effect of the intervention. This concurs with the findings of a meta-analysis showing that community engagement interventions have a positive impact on the health and psychosocial aspects of disadvantaged populations (O'Mara-Eves et al., 2015). A possible reason for why there was a positive impact irrespective of income levels might be linked to the fact that these results are from a strategic data-oriented intervention. More specifically, some municipalities may have used health data by income level for intervention targeting (Kondo, 2015). Lower income groups might have been embraced and prioritized for action (e.g., increasing some activities in the community that are easy for low-income people to participate in) because of the poorer health data among disadvantaged individuals. Despite the association with mortality, the intervention was not linked to functional decline. This was an unexpected finding given that a number of studies have shown that differences in functional decline are also associated with social participation (Douglas et al., 2017; Takahashi et al., 2019). This might have been due to measurement error linked to the outcome. We defined the onset of functional decline as becoming qualified for public long-term care insurance benefits. In intervention communities, it is possible, however, that residents may have had greater access to long-term care services as a result of the building of a stronger network of stakeholders. This situation may have enhanced the potential demand for formal support, resulting in more "disability" onset. Our intervention might have also been insufficient to prevent the

transition to a functional disability status for individuals who were severely frail at the baseline.

This study has several limitations. First, some bias might have been induced when allocating the municipalities into the intervention and control groups. In some municipalities, close JAGES-municipality collaborative actions had already been established before the baseline. In this case, the HRs may reflect effects carried over before baseline. Nonetheless, we believe that our balancing of the propensities of being selected for the intervention, that even considered the personal characteristics of municipality staff, minimized the impact of potential confounders. This being said, as it was not possible to allocate municipalities randomly in this study, future studies which randomly allocate municipalities participating in the program at the same time point are required to ensure there is no potential confounding. Second, residual confounding may have existed. For example, the participating municipalities might have been receiving external support from non-JAGES bodies (e.g., other universities and commercial consultation services). It is also possible that the pre-intervention mortality trends might have been different between the two groups. However, we were not able to examine this issue due to a lack of suitable data. Additionally, we grouped missing data into a missing category in our analyses which may have introduced bias. Further studies are needed where other approaches are adopted for dealing with missing data, such as through multiple imputation. Third, municipality staff members in all municipalities participating in the JAGES program might have been highly motivated to engage in community organizing actions from the beginning of this study, even if they were subsequently allocated to the control group. This might have resulted in an underestimation in the effect size we observed. Fourth, the follow-up period might not have been sufficient to determine whether the intervention had been truly effective. In addition, given that there was only a marginally beneficial effect of the intervention on mortality among men, the results might have been observed by chance. Further studies examining the long-term effects and underlying mechanisms behind these changes using a longer follow-up period and more precise health-status data are necessary. Fifth, the intervention might not have been consistent across the intervention group and thus may have violated the consistency assumption since the specific content of the efforts in each municipality differed according to the context. However, the main framework and concept used were consistent among all intervention municipalities. Furthermore, this intervention framework allowed flexible support according to the situation of the local government, and such flexibility may have had a beneficial effect in terms of the intervention.

5. Conclusions

Supporting municipality staff members in two key aspects of community organizing – utilizing quantitative community data and building intersectoral and organizational partnerships – might be important for lowering the mortality risk among older male residents, regardless of their income levels, assuming our results were not observed by chance. Governmental policies to promote these support schemes among municipalities may be effective in promoting overall healthy longevity and in reducing its inequality due to gender and income. Further research is required to assess the effectiveness of these collaborative interventions over a longer period and if such interventions are effective even when provided by non-academic support providers, using more robust study designs, e.g., cluster randomized controlled trials.

Data availability statement

The data underlying this article were provided by the JAGES data administration office by permission. Data will be shared on request to the corresponding author with the permission of the JAGES data administration office (https://www.jages.net/data_application/).

Ethical approvals

This study was approved by the ethics board of the Faculty of Medicine, the University of Tokyo (approval No:10,555). The 2013 JAGES wave was approved by the ethics committee of the Nihon Fukushi University (approval No: 13–14).

Declaration of competing interest

None declared.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.healthplace.2022.102764.

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