Roles of participation in social activities in the association between adverse childhood experiences and health among older Japanese adults

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https://doi.org/10.1016/j.ssmph.2021.101000
Received 27 July 2021; Received in revised form 14 November 2021; Accepted 11 December 2021
Available online 14 December 2021
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ARTICLE INFO

Keywords:
Social participation
Adverse childhood experience
Older adults
Controlled direct effect
Depression
Subjective health

ABSTRACT

Adverse childhood experiences (ACEs) have shown strong associations with later-life health such as depression and subjective health. Social participation is also associated with later-life health but it is unclear to what extent this could contribute to alleviating harmful impacts of ACEs, nor is it clear whether ACEs are themselves associated with later-life social participation. Thus, this study aims to understand: (1) the influence of ACEs on social participation in later life and (2) whether social participation can alleviate the harmful influences of ACEs on depression and subjective health among Japanese older adults. Data were from 5,671 Japanese older adults (aged 65+) in surveys in 2013 and 2016 as part of the Japan Gerontological Evaluation Study (JAGES). Logistic regression analyses were conducted to estimate the relations between ACEs and later-life social participation, adjusting for potential confounders and mediators. Inverse probability weighting was used to estimate average effects of ACEs on later-depression and subjective health, adjusting for potential confounders, and these were compared against controlled direct effect (CDE) estimates from marginal structural models based on all respondents experiencing weekly social participation. We found that ACEs were associated with reduced later-life social participation (OR for >1 ACEs = 0.88, 95% CI = 0.79, 0.99). The estimated effect of ACEs on depression (adjusted total effect estimates: OR = 1.23, 95% CI = 1.05, 1.45) was marginally alleviated in estimates assuming weekly social participation for everyone (CDE = 1.18, 95% CI = 0.98, 1.43). A similar tendency was seen for poor subjective health. Negative impacts of ACEs on depression may be marginally mitigated through social participation, but mitigating effects were moderate. Further investigation on other potential later-life mitigating factors is needed.

1. Introduction

Population ageing is expanding worldwide. In 2019, 703 million people were aged 65 years or over, which was 10% of the global population (UN Population Division, 2019). Countries will continue to face increasingly older populations until 2050 when they are expected to reach 1.5 billion or more. Japan is the leading country worldwide in the speed of population ageing and is projected to maintain the world’s highest ratio of people aged 65 years or over to those of working age until at least 2050 (projected at 81 per 100) (UN Population Division, 2019). The maintenance of physical, mental and social capabilities of older people has become a significant target for public health interventions (World Health Organization, 2002), which are especially relevant to Japan and its ageing population. This study explores social participation as a means of mitigating impacts of adverse early life experiences on later-life health and depression.

In life course epidemiology, early life experiences are understood to be important determinants of later-life health (Cheong et al., 2017; Cristóbal-Narváez et al., 2016; Hughes et al., 2016, 2017; Nuris et al., 2012; Shawi et al., 2019; Westreich & Greenland, 2013), and there is a growing recognition of the influence of Adverse Childhood Experiences (ACEs). ACEs are ‘potentially traumatic events or chronic stressors that occur before the age of 18 and are uncontrollable to the child’ (Felitti et al., 1998). They can include both direct harm (e.g. violence, financial
difficulties and neglect) and indirect harm (e.g. mental illness and parental conflict) (Edwards, 2019; Hughes et al., 2017). Older people who have had ACEs are more likely to experience depression and have lower subjective health (Cheong et al., 2017; Tani, Fujiwara, et al., 2016; Tani, Kondo, et al., 2016), and with populations continuing to age globally, the development of public/global health interventions that can mitigate such effects in old age is especially important (World Health Organization, 2015). Older people with a history of childhood maltreatment tend to have additional medical and care costs compared with those who have not had ACEs (Bellis et al., 2019; Isumi et al., 2020), so any mitigating interventions could have important impacts in reducing healthcare costs. There is evidence that social participation in neighbourhood activities can enhance the health of older people (Levasseur et al., 2010; Saito et al., 2019; World Health Organization, 2002). For instance, many studies have found that social participation was associated with reduced risk of depression (Takagi et al., 2013), poor subjective health (Leone & Hessel, 2015), cognitive decline (Zunnegui et al., 2003), mortality (Glass et al., 1999; Hsu, 2007) and impaired physical function (Kanamori et al., 2014). This might be because social participation can create a network of relationships and intimate ties, allowing access to actual, expressive and crisis support, facilitating mental well-being (Lin et al., 1999).

In the absence of intervention, however, ACEs could actually influence the extent of later-life social participation. This is because prior empirical studies show that a favourable family environment, such as warm, sensitive parenting in childhood, predicts adaptive personality traits and temperament in later-life (Eisenberg et al., 2015; Josefsson et al., 2013; Kazuhisa et al., 2000). Moreover, childhood experience of ACEs was significantly associated with later behavioral problems from childhood to adolescence (Choi et al., 2019). Thus, if ACEs hinder the development of sociability, people with adverse experiences could find it more difficult to participate in social activities, and this could contribute to or widen the health disadvantage of those with ACEs. Alternatively, social participation may be a coping strategy used by those who have experienced ACEs to foster resilience and recovery (Bonanno et al., 2011; Southwick et al., 2014), so social participation in later life could be more frequent for those who have experienced ACEs.

Nevertheless, it is unclear how strongly ACEs are related to sociability in later-life and unclear to what extent social participation can mitigate the impact of ACEs. Thus, this study aims to understand: (1) the influence of ACEs on social participation in later life and (2) whether social participation can alleviate the harmful influences of ACEs on depression and subjective health among Japanese older adults (both known as later-life health outcomes associated with ACEs (Hughes et al., 2017)).

2. Methods

2.1. Data

Data were from the Japan Gerontological Evaluation Study (JAGES). The JAGES Project is an ongoing nationwide survey to understand the physical and mental health, socioeconomic status and health behaviour of community-dwelling older adults in Japan (Kondo et al., 2018). Ethics approval for the JAGES study was obtained from the ethical committee at the National Centre for Geriatrics and Gerontology (approval no. 992) and Chiba University (approval no. 2493). This study used data from waves four (in 2013) and five (in 2016) because these included more municipalities with better response rates than previous waves. In wave four, random sampling was conducted by local government officials in each of 4 large municipalities, while all eligible residents in 14 small municipalities and one region received the questionnaire. The remaining 13 municipalities mailed questionnaires to their pre-wave 4 participants and newly eligible participants (newly aged 65 and over). A total of 137,736 participants gave valid data (overall response rate: 71.1%). JAGES consists of a core questionnaire for all respondents with more specific and sensitive content, such as on ACEs and disability, in additional modules. The additional modules were randomly allocated within each municipality as follows: first, extracting older people who were born before 1 April 1948 and who live independently (i.e. those who do not use care services) as the eligible population; second, making a list of eligible population sorted by postcode and age in ascending order; third, the additional modules A to E were allocated within each municipality by consecutive assignment to every fifth respondent from a list of all those eligible, sorted by postcode and age. From participants assigned to the ACEs module in wave four, those who also participated at wave five were extracted (n = 12,271). Data from 5,671 people was used for analysis, after excluding 6,600 who did not complete all questions of interests (Fig. 1). Response rates are shown in supplementary appendix 1 (Figure A.1).
other); instrumental activities of daily living scale (IADL: <5 (low disability) vs ≥5 (high disability)); activities of daily living (ADL: no need of nursing care vs needs nursing care/receives nursing care); current disease (no disease vs currently receiving treatment or experiencing at least one of a list of common diseases); marital status (married vs widowed/divorced/never married/other); living status (living alone vs living with others); subjective health (very good/good vs not good/bad); depressive symptoms (GDS 15: <5 (no depression) vs ≥5 (depression)).

These confounders may also be potential mediators between ACEs and later-life social participation (Fig. 2). We repeated analyses stratified by age (<68 vs 68+) to see if results differed depending on whether respondents were born after world war II, but findings were consistent (data not shown).

2.3. Statistical analysis

The associations between ACEs and social participation were estimated by logistic regression and results are presented as odds ratios (OR) with 95% confidence intervals (CI). Covariate adjustment was performed in four, cumulative stages: (1) sex and age; (2) childhood SES; (3) socio-demographic backgrounds and adult SES; and (4) physical and mental health. Although the confounder adjusted Model 2 might be the best estimate for the effect of ACEs on adult sociability, Models 3 and 4 were conducted to estimate direct effects of ACEs, not via these mediators. This is useful for comparing with other studies that have adjusted for potential mediators (Kelly-Irving & Delpierre, 2019). However, such adjustment may induce collider bias (Greenland, 2003) on the ACEs-sociability relationship if there are unmeasured confounders of the relationship between these mediators and later-life sociability.

In order to assess the extent to which a relationship between ACEs and later-life health can be modified by later-life social participation, counterfactual mediation analysis was then conducted (see Fig. 2 for DAG).

We compare three estimates: (1) an unadjusted association between ACEs and the outcome; (2) a confounder adjusted total effect estimate of ACEs on the outcome; and (3) a controlled direct effect (CDE) estimate where social participation is fixed to ‘weekly for everyone’ (along with adjustment for confounders). More traditional mediation methods can be subject to well-known biases related to exposure-mediator interaction and exposure-induced mediator-outcome confounding (Richiardi et al., 2013; VanderWeele, 2009). Our CDE estimates account for these issues and focus on what we are most interested in (Naimi et al., 2014; VanderWeele, 2009), namely the effect of ACEs after controlling social participation to the same level for everyone.

In second and third models, the inverse probability-weighted (IPW) method was adopted to remove imbalance that is not caused by exposure (Hernán & Robins, 2020). Predicted probabilities were extracted from logistic regression models predicting the exposure of interest (ACEs) and the mediator (social participation) and analysis weights were calculated and employed to obtain the average effect and CDE estimates (see supplementary appendix 2 for details). The CDEs of ACEs on depressive symptoms and subjective health were obtained by inverse-probability

Fig. 1. Flowchart showing the structure of JAGES 13–16 panel dataset and selection of participants.
weighted logistic regression models including ACEs, social participation and their interaction terms. Each CDE was interpreted as the remaining ‘direct’ effect of the ACEs (i.e. not through social participation) under a hypothetical intervention setting social participation to a particular level (i.e. social participating once a week in at least one group or organisation) for all participants. All analyses were performed using Stata version 14.2 (StataCorp, College Station, TX, USA).

3. Results

3.1. Descriptive analysis

Descriptive analysis (Table 1) showed that the mean numbers of ACEs were 0.978 (SD = 0.97) for males and 0.782 (SD = 0.911) for females. Financial trouble was the most frequent ACE in both males and females (50.7% and 38.52%, respectively). Weekly participation in social activities was more prevalent among females: (male vs female: 31.05% vs 43.16%). The proportion of participants with depression and poor subjective health were about the same for men and women (19.57% male and 20.24% female for the former; 15.54% male and 12.21% female for the latter).

The basic sex- and age-adjusted model showed that experience of one or more ACEs was associated with an odds ratio (OR) for participating in community activities more than once a week of 0.88 (95% confidence interval [CI] = [0.79, 0.99]), compared with those having not experienced any ACEs (Model 1, Table 2). However, these associations were not statistically significant after adjusting for childhood SES (Model 2, Table 2) and were further attenuated with adjustment for other potential later-life mediators.

In addition, the association between later-life social participation and ACEs varied by the types of ACEs (Fig. 3).

Participants who had a parent with a mental illness in childhood had reduced odds of weekly social participation in later life (OR = 0.35, 95% CI [0.15, 0.86]) (see appendix 3 for detail). None of the other types of ACE showed a clear, independent relationship, though many had ORs lower than 1.

Table 3 shows the unadjusted estimates, adjusted total effect estimates and CDE estimates for the effect of one or more ACEs on depressive symptoms and subjective health in each. CDE estimates were adjusted for confounders and fixed social participation to weekly for everyone.

The unadjusted associations indicate that having any ACE was associated with a greater likelihood of having depression in later life with statistical significance (OR = 1.45, 95% CI = 1.26,1.66). After adjusting for confounders, the total effect estimate was weaker but still present (OR = 1.23, 95% CI [1.05, 1.45]). CDE estimates of ACEs on depression (setting all participants to weekly social participation) were more attenuated (CDE: OR = 1.18, 95% CI [0.98, 1.43]). A similar tendency was seen in all estimates, including CDEs, on subjective health.

4. Discussion

We present empirical evidence from a large cohort study of Japanese older adults regarding the correlation between ACEs and later-life sociability and health. ACEs were associated with a lower frequency of social participation in later life, and that one particular ACE — mother or father suffered a mental illness — was most clearly associated with a reduced probability of later-life social participation. Further, it was estimated that weekly social participation in later life could only marginally alleviate the negative influence of ACEs on both depression and subjective health.

Our findings are consistent with others who have found that childhood adversities were associated with reduced later-life social engagement, as indicated by part-time employment and retirement in those age 55 years old (Fahy et al., 2017). Our study demonstrates that ACEs also affect participation in community social activities, including hobbies and sports. In Japan, health promotion policies encourage older people participating in community social activities (Minister of Health, 2012), which may increase the gap in social participation between those with and without ACE.

However, in our study, introducing a childhood SES adjustment attenuated the estimated association between ACEs and social participation. This might be a case of over-adjustment. The available measure of childhood SES concerned individuals’ socioeconomic status (or household conditions) when they were 15 years old, while respondents were asked to report ACEs from infancy up to age 18. Therefore, the
Descriptive analysis.

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Living status in 2013

- Instrumental activities of daily living scale (IADL) in 2013
- Activities of daily living (ADL) in 2013
- Equivalised income in 2013 (average: 232,380.5 JPY)

Subjective health in 2016

- Depressive symptoms in 2016
- Frequency of social participation in 2013

Childhood SES

- Financial trouble
- Was told hurtful things or was insulted by your mother/father
- Your father was violent with your mother
- Mother or father suffered a mental illness
- Loss of a parent

ACEs in each

- Number of Adverse Experiences (ACEs) in total

| | Overall | Male | Female |
| --- | --- | --- | --- |
| Age in 2016 | mean (n = 5,671) | SD | mean (n = 2,953) | SD | mean (n = 2,718) | SD |
| Number of Adverse Childhood Experiences (ACEs) in total | | | | | | |
| N | % | N | % | N | % |
| Low IADL | 48 | 0.85 | 26 | 0.88 | 22 | 0.80 |
| High IADL | 5,623 | 99.15 | 2,977 | 99.12 | 2,646 | 99.19 |
| Current disease in 2013 | | | | | | |
| Having no disease | 1,121 | 19.77 | 575 | 19.47 | 546 | 20.09 |
| Having 1 or more | 4,550 | 80.23 | 2,378 | 80.53 | 2,172 | 79.91 |
| Marital status in 2013 | | | | | | |
| Married or was married | 1,193 | 21.04 | 279 | 9.45 | 914 | 33.63 |
| Never married or other | 4,478 | 78.96 | 2,674 | 90.55 | 1,804 | 66.37 |
| Living status in 2013 | | | | | | |
| Living alone | 505 | 0.95 | 187 | 6.33 | 343 | 15.97 |
| Living with others | 5,050 | 9.05 | 2,766 | 93.67 | 2,284 | 84.03 |

In this study, a large sample of population-based panel data was used, which enabled the use of conditional causal mediation analysis by adopting marginal structural modelling with inverse probability-weighted methods. This helped overcome some potential biases present in traditional mediation analyses that are associated with adjustment for mediator-outcome confounders that are caused by exposure and exposure-mediator interaction (Naime et al., 2014; Richardi et al., 2015; VanderWeele, 2009). This study has some limitations. Given the nature of self-reported retrospective surveys, the data concerning ACEs and childhood SES may be susceptible to recall bias (Kelly-Irving & Delpierre, 2019). If, for example, more adverse experiences are more easily recalled, then the true association between childhood SES and ACEs may be accentuated in the data, and the impact of controlling for childhood SES may be over-estimated. Furthermore, reverse causation between ACEs and later-life social participation and/or later-life SES could not be ruled out.
Even though the questionnaire asked participants about their experiences when they were younger than 18, it is possible, for example, that those who participate in social activities are more willing to talk about and recall their adverse childhood experiences. It is also possible that people who are economically deprived (i.e., who have low SES) may be more likely to remember their adverse experiences. Finally, the association between ACEs and later-life social participation and health could also reflect other omitted variables, such as individual characteristics, the inability to communicate with others, temperament, personality or later-life traumatic events, which are not measured in the JAGES study.

5. Conclusion

Having any one of the ACEs was associated with reduced social participation in later-life, but this association was not independent of childhood SES or other later-life characteristics. Such inequality in social participation may result in a wider health imbalance between people with and without ACEs. The negative impact of ACEs on later-life health may be marginally mitigated through promoting social participation, but estimated mitigating effects were limited. Prevention and early interventions for ACEs are vital, although understanding effective later-life interventions are important to help reduce disparities among those who have missed those early-life opportunities. Further study is needed to understand other potential interventions that may mitigate the negative impact of ACEs in later-life.

Table 2
Multivariate logistic regression models for the association of more than one ACE and later-life social participation.

| Model 1 | Model 2 | Model 3 | Model 4 |
|---------|---------|---------|---------|
| OR      | OR      | OR      | OR      |
| 95% CI  | 95% CI  | 95% CI  | 95% CI  |
| No ACE  | Reference | Reference | Reference | Reference |
| 1ACEs   | 0.88 [0.79, 0.99] | 0.96 [0.85, 1.09] | 1.01 [0.89, 1.14] | 1.07 [0.94, 1.21] |

Notes: OR denotes odds ratio, CI indicates confidence interval.
Model 1: adjusted for sex and age.
Model 2: adjusted for potential confounder, i.e. childhood SES.
Model 3: adjusted for potential confounder and mediators in relation to socio-demographic backgrounds and adulthood SES, i.e. marital status, household status, education history, current income and occupation.
Model 4: adjusted for childhood SES, socio-demographic backgrounds and adulthood SES and potential mediators in relation to physical and mental health, i.e. subjective health, depressive symptoms, current disease, ADL and IADL.

Table 3
Estimates of effects of ACEs on depressive symptoms and health (social participation at least once a week).

| Outcomes                          | Unadjusted association OR 95% CI | Adjusted total effect estimate OR 95% CI | CDE OR 95% CI |
|-----------------------------------|---------------------------------|----------------------------------------|---------------|
| Depressive symptoms               | 1.45 [1.26,1.66]                | 1.23 [1.05,1.45]                       | 1.18 [0.98,1.43] |
| Subjective health                 | 1.46 [1.25,1.71]                | 1.20 [0.99,1.45]                       | 1.18 [0.95,1.46] |

Notes: OR denotes odds ratio, CI indicates confidence interval.

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Author statement

Marisa Nishio: Conceptualization, Formal analysis, Writing- Original draft, Visualization; Michael Green: Supervision, Writing- Reviewing and Editing; Naoki Kondo: Data curation, Writing- Reviewing, Funding acquisition.

Declaration of competing interest

MG was funded by the UK Medical Research Council (MC_UU_00022/2), and the Scottish Government Chief Scientist Office (SPHSU17). This study used data from JAGES (the Japan Gerontological Evaluation Study), which was supported by Grant-in-Aid for Scientific Research (15H01972, 15H04781, 15H05059, 15K03417, 15K03982,
sectional study. BMC Public Health, 19(1). https://doi.org/10.1186/s12889-019-7957-9

Southwick, S. M., Bonanno, G. A., Masten, A. S., Panter-Brick, C., & Yehuda, R. (2014). Resilience definitions, theory, and challenges: Interdisciplinary perspectives. European Journal of Psychotraumatology, 5. https://doi.org/10.3402/ejpt.v5.25338

Stein, A., Pearson, R. M., Goodman, S. H., Rapa, E., Rahman, A., McCallum, M., Howard, L. M., & Pariente, C. M. (2014). Effects of perinatal mental disorders on the fetus and child. The Lancet, 384(9956), 1800-1819. https://doi.org/10.1016/s0140-6736(14)61277-0

Takagi, D., Kondo, K., & Kawachi, I. (2013). Social participation and mental health: Moderating effects of gender, social role and rurality. BMC Public Health, 13. https://doi.org/10.1186/1471-2458-13-701, 701.

Tani, Y., Fujiwara, T., Kondo, N., Noma, H., Sasaki, Y., & Kondo, K. (2016). Childhood socioeconomic status and onset of depression among Japanese older adults: The JAGES prospective cohort study. American Journal of Geriatric Psychiatry, 24(9), 717–726. https://doi.org/10.1016/j.jagp.2016.06.001

Tani, Y., Kondo, N., Nagamine, Y., Shinozaki, T., Kondo, K., Kawachi, I., & Fujiwara, T. (2016a). Childhood socioeconomic disadvantage is associated with lower mortality in older Japanese men: The JAGES cohort study. International Journal of Epidemiology, 45(4), 1226–1235. https://doi.org/10.1093/ije/dyw146

UN Population Division. (2019). World population ageing 2019.

VanderWeele, T. J. (2009). Marginal structural models for the estimation of direct and indirect effects. Epidemiology, 20(1), 18–26. https://doi.org/10.1097/ EDE.0b013e3181f69ce

Walsh, D., McCartney, G., Smith, M., & Armour, G. (2019). Relationship between childhood socioeconomic position and adverse childhood experiences (ACEs): A systematic review. Journal of Epidemiology & Community Health, 73(12), 1087–1093. https://doi.org/10.1136/jech-2019-212738

Westreich, D., & Greenland, S. (2013). The table 2 fallacy: Presenting and interpreting confounder and modifier coefficients. American Journal of Epidemiology, 177(4), 292–298. https://doi.org/10.1093/aje/kws412

World Health Organization. (2002). Active ageing: A policy framework. https://www.who.int/ageing/publications/active_ageing/en/

World Health Organization. (2015). World report on ageing and health.

Zunzunegui, M.-V., Alvarado, B. E., Ser, T. D., & Otero, A. (2003). Social networks, social integration, and social engagement determine cognitive decline in community-dwelling Spanish older adults. Journal of Gerontology: Social Sciences, 58R(2), 593-5100.