World Dementia Council
Leading the Global Action Against Dementia

Dementia prevention in Japan

An independent review of evidence submitted to the World Dementia Council

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About this paper

This paper was prepared by the authors to inform the World Dementia Council about dementia risk factors and risk reduction efforts in Japan. It was written independently and submitted as evidence to the WDC's project on presenting a global evidence base for dementia friendly initiaitves.

The evidence submitted in this paper is solely the work of the authors and should not be read as representing the views of any one individual on the World Dementia Council, nor any other individuals and organizations that have contributed to or advised the project.

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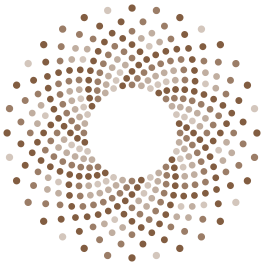


Dementia risk factors include:

1. Those possessed by the individual (individual level risk factors) and;
2. Those present in the social environment (social environment level risk factors).

To create dementia-friendly communities, efforts must be made to decrease risk factors on both levels. Studies have revealed individual level dementia risk factors include psychological and social factors in addition to biological factors. Biological factors that suggested lower dementia risk include having many teeth left; following a Japanese diet that includes rice, miso soup, seaweed, green and yellow vegetables, fish, and green tea; high intake volume of milk and dairy products; daily consumption of green tea; walking one hour or more per day; and having a high walking speed. From the psychological perspective, maintaining healthy psychological and social conditions may be more important for dementia prevention than making efforts to improve physical health. Appropriate sleep levels were also shown to lower dementia risk. Social and environmental activities linked to lower dementia risk included shopping, gardening, reading newspapers, using computers, living together with family, interacting with friends, participating in community groups, and being employed. People who were the victims of natural disasters with weak community social cohesion had slower dementia progression if they lived in communities with strong community social cohesion overall. People who grew up in socioeconomically poor situations had the highest subjective dementia risk.

On the social environment level, regional comparisons were conducted using the results of Japan Gerontological Evaluation Studies (JAGES). Comparisons revealed discrepancies in built environments and ease of social participation. It was shown to be possible for a person to lower their dementia risk by moving to an area with higher exercise group participation rates, even when other conditions remained unchanged. Namely, this means one condition for Age-Friendly and Dementia Cities is having ample opportunities for social participation. In addition, intervention studies showed that it is possible to conduct community-building in a way that encourages social participation. Among the people in such communities who started to engage in social participation, dementia and the risk of needing long-term care were prevented. In the future, we look forward to efforts for creating Dementia Friendly and Dementia Preventing Communities by using regional diagnostic indicators to evaluate the degree to which social participation is encouraged.

Introduction

Dementia risk factors include:

1. Those possessed by the individual (individual level risk factors) and;
2. Those present in the social environment (social environment level risk factors).

To create dementia-friendly communities, efforts must be made to decrease risk factors on both levels. The purpose of this report is to review dementia risk factors reported in Japan, the country where population aging has advanced the most.

We searched the Japan Medical Abstracts Database to find Japanese articles. The retrieval style was set to "elderly people AND (dementia risk reduction OR dementia risk)." Results that included non-Japanese people, included fewer than 400 participants,[1] or that described specific diseases or medical treatments were removed. For English articles, we searched on PubMed. The retrieval style on PubMed was set to "dementia AND older Japanese." The search was limited to articles published in English within the last ten years. Articles that did not fit the above-mentioned selection criteria were removed based on titles and abstracts. We also conducted a handsearch after obtaining the opinions of experts in the field. We sorted articles by explanatory variables handled and main findings on dementia risk factors.

1. Haneda M, Noda M, Origasa H, et al. : Japanese Clinical Practice Guideline for Diabetes 2016. Journal of Diabetes Investigation, 9(3):657-697(2018).

Dementia risk factors at the individual level

Studies have revealed individual level dementia risk factors include psychological and social factors in addition to biological factors. Study endpoints linked with dementia risk include biological factors like number of teeth remaining, adherence to a Japanese diet, consuming milk and dairy products, and daily walking duration; psychological factors like depression; and social factors like social participation and social support. Below, we will introduce:

1. Biological factors;
2. Psychological factors, and;
3. Social and environmental factors.

Biological factors

Missing teeth; diet; milk and dairy intake volume; green tea, black tea, and coffee intake volume; supplement intake volume; daily routines and illnesses; and time spent walking have all been linked with dementia risk. Results on these topics have been obtained as described below.

Oral cavity health

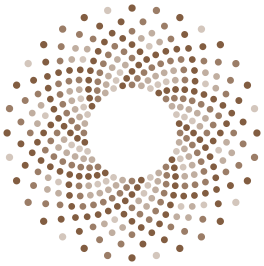
A four-year longitudinal Aichi Gerontological Evaluation Study (AGES) with 4,425 participants showed that dementia risk was higher for people with dentures who were missing most of their teeth compared to people with 20 or more teeth remaining (hazard ratio HR = 1.85, 95 per cent CI:1.04-3.31) and for people without family dentists compared to people with family dentists (HR = 1.44, 95 per cent CI:1.04-2.01). It also showed that using dentures for those with no teeth remaining lowered dementia risk by 40 per cent.[2] A five-year longitudinal study conducted in Hisayama Town, Fukuoka Prefecture with 1,566 participants aged 60 and over reported a higher dementia risk for people with 1 to 9 teeth (HR = 1.81, 95 per cent CI:1.11-2.94) and 10 to 19 teeth (HR = 1.62, 95 per cent CI: 1.06-2.46) compared to people with 20 or more teeth remaining.[3]

Diet and nutrition

A cross-sectional study was conducted on the diets of 635 subjects aged 69 to 71 years living in Itami and Asago in Hyogo Prefecture and the Itabashi and Nishitama districts in Tokyo. A significant association was found between cognitive decline and diets high in foods of plant origin and fish, such as vegetables, soy products, seaweed, mushrooms, potatoes, fruit, and green tea (β = 0.41, 95 per cent CI:0.33-0.79 using scores from Japan's version of the

2. Yamamoto T, Kondo K, Hirai H, et al. : Association Between Self-Reported Dental Health Status and Onset of Dementia: A 4-Year Prospective Cohort Study of Older Japanese Adults from the Aichi Gerontological Evaluation Study (AGES) Project. Psychosomatic Medicine, 74(3):241-248(2012).

3. Takeuchi K, Ohara T, Furuta M, et al. : Tooth Loss and Risk of Dementia in the Community: the Hisayama Study. Journal of the American Geriatrics Society, 65(5):e95-e100(2017).



Montreal Cognitive Assessment (MoCA-J), an examination for scoring Mild Cognitive Impairment (MCI)). However, no association was found between cognitive function and diets based on rice and miso soup and animal food products.[4]

Next is the results of longitudinal studies. A 5.7-year longitudinal study with 14,402 participants living in Osaki City, Miyagi Prefecture showed that people with diets high in Japanese food had a lower dementia risk compared to those with diets low in Japanese food based on nine items: rice, miso soup, seaweed, pickled vegetables, green and yellow vegetables, fish, green tea, beef and pork, and coffee (HR = 0.80, 95 per cent CI: 0.66-0.97).[5] A 17-year longitudinal study that followed 1,081 participants aged 60 and over in Hisayama Town, Fukuoka Prefecture showed the subgroup with the highest intake volume of milk and dairy products had lower dementia risk particularly for Alzheimer's disease compared to the subgroup with the lowest intake volume (HR = 0.63, 95 per cent CI:0.41-0.98),[6] and that the subgroup with the highest intake volume of potassium, calcium, and magnesium had lower dementia risk compared to the subgroup with the lowest intake volume (HR = 0.20, 95 per cent CI:0.07–0.56).[7] A ten-year longitudinal study that followed 570 participants aged 60 to 81 years in Obu City and Higashiura Town in Aichi Prefecture found that decreases in cereal intake volume of 108 grams per day and increases in the intake volume of milk and dairy products of 128 grams per day had the potential to reduce the risk of cognitive decline for Japanese women.[8] A 4.9-year longitudinal study that followed 723 participants aged 60 and over in Nanao City's Nakajimachi area in Ishikawa Prefecture showed a lower incidence of dementia or MCI for people who drank green tea daily compared to people who drank no green tea whatsoever (odds ratio: OR = 0.26, 95 per cent CI:0.06-1.06).[9] In a seven-year longitudinal study with 918 participants in the town of Tone in Ibaraki Prefecture, those who took supplements (n-3 polyunsaturated fatty acids, dried ginkgo biloba extract, lycopene) for three years had a lower risk of developing Alzheimer's disease (HR = 0.69, 95 per cent CI:0.47-0.92).[10] Meanwhile, a 5.7-year longitudinal study that followed 14,402 participants in Osaki City, Miyagi Prefecture showed no significant link between diets heavy in animal and dairy products and dementia risk,5 and the aforementioned 4.9-year longitudinal study that followed 723 participants aged 60 and over in Nanao City's Nakajimachi area in Ishikawa Prefecture reported no significant link between tea and coffee and the risk of dementia or MCI.[9]

Physical activity

A cross-sectional study with 1,552 participants in Sasaguri Town in Fukuoka Prefecture examined associations between five physical fitness measures (handgrip strength, leg strength, sit-to-stand rate, gait speed, and one-leg stand time) and cognitive function. It showed that physical fitness has the potential to be a marker for low cognitive function.[11] In the National Center for Geriatrics and Gerontology Study of Geriatric Syndromes, a cross-sectional study of 9,683 participants with a mean age of 73.6 years, a higher prevalence of Motoric Cognitive Risk Syndrome (MCR) (a predementia

4. Okubo H, Inagaki H, Gondo Y, et al. : Association between dietary patterns and cognitive function among 70-year-old Japanese elderly: a cross-sectional analysis of the SONIC study. Nutriton Journal, 16(1):56(2017).

5. Tomata Y, Zhang S, Sugiyama K, et al. : Changes in time spent walking and the risk of incident dementia in older Japanese people: the Ohsaki Cohort 2006 Study. Age and Ageing, 46(5):857-860(2017).

6. Ozawa M, Ohara T, Ninomiya T, et al. : Milk and dairy consumption and risk of dementia in an elderly Japanese population: the Hisayama Study. Journal of the American Geriatrics Society. 62(7):1224-1230(2014).

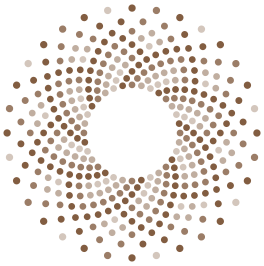
7. Ozawa M, Ninomiya T, Ohara T, et al. : Self-reported dietary intake of potassium, calcium, and magnesium and risk of dementia in the Japanese: the Hisayama Study. Journal of the American Geriatrics Society, 60(8):1515-1520(2012).

8. Otsuka R, Kato Y, Nishita Y, et al. : Cereal Intake Increases and Dairy Products Decrease Risk of Cognitive Decline among Elderly Female Japanese. The journal of prevention of Alzheimer's disease, 1(3):160-167(2014).

9. Noguchi-Shinohara M, Yuki S, Dohmoto C, et al. : Consumption of green tea, but not black tea or coffee, is associated with reduced risk of cognitive decline. PLoS One, 9(5):e96013(2014).

10. Bun S, Ikejima C, Kida J, et al. : A combination of supplements may reduce the risk of Alzheimer's disease in elderly Japanese with normal cognition. Journal of Alzheimer's Diseaese, 45(1):15-25(2015).

11. Narazaki K, Matsuo E, Honda T, et al. : Physical Fitness Measures as Potential Markers of Low Cognitive Function in Japanese Community-Dwelling Older Adults without Apparent Cognitive Problems. Journal of Sports and Medicine, 13(3):590-596(2014).



syndrome characterized by slow gait and cognitive abnormalities) was seen with advancing age with no significant difference between men and women. Lifestyle factors and diseases associated with increased risk of MCR were diabetes (adjusted odds ratio [OR] = 1.47, P = 0.001), depressive symptoms (OR = 3.57, P < 0.001), falls (OR = 1.45, P < 0.001), obesity (OR = 1.26, P = 0.018) and physical inactivity (OR = 1.57, P < 0.001).[12]

A 5.7-year longitudinal study with 6,909 participants living in Osaki City, Miyagi Prefecture showed that dementia risk was lower for participants who walked for one hour or more per day compared to those who walked 30 minutes or less per day (HR = 0.72, 95 per cent CI:0.53–0.97).[13] A 12-year longitudinal study conducted by the Tokyo Metropolitan Institute of Gerontology involving 1,686 participants aged 65 to 90 years showed that participants with lower gait speeds had a dementia risk 3.46 times higher than those with higher gait speeds (95 per cent CI:1.88–6.40) and those with shorter step lengths had a dementia risk 2.12 times higher than those with longer step lengths (95 per cent CI:1.29–3.49).[14]

As described above, a lower dementia risk was observed among people with a greater number of remaining teeth,[2,3] people that consumed Japanese foods including rice, miso soup, seaweed, green and yellow vegetables, fish, and green tea,[5] people with greater milk and dairy consumption,[6] people who drank green tea daily,[9] people who walked one hour or more per day,[13] and people with high gait speeds.[14]

Psychological factors

The following results have been obtained about the effects of psychological health, mental health, and sleep times on dementia risk.

Psychological and mental health

In a five-year longitudinal AGES study with 2,340 participants, psychological or social elements present among many of the participants that did not develop dementia included having a hobby (OR = 2.27, 95 per cent CI:1.67–3.10), subjectively feeling healthy (OR = 2.00, 95 per cent CI:1.48–2.73), not suffering depression (OR = 1.91, 95 per cent CI:1.36–2.69), and independently conducting Instrumental Activities of Daily Living (IADLs) (OR = 2.56, 95 per cent CI:1.84–3.56).[15] Physical activities among that subgroup included receiving physical check-ups (OR = 1.71, 95 per cent CI:1.25–2.35) and walking for 30 minutes or more per day (OR = 1.54, 95 per cent CI:1.14–2.16).[15] A four-year AGES longitudinal study with 14,286 participants showed that men with positive emotions had a 50 per cent lower risk and women had a 69 per cent lower risk of developing dementia compared to participants without positive emotions.[16]

12. Doi T, Verghese J, Shimada H, et al. : Motoric Cognitive Risk Syndrome: Prevalence and Risk Factors in Japanese Seniors. Journal of the American Medical Directors Association, 16(12):1103.e1121-1105(2015).

13. Tomata Y, Zhang S, Sugiyama K, et al. : Changes in time spent walking and the risk of incident dementia in older Japanese people: the Ohsaki Cohort 2006 Study. Age and Ageing, 46(5):857-860(2017).

14. Taniguchi Y, Kitamura A, Seino S, et al. : Gait Performance Trajectories and Incident Disabling Dementia Among Community-Dwelling Older Japanese. Journal of the American Medical Directors Association, 18(2):192.e113-192.e120(2017).

15. 竹田徳則, 近藤克則, 平井寛, ほか. : 地域在住高齢者の認知症発症と心理・社会的側面との関連. 作業療法, 26(1):55-65(2007).

16. Murata C, Takeda T, Suzuki K, et al. : Positive affect and incident dementia among the old. Journal of Epidemiological Research, 2(1):118-124(2015).

Dementia risk and sleep

A ten-year longitudinal study with 1,517 participants in Hisayama Town, Fukuoka Prefecture found a higher dementia risk for subjects with daily sleep duration of five hours or less (HR = 2.64, 95 per cent CI:1.38–5.05) and 10 hours or more (HR = 2.23, 95 per cent CI:1.42–3.49) compared to subjects with daily sleep duration of 5 to 6.9 hours. It also showed that subjects who used hypnotics had higher dementia risk than those who did not (HR = 1.66, 95 per cent CI:1.09–2.53).[17]

As described above, longitudinal studies suggested that maintaining better psychological health and social circumstances may be more important for preventing dementia than activities undertaken to improve physical health[15] and that appropriate daily sleep duration lowers dementia risk.[17]

Social and environmental factors

The following findings have been made about the associations between dementia risk and cognitive activity, social participation, social relationships, social support, and socioeconomic status.

Cognitive activities and hobbies

A cross-sectional study conducted in Obu City and Nagoya City in Aichi Prefecture with 5,300 participants with a mean age of 75 showed that participants who engaged in five cognitive activities other than board games (reading books and newspapers, writing diaries and letters, doing crossword puzzles, using computers, and keeping track of household expenses) had 35 per cent to 67 per cent fewer incidences of cognitive impairment. Participants who engaged in cognitive activities less than once per week had the highest risk of cognitive impairment.[18]

A longitudinal study that followed 4,564 participants in Obu City, Aichi Prefecture for 3.6 years showed lower dementia risk for participants who engaged in conversations daily (HR = 0.56, 95 per cent CI: 0.35–0.89), drove (HR = 0.63, 95 per cent CI:0.45–0.88), went shopping (HR = 0.57, 95 per cent CI:0.34–0.96), and did gardening (HR = 0.71, 95 per cent CI:0.54–0.94). However, these associations may vary due to age and sex.[19] Similarly, a longitudinal AGES study that followed 9,720 participants for three years showed a higher dementia risk for those with impaired ability to conduct everyday activities like going out, shopping, and cooking for both men (HR = 1.80, 95 per cent CI:1.22–2.66) and women (HR = 2.23, 95 per cent CI:1.60–3.13) and for men without artistic hobbies (HR = 1.99, 95 per cent CI:1.23–3.22) and women without athletic hobbies (HR = 1.92, 95 per cent CI:1.15–3.19).[20] A study conducted by the Chubu Regional City Municipality that followed 558 participants for six years showed a higher incidence rate of dementia for people who do not read newspapers compared to those who did (OR = 2.12, 95 per cent CI:1.32–3.40).[21]

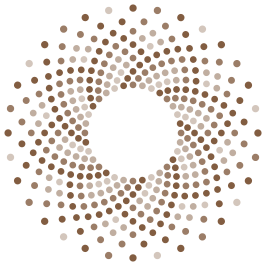
17. Ohara T, Honda T, Hata J, et al. : Association Between Daily Sleep Duration and Risk of Dementia and Mortality in a Japanese Community. Journal of the American Geriatrics Society, 66(10):1911-1918(2018).

18. Kurita S, Doi T, Tsutsumimoto K, et al. : Cognitive activity in a sitting position is protectively associated with cognitive impairment among older adults. Geriatrics & Gerontology International, 19(2):98-102(2019).

19. Shimada H, Makizako H, Lee S, et al. : Lifestyle activities and the risk of dementia in older Japanese adults. Geriatrics & Gerontology International, 18(10):1491-1496(2018).

20. 竹田徳則, 近藤克則, 平井寛. : 地域在住高齢者における認知症を伴う要介護認定の心理社会的危険因子AGESプロジェクト3年間のコホート研究. 日本公衆衛生雑誌, 57(12):1054-1065(2010).

21. 矢内悠里, 篠原亮次, 杉澤悠圭, ほか. : 社会とのかかわりと認知症発症との関連性の研究. 日本保健福祉学会誌, 18(2):21-28(2012).



Social participation, social relationships, and social support

A cross-sectional study that followed 929 participants in Tsuru City's Shimoyaji Ward in Yamanashi Prefecture showed a negative association between cognitive decline and participation in regional organization activities (OR = 0.57, 95 per cent CI:0.29-1.11) and socioeconomic activities (OR = 0.47, 95 per cent CI:0.20-1.10) among men and volunteer activities (OR = 0.27, 95 per cent CI:0.09-0.80) among women. There were links between depression and these associations.[22]

An AGES longitudinal study that followed 13,850 participants for 9.4 years showed a higher risk of dementia onset among the young-old elderly who did not engage in local activities compared those who engaged in local activities in non-leadership roles (HR = 1.22, 95 per cent CI:1.02–1.46) and a lower risk for those in leadership roles compared to those in non-leadership roles (HR = 0.81, 95 per cent CI:0.65–0.99).[23] In an AGES longitudinal study that followed 13,984 participants for 9.4 years, dementia risk was 11 per cent to 17 per cent lower for those who were married, engaged in mutual support with co-residing family members, had contact with friends, participated in community groups, and were employed. Participants who fulfilled all five of these conditions had a lower dementia risk (HR = 0.54,P < 0.001).[24] In an AGES longitudinal study that followed 14,088 participants for 9.4 years, providing emotional support to coresiding family members was shown to lower dementia risk for men (HR = 0.83, 95 per cent CI:0.72–0.95) while providing emotional support to non-coresiding family members and relatives (HR = 0.87, 95 per cent CI:0.76–0.98) and receiving emotional support from friends and neighbors (HR = 0.85, 95 per cent CI:0.74–0.97) to lowered dementia risk for women.[25] An AGES longitudinal study that followed 12,085 participants for ten years reported that those who interacted with non-cohabitant people less than once per month were more likely to acquire functional disability requiring long-term care level two (HR = 1.37, 95 per cent CI:1.16–1.61) or dementia accompanying functional disability (HR = 1.45, 95 per cent CI:1.21–1.74) and suffer premature death (HR = 1.34, 95 per cent CI:1.16–1.55) compared to those that interacted with non-cohabitant people daily. However, there was no significant association found for those who engaged in social interaction once or more per week. In other words, this study showed that face-to-face and non-face-to-face interaction with people other than cohabitants less than once per week may lead to a state requiring long-term care or dementia.[26]

In a 3.2-year longitudinal study that followed 3,560 participants in Iwanuma City, Miyagi Prefecture, among those whose community social cohesion fell one point on a five-point scale after the Great East Japan Earthquake, the severity of cognitive disability increased by 0.04 points (where level one corresponds to independence and level eight corresponds to needing specialized medical treatment) per level of housing damage experienced on a five-point scale. The severity of cognitive disability was 0.07 points lower for each point the respondent scored in community social cohesion.[27]

22. 根本裕太, 佐藤慎一郎, 高橋将記, ほか. : 地域高齢者における認知機能低下の関連要因　横断研究. 日本老年医学会雑誌, *54(2):143-153(2017).*

23. *Nemoto Y, Saito T, Kanamori S, et al. : An additive effect of leading role in the organization between social participation and dementia onset among Japanese older adults: the AGES cohort study. BMC Geriatrics, 17:297(2017).*

24. *Saito T, Murata C, Saito M, et al. : Influence of social relationship domains and their combinations on incident dementia: a prospective cohort study. Journal of Epidemiology and Community Health, 72(1):7-12(2018).*

25. *Murata C, Saito T, Saito M, et al. : The Association between Social Support and Incident Dementia: A 10-Year Follow-Up Study in Japan. International Journal of Environmental Research and Public Health, 16:16(2):239(2019).*

26. 斉藤雅茂, 近藤克則, 尾島俊之, ほか. : 健康指標との関連からみた高齢者の社会的孤立基準の検討10年間のAGESコホートより. 日本公衆衛生雑誌, *62(3):95-105(2015).*

27. *Hikichi H, Tsuboya T, Aida J, et al. : Social capital and cognitive decline in the aftermath of a natural disaster: a natural experiment from the 2011 Great East Japan Earthquake and Tsunami. The Lancet Planetary health, 1(3):e113(2017).*

The effects of socioeconomic status

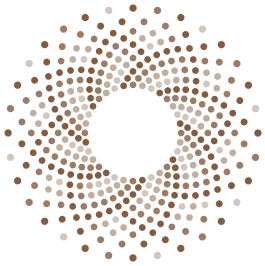
A retrospective longitudinal study with 75,358 respondents in Adachi Ward, Tokyo showed a greater likelihood of subjective dementia symptoms for elderly people with the lowest childhood socioeconomic status compared to elderly people with the highest childhood socioeconomic status. In particular, the older subgroup (OR = 1.46, 95 per cent CI:1.21-1.76) had a greater likelihood of subjective dementia symptoms compared to the younger subgroup (OR = 1.32, 95 per cent CI:1.04-1.68). However, there were no interactions between childhood socioeconomic status and sex. It is possible that this difference was caused by respondents' early life experiences or the effects of social and historic events (such as World War II, the chaotic period after the war, or Japan's period of rapid economic growth).[28]

As described above, activities associated with lower dementia risk were shopping,[19,20] gardening,[19,20] reading newspapers,[18,21] using computers,[18] interacting with coresiding family members and friends, participating in community groups, and being employed.[24] In areas struck by natural disaster, living in communities with strong community social cohesion had a protective effect from dementia symptom progression even for individuals with weak community social cohesion.[27] Elderly people with the lowest childhood socioeconomic status had the highest risk of subjective dementia symptoms.[28]

As was seen in prior research conducted overseas, there was an abundance of social epidemiology research in Japan that found associations between dementia risk and factors such as community social cohesion. It was also evident that studies conducted in disaster-stricken regions and similar areas are unique.

28. Murayama H, Sugiyama M, Inagaki H, et al. : The Differential Effects of Age on the Association Between Childhood Socioeconomic Disadvantage and Subjective Symptoms of Dementia Among Older Japanese People. Journal of Epidemiology, JE20180002-1 (2018).

Dementia risk factors at the social environment level



While there are various aspects to dementia risk factors at the social environment level, evidence recently accumulated in Japan can be broadly classified into two categories: the built environment and efforts to create environments that encourage social participation.

The built environment as a dementia risk factor

It has been reported that poor access to neighborhood food stores may affect health. A three-year longitudinal study originating from the 2010 JAGES survey that was conducted among 49,511 participants aged 65 and over from 31 municipalities showed that poor access to neighborhood food stores may increase dementia risk. Compared to respondents who said "There are many food stores in my neighborhood," respondents who said "There are no food stores in my neighborhood whatsoever" had a higher dementia risk (HR = 1.65, 95 per cent CI:1.40-1.93). Compared to the subgroup that had the most food stores within a 500-meter radius of their residential area, the subgroup with fewer food stores had higher dementia risk (HR = 1.51, 95 per cent CI:1.34-1.69). Many elderly people named visiting neighborhood stores as a reason for outings and there is data that over half of elderly people visit food stores three to four times per week. Ready access to neighborhood food stores may also increase the likelihood that shopping trips are made on foot. Good access to neighborhood food stores may promotes outings and contribute to reducing dementia risk. This study demonstrated that access to food stores may be important for dementia rather than access to restaurants or convenience stores.[29]

Additionally, a cross-sectional study of the JAGES 2010 survey that included 83,384 respondents aged 65 and over from 31 municipalities confirmed that people with few neighborhood food stores had a lower intake frequency of 2.7 times per month for vegetables and 0.9 times per month for meat compared to people with many neighborhood food stores nearby.[30]

Also, a study showed that poor neighborhood food access may be a mortality risk in addition to a dementia risk. A three-year longitudinal study was conducted with 49,511 people who participated in the 2010 JAGES survey aged 65 and over in 31 municipalities who had been asked about the number of neighborhood food stores with fruits and vegetables. Elderly people who did not drive for outings that responded "There are not many" had a higher mortality risk (HR = 1.59, 95 per cent CI:1.20-2.10) compared to those who responded "There are many."[31]

29. Tani Y, Suzuki N, Fujiwara T, et al. : Neighborhood Food Environment and Dementia Incidence: the Japan Gerontological Evaluation Study Cohort Survey. American Journal of Preventive Medicine, 56(3):383-392(2019).

30. Yamaguchi M, Takahashi K, Hanazato M, et al. : Comparison of Objective and Perceived Access to Food Stores Associated with Intake Frequencies of Vegetables/Fruits and Meat/Fish among Community-Dwelling Older Japanese. International Journal of Environmental Research and Public Health, 16(5):772(2019).

31. Tani Y, Suzuki N, Fujiwara T, et al. : Neighborhood food environment and mortality among older Japanese adults: results from the JAGES cohort study. International Journal of Behavioral Nutrition and Physical Activity, 15:101(2018).

Dementia risk factors in environments that promote opportunities for social participation

Dementia risk factors in observational studies

A cross-sectional JAGES study that included 88,370 participants from 30 municipalities reported a nearly threefold difference in IADL decline between municipalities (Figure 1). Municipalities had lower rates of IADL decline the more residents participated in hobbies, sports, or volunteer groups. This demonstrated that developing communities with population strategies may result in lower dementia risk and prevent IADL decline.[32]

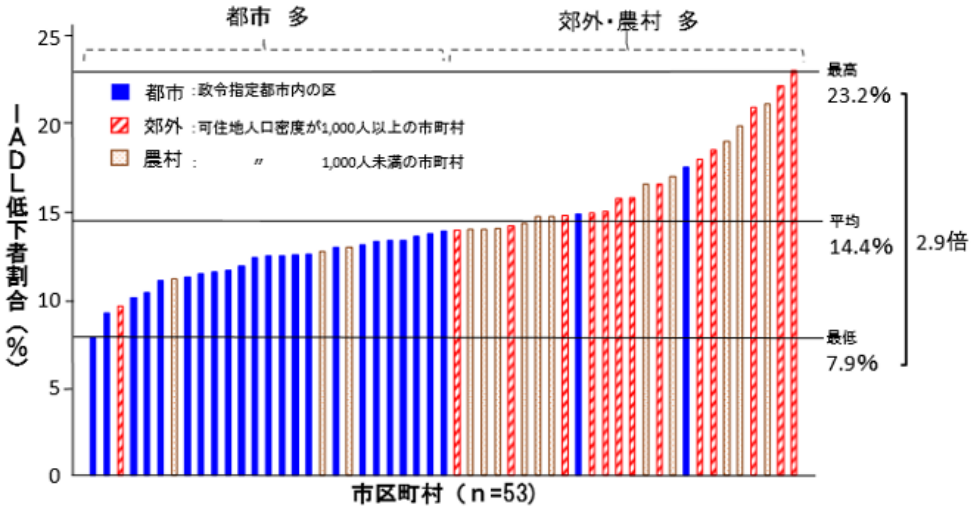
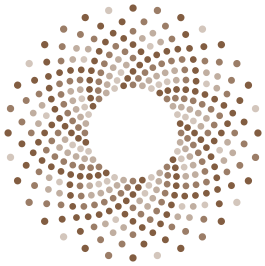


Figure 1: Ratio of subjects with IADL decline per municipality (limited to early elderly subgroup)

X-axis:	Ratio of subjects with IADL decline (per cent)
Y-axis:	Municipality (n = 53)
Top left:	City (many)
Top right:	Suburb, rural village (many)
Blue box:	City: Ordinance-designated city wards
Red/white box:	Municipalities with land population density 1000 people and over
White box:	Rural village: Municipalities with land population density less than 1000 people
Right axis:	2.9 times: highest, average, lowest

To investigate if this disparity can be accounted for by tallying at-risk individuals or if it persists even when statistically accounting for the effects of individual level factors, a multilevel analysis was conducted on 30,587 elderly people from 24 municipalities who participated in the 2010 and 2013 JAGES surveys. The results of that analysis confirmed there was a 10 per cent lower risk of IADL decline over three years for communities with high social participation in the cross-sectional study even when accounting for factors on the individual level (OR = 0.90, 95 per cent CI:0.84-0.96). IADL

32. 加藤清人, 近藤克則, 竹田徳則, ほか. : 手段的日常生活活動低下者割合の市町村間格差は存在するのかJAGESプロジェクト. 作業療法, *34(5):541-554 (2015).*



decline has been associated with dementia risk, so it may be possible to reduce dementia risk through community development initiatives that increase social participation among the elderly.[32]

Also, in a cross-sectional analysis of 180 respondents to the 2013 JAGES survey aged 70 to 74 years residing in Higashikawa, Higashikagura, and Biei in Hokkaido, cognitive function scores were 0.63 per cent higher for every type of social activity each individual participated in. It also showed that individual cognitive function scores may be kept 3.4 per cent higher as the average number of area-level social activities available in the community increases by one. These findings suggest that in addition to social participation on the individual level, abundant area-level social activities may help maintain cognitive function among elderly people.[34]

In addition, a six-year longitudinal study originating from the 2010 JAGES survey was conducted among 40,308 participants from 16 municipalities in 346 regions. It showed that cognitive decline risk for elderly people in a region decreased by 8 per cent as exercise group participation increased by 10 per cent of the elderly population in that region (HR = 0.92, 95 per cent CI:0.86-0.99).[34]

A cross-sectional study to examine the mechanism of that protective effect analyzed 74,681 participants in the 2010 JAGES survey who lived in 39 municipalities and 516 regions across 12 prefectures. It found that the risk of depressive symptoms decreased for all elderly people living in a region by 11 per cent for men (Prevalence Ratio: PR = 0.89, 95 per cent CI:0.85-0.92) and 4 per cent for women (PR = 0.96, 95 per cent CI:0.92-0.99) as the elderly population participation rate in exercise groups increased by 10 per cent. This study showed that in regions with high participation rates in exercise groups among elderly people, the risk of depressive symptoms – a dementia risk – was lowered even among elderly people in the region who did not participate in exercise groups.[35] This finding was reflected in a three-year longitudinal JAGES study that followed 29,065 elderly people in 295 school districts which confirmed a tendency for the development of depressive symptoms to be 7 per cent lower among men (OR = 0.93, 95 per cent CI:0.88-0.99)[35] and 6 per cent lower among women (OR = 0.94, 95 per cent CI:0.88-0.997) as the participation rate in community groups and exercise groups increased by 6 per cent.[36]

Developing a regional diagnostic index of dementia risk factors

As described above, regional disparities in dementia risk have been verified according to differences in factors at the social environment level, particularly ease of social participation. Furthermore, research has advanced on diagnostic indicators for assessing dementia risk levels per region.

The World Health Organization (WHO) declared the decade starting in 2020 to be the Decade of Healthy Aging and momentum is building towards that goal. Efforts to develop and use Indicators for Age Friendly Communities are advancing using results generated by JAGES research. Specifically, a JAGES

33. Fujihara S, Tsuji T, Miyaguni Y, et al. : Does Community-Level Social Capital Predict Decline in Instrumental Activities of Daily Living? A JAGES Prospective Cohort Study. International Journal of Environmental Research and Public Health,16(5):828(2019).

34. Sakamoto A, Ukawa S, Okada E, et al. : The association between social participation and cognitive function in community-dwelling older populations: Japan Gerontological Evaluation Study at Taisetsu community Hokkaido. International Journal of Geriatric Psychiatry, 32(10):1131-1140(2017).

35. Tsuji T, Kanamori S, Miyaguni Y, et al. : Community-Level Sports Group Participation and the Risk of Cognitive Impairment. Medicine & Science in Sports & Exercise, 51(11):2217-2223(2019).

36. Tsuji T, Miyaguni Y, Kanamori S, et al. : Community-level Sports Group Participation and Older Individuals' Depressive Symptoms. Medicine & Science in Sports & Exercise, 50(6):1199-1205(2018).

survey conducted from 2010 to 2011 in 53 municipalities confirmed a regional disparity of 2.9 times the rate of elderly people who could not conduct one of the following: use public transportation, shop for daily necessities, prepare meals, pay bills, or manage deposits at a bank or post office. Inability to conduct any of these activities has been associated with higher dementia risk. The necessity of visualizing regional circumstances using these indicators (using public transportation, shopping, preparing meals, paying bills, managing savings) and advancing measures including preventative care was discussed at a symposium held in 2017 at the 21st World Congress of Epidemiology. Based on that discussion, a study was conducted on the 98,774 people who participated in the 2010 JAGES survey to investigate regional diagnostic indicators that will be useful when promoting preventative care through community developmental efforts. It discovered that only some indicators of social participation among those examined showed a negative correlation with low risk factors for dementia, such as participation in volunteer groups, sports groups, and hobby groups.[37] Dementia and depression – which has been identified as a dementia risk factor – are present in 60 per cent of elderly people who require support or long-term care. A study on the likelihood of requiring support or long-term care on a regional level identified 14 indicators that describe regions where likelihood for requiring long-term care is low. The importance of having many forms of social participation (volunteer groups, sports groups, hobby groups) and social support (reception and provision of emotional and instrumental support) has been reported multiple times.[38]

A cross-sectional JAGES study with 338,659 participants in 105 municipalities nationwide examined the indicator for the correlation between social participation and the number of people with forgetfulness, a reported dementia risk factor. It showed that fewer people experienced forgetfulness the greater the number of people that engaged in any form of social participation for more than a few times per year (correlation coefficient: $r = -0.72$, $p<0.001$) in the municipality, and that there was a disparity of 1.9 times between municipalities. This suggests that it may be appropriate to use the ratio of people engaged in social participation or the ratio of people who experience forgetfulness as regional diagnostic indicators to be used when implementing dementia risk reduction measures at the municipal level.[39]
A five-year longitudinal study followed 72,718 people who participated in the JAGES 2010 survey and 84,211 people who participated in the JAGES 2016 survey in 44 municipalities. In municipalities with 10 per cent higher participation rates in sports groups once or more per week (partial regression coefficient B = -0.356) or hobby groups once or more per month (B = -0.309), there was a trend for the overall community depression rates, a dementia risk, to be 3 per cent lower.[40]

Intervention studies conducted as part of the Taketoyo Project

Observational studies showing social participation to be effective at preventing dementia and other forms of cognitive decline in elderly people have been accumulated. However, without conducting intervention studies,

37. Yamaguchi M, Inoue Y, Shinozaki T, et al. : Community Social Capital and Depressive Symptoms Among Older People in Japan: A Multilevel Longitudinal Study. Journal of Epidemiology, 29(10):363-369(2019).

38. 井手一茂, 宮國康弘, 中村恒穂, ほか. : 個人および地域レベルにおける要介護リスク指標とソーシャルキャピタル指標の関連の違い　JAGES2010横断研究. 厚生の指標, 65(4):31-38(2018).

39. 井手一茂, 鄭丞媛, 村山洋史, ほか. : 介護予防のための地域診断指標　文献レビューと6基準を用いた量的指標の評価. 総合リハビリテーション, 46(12):1205-1216(2018).

40. Jeong S, Inoue Y, Kondo K, et al. : Correlations between Forgetfulness and Social Participation: Community Diagnosing Indicators. International Journal of Environmental Research and Public Health, 16(13):2426(2019).

there is no way to know if social participation can be increased through intervention or if doing so can prevent cognitive decline. In recognition of this need, various regional intervention studies have been carried out in Taketoyo City in Aichi Prefecture. There, places for elderly people to engage in social participation called "salons" were established at locations that members of the elderly population could commute on foot.

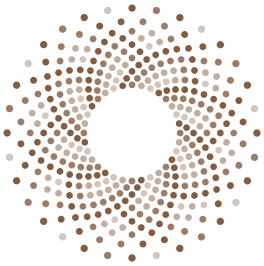
Three salons were opened in 2007 in Taketoyo City, a city where approximately one-fourth of the population is elderly. One or two more locations were opened every year after that, and as of 2019, preparations are underway to open the 14th salon. Each location is operated by about 20 city-trained community volunteers. Programs are provided at the community center one to three times per month and each program is attended by an average of about 60 elderly people. Ten percent of the city's elderly population participate multiple times per year. In addition to physical exercise sessions, the programs also include a variety of activities like seasonal events, interaction with children, music, lectures on health, and conversation groups. Videos of these events can be viewed online.

A seven-year longitudinal JAGES study that examined 2,593 people by participation status in the salons showed that the risk for requiring long-term care with the presence of dementia was lowered by 27 per cent for those who participated four times or more per year (OR = 0.73, 95 per cent CI:0.54–0.99).[41] However, the possibility remains that unobservable differences in background factors between the participation and non-participation groups may have influenced this outcome. For example, it is easy to question if the salons were only effective because healthier people were able to participate more frequently, thus further improving the health of those who were already healthy. To remove such doubts, results were analyzed with a technique to verify only the effects of salon participation by minimizing the health condition bias between the two sub-groups before the salons were established. Specifically, results were analyzed using an instrumental variable method, which is considered a pseudo-randomized control trial (RCT). The number of salons located within 350 meters of the homes of participants was used as the instrumental variable. Compared to people without a salon nearby, participation rates increased proportionally to the number of salons nearby, but there were no differences in health conditions between the two sub-groups. In other words, this was a pseudo-RCT in which participants were randomly divided into participants with salons nearby and non-participants without salons nearby. The endpoint was set as the certification rate for requiring support or long-term care including for physical decline other than dementia. The results confirmed that the certification rate for requiring support or long-term care among the participating sub-group was lowered by 50 per cent (HR = 0.49, 95 per cent CI:0.33-0.72).[42]

As described above, multiregional comparisons made possible by JAGES demonstrated that attention must not only be paid to individual-level factors causing dementia, but also to factors on the community and society level. It has also been demonstrated that various factors such as the built environment and

41. Watanabe R, Kondo K, Saito T, et al. : Change in Municipality-Level Health-Related Social Capital and Depressive Symptoms: Ecological and 5-Year Repeated Cross-Sectional Study from the JAGES. International Journal of Environmental Research and Public Health,16(11):2038(2019).

42. Hikichi H, Kondo K, Takeda T, et al. : Social interaction and cognitive decline: Results of a 7-year community intervention. Alzheimer's & Dementia, 3(1):23-32(2017).



social participation rates affected the differences in community and social level factors. It was shown to be possible for a person to lower their dementia risk by moving to an area with higher exercise group participation rates, even when other conditions remained unchanged. Namely, this means one condition for Age-Friendly and Dementia Cities is having ample opportunities for social participation. In addition, intervention studies showed that it is possible to conduct community-building in a way that encourages social participation. Among the people in such communities who started to engage in social participation, dementia and the risk of needing long-term care were prevented. In the future, we look forward to efforts for creating Dementia Friendly and Dementia Preventing Communities by using regional diagnostic indicators to evaluate the degree to which social participation is encouraged.

The World Dementia Council (WDC) is an international charity. It consists of senior experts and leaders drawn from research, academia, industry, governments and NGOs in both high-income and low- and middle-income countries, including two leaders with a personal dementia diagnosis. The WDC has an executive team based in London, UK.

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