List of Iwanuma Project Papers (by Order of topics)

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Iwanuma Project Research Results

Social capital and functional recovery of older adults after the Great East Japan Earthquake and Tsunami

Editing : Iwanuma Project
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Design : Liberty Area Incorporate

I W A N U M A P R O J E C T

Social capital and functional recovery of older adults after the Great East Japan Earthquake and Tsunami

Iwanuma Project
Research Results

I W A N U M A
P R O J E C T

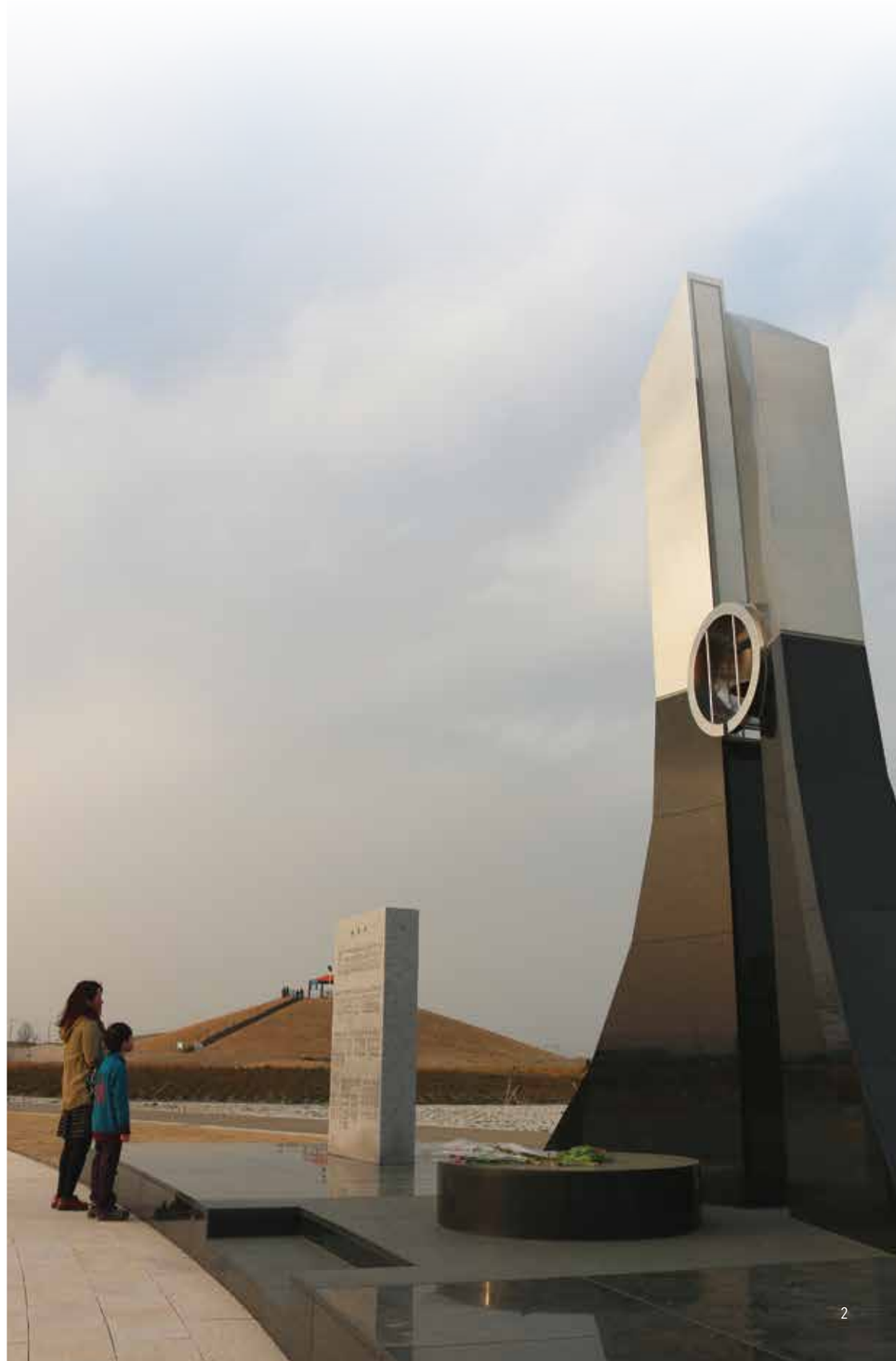
Iwanuma Project Suggestions

The impact of social capital on the physical and mental health of disaster survivors

Growing attention has been focused on the role of social connections (“social capital”) in assisting recovery after natural disasters. Social capital is thought to be a factor that promotes community resilience after a disaster.

Seven months before the 2011 Great East Japan Earthquake, a survey was conducted on the relationship between social capital and health in Iwanuma City, Miyagi Prefecture, Japan. Survivors have been followed since, providing a unique opportunity to study the impact of social capital on their health.

Through collaboration between the Japan Gerontological Evaluation Study (JAGES), Iwanuma City, and Professor Ichiro Kawachi of Harvard University's School of Public Health, the Iwanuma Study has contributed to our understanding of the factors that promote recovery among older disaster survivors.



CROSS TALK

Strengthening social capital is a key strategy for disaster preparedness

PROFILE

Professor, School of Public Health, Harvard University

ICHIRO KAWACHI

Graduated from University of Otago. He received his M.D. from the University of Otago in 1985. After working as a physician, Dr. Kawachi was awarded his Ph.D. in 1991. Since 1992, he has taught at Harvard University, where he is currently the John L. Loeb and Frances Lehman Loeb Professor of Social Epidemiology in the Department of Social and Behavioral Sciences at the Harvard University T.H. Chan School of Public Health. Kawachi is an elected member of the National Academy of Medicine of the United States and an Honorary Fellow of the Royal Society of New Zealand.

PROFILE

Professor, Center for Preventive Medical Sciences, Chiba University;
Head of the Department of Gerontological Evaluation, National Center for Geriatrics and Gerontology

KATSUNORI KONDO

Graduated from Chiba University Graduate School of Medicine in 1983. After working as a physician, Dr. Kondo became Associate Professor at the Nihon Fukushi University in 1997. After a stint as a Visiting Research Fellow at the University of Kent at Canterbury (UK) (2000-2001) and then as Professor at Nihon Fukushi University, he has been the Professor at Chiba University since 2014, and a Head of Department of the National Center for Geriatrics and Gerontology since 2016 (Cross-Appointment Post). In 2020, he received the Medical Award of the Japan Medical Association in 2020.

What was your motivation to start the Iwanuma Project?

Kawachi: Globally, disasters are becoming increasingly severe and frequent. However, the impact of disasters on older adults is still poorly understood. After the tragedy of the Great East Japan Earthquake in March 2011, we have had an invaluable opportunity through the Iwanuma Research Project to deepen our understanding of the impact of disasters on the health of older adults, their recovery, and the factors that contribute to it.

Kondo: We wanted to demonstrate scientifically, using data, not just anecdotally, that social capital or "connections" between people can contribute to disaster preparedness and resilience (recovery from a major shock).

There was an inconclusive debate in the studies that started after the disaster about which came first–health or social capital–the cause and the effect. However, Iwanuma City conducted a survey on the health and social capital of older adults in August 2010, seven months before the earthquake, which gave us a rare opportunity to settle this debate.

What was the goal of this plan?

Kawachi: Our goal was to examine whether communities with high social capital could help people overcome the damage caused by disasters. Disaster preparedness involves stockpiling food, water, medicines, and arranging evacuation shelters. Our hypothesis was that resilience arises from peoples' social connections.

What have been the main findings so far?

Kawachi: First, we found a marked increase in cognitive disability and metabolic syndrome among those who moved into temporary housing. However, we also found that older adults were more resilient in terms of mental health. For example, three years after the disaster, the majority of people had recovered from their grief, and depression rates in the community had returned to pre-disaster levels.

Kondo: We observed other health concerns as well, including post-traumatic stress disorder (PTSD), instrumental activities of daily living (IADL), and tooth loss. What surprised me was that the greater the damage to the house, the greater the health hazard. However, we were also able to identify the factors that alleviated these health hazards.

Kawachi: We found that even among people who had suffered difficult experiences, such as losing their loved ones and damaging their houses, those who lived in communities with high social capital before the disaster, or who became richer in social capital before and after the disaster, were less likely to deterioration. This means that strengthening the social capital of a community is an important strategy for disaster preparedness.

Kondo: There are dual aspects here: hard disaster preparedness, such as building breakwaters, and soft disaster preparedness. One such example is the development of social capital. The National Institute of Health in the United States also provided research grant for the Iwanuma Project. Was it useful for the United States?

Kawachi: The valuable lessons learned from the Iwanuma Project are useful, not only in Japan but also around the world. For example, we found that when relocating people to temporary housing, it was best to do so in groups that maintained pre-existing neighborhood relationships to preserve social capital. After learning about the results of the Iwanuma Project through The Wall Street Journal, the City of Houston contacted us and made use of this insight during their response to Hurricane Harvey.

What are your plans for the future?

Kawachi: The next phase of the Iwanuma Project is to understand the heterogeneity of health outcomes following exposure to the same traumatic events. For example, only half of the people who experience severe trauma develop severe post-traumatic stress disorder (PTSD), while the other half remain relatively asymptomatic. Using machine learning, we can identify the characteristics of resilient individuals. This information can help focus resources more efficiently on people and communities that are vulnerable to disasters.

Kondo: We are also working with the National Research Institute for Earth Science and Disaster Resilience, Japan, to develop a disaster preparedness "visualization" system (see p. 29), which allows you to see which areas are resistant or vulnerable to disasters. This system will be used by residents and local governments in workshops for disaster preparedness. We hope that the Iwanuma Project will serve as an opportunity to foster social capital and connections between residents during normal times, the significance of which has been demonstrated by the project.

We would like to thank the people of Iwanuma City and everyone who cooperated with this project. We are working on a follow-up study in 2022 to examine its long-term impact and look forward to your continued cooperation.

MESSAGE

PROFILE

Professor, Tokyo Medical and Dental University

JUN AIDA

Is a Core Member of the Japan Gerontological Evaluation Study. Since 2020, Dr. Aida has worked as a Professor in the Department of Oral Health Promotion, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University, Tokyo, Japan, and Professor in the Regional Community Development, Liaison Center for Innovative Dentistry, Graduate School of Dentistry, Tohoku University (Cross-Appointment, until May 2021). He has specialized in social epidemiology and dental public health.

We would like to connect the value of the pre-earthquake data with internationally useful evidence.

The Iwanuma Project started in 2007 when the Iwanuma City Care and Welfare Division, together with the Department of International and Community Oral Health, Graduate School of Dentistry, Tohoku University, jointly implemented a model project for preventive care, led by Professor Ken Osaka, under whom I worked with his department at the time.

The JAGES 2010 survey was conducted before the earthquake, which became the baseline for the Iwanuma Project, and follow-up surveys have continued every three years.

In addition to the direct risk of injury and death, disasters also destroy houses, farmlands, and factories. This causes damage to jobs and the economy. Residential relocation and migration also change social relationships. From the viewpoint of social determinants of health, these changes in the physical and social environment are believed to have a significant impact on health.

The factors that contribute to protecting the health of disaster survivors and promoting their recovery are not clear.

Most disaster research has been conducted after disasters have occurred. Few studies have used data on pre-disaster conditions. As a result, the Iwanuma Project has been recognized in Japan and the US as a valuable source of pre-earthquake data. Therefore, we have received funding to continue research related to health and disasters. This project is being conducted with the cooperation of citizens and the Iwanuma local government. We will continue our efforts to produce results that will be useful to the people of Iwanuma City and generate helpful evidence for global communities.

We look forward to your continued support and encouragement.

MESSAGE

PROFILE

Former Mayor of Iwanuma City

TSUNEAKI IGUCHI

Graduated from Miyagi University of Education, worked in a tutoring school, and was elected to the Iwanuma City Council at the age of 25. He served as the Chairman of the Iwanuma City Social Welfare Council for seven consecutive terms. After serving as Council Chairman, he was elected mayor, and served four terms for 16 years. During this time, he also served as the Vice President of the Japan Association of City Mayors. Mr. Iguchi was awarded Order of the Rising Sun, Gold Rays with Neck Ribbon for his distinguished service to local government. Currently, he is a Visiting Professor at the Tohoku Fukushi University, an Interim Member of the Social Security Council, and Director of the Millennium Hope Hills Association.

Many results of the Iwanuma Project provide lessons that will guide us in the "Era of Disasters."

After taking up the post of Mayor, I established the goal of "Building a "Healthy and Happy City." As part of this effort, we conducted a health and lifestyle survey for all people over the age of 65 under the guidance of Professors Ken Osaka and Jun Aida of Tohoku University. Seven months later, the Great East Japan Earthquake struck 48% of the Iwanuma City area, claiming many victims. There were no other surveys with data on the health status of older adults and people's connections before the disaster. The Iwanuma Project was created based on these data.

In the process of reconstruction, we decided to protect lives, work quickly, and become self-reliant. Iwanuma City was able to achieve the fastest mass relocation among the affected areas. We did not apply a lottery when transferring people from evacuation shelters to temporary housing and group relocation. Each community was relocated individually because we wanted to protect the bonds between residents. The decision on what kind of town to build was made at a meeting of village representatives, including women and young people. We were able to establish commercial facilities necessary for daily life because the six affected communities were relocated en masse to a single location. We also promoted the development of the Millenium Hope Hills, which was named as a symbol of reconstruction. Many people throughout Japan participated in a tree-planting ceremony featuring broad-leaved trees, used as symbols for a torch-relay course for the Reconstruction Olympics. The forest on the hill will serve as a breakwater in addition to the concrete embankment. Pillars and memorabilia from houses that were washed away were also used. We became a top runner in the reconstruction process since we formulated a recovery plan early and worked to implement it. Many results were announced from the Iwanuma Project, which we communicated with the assistance of teachers. There are many lessons to be learned that will guide us in the "Era of Disasters."

Description

Iwanuma location and terrain

Located approximately 17.6 km south of Sendai, Miyagi Prefecture, the city's eastern border is the Pacific coast and the western border is mountainous. Sendai Airport was established, followed by the development of an adjacent industrial area. Population of approximately 44,000 / area of approximately 60km².

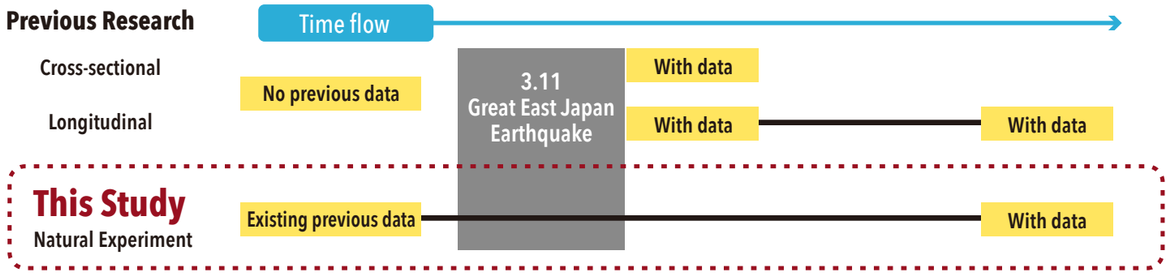
Iwanuma damage assessment

- Over ~48% of the city area flooded by the tsunami (Largest affected municipalities)
- Six coastal villages destroyed, 187 dead/missing
- Approximately 5400 homes damaged
- Severe land subsidence / 8% of city area below sea level
- Extensive damage to agricultural lands and 200 companies in the industrial park

This project was possible due to the existence of data from a survey of all older adults conducted seven months before the earthquake

In August 2010, seven months before the Great East Japan Earthquake, the Japan Gerontological Evaluation Study (JAGES) conducted a survey of all older adults in Iwanuma City.
The survey included data on social capital and health, which made it possible to compare situations before and after the disaster, providing new insights into the causal relationship between social capital and health.

- **Existence of Survey Data** — Information on disaster victims surveyed before the earthquake
- **Survey System** — It was possible to create a system to obtain accurate follow-up surveys and information in cooperation with Iwanuma City.
- **Long Follow-up Period** — Most of the previous research on earthquakes was completed within a few years after the earthquake; in this project, we were able to analyze survey results with a long follow-up period of approximately eight and a half years after the earthquake.
- **Impact on Older Adults** — Few previous studies have examined the impact of earthquakes on older adults; however, this project was able to shed light on this topic
- **Impact on Physical Function and Social Participation** — While previous research on earthquakes mostly focused on mental health, this project was able to analyze the effects of the disaster on physical functioning, cognitive deterioration, and social participation of the older population in particular.



Research Design

Did social capital have an impact on the functional deterioration and recovery of older adults after the Great East Japan Earthquake?

Hypothesis 1

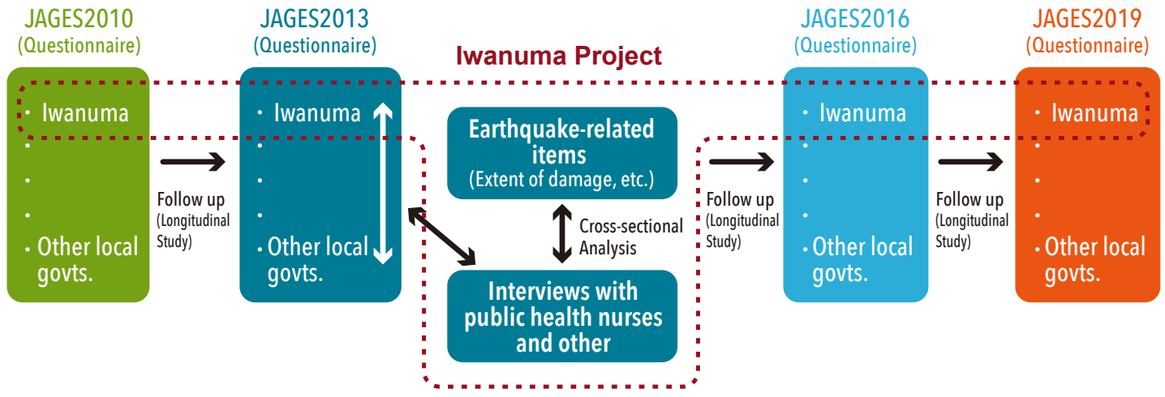
The more severe the damage caused by the disaster (e.g., loss of family and friends, damage to house, reduced access to medical care, etc.), the worse the health status (ADL/IADL) after the disaster (2013, 2016, 2019).

Hypothesis 2

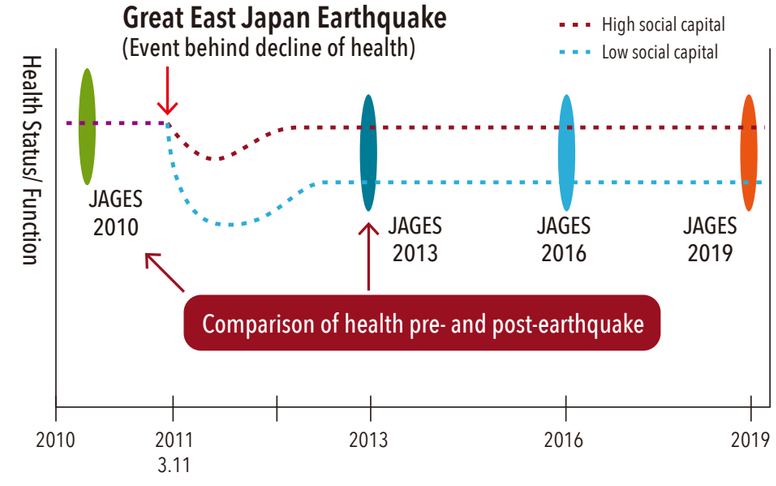
Higher social capital before the earthquake led to good health (ADL/IADL) two and a half

Longitudinal Study and Interview Survey

Research design for JAGES and Iwanuma Project



Verification of Hypothesis 2



Target
All older adults (65 years old and over) living in Iwanuma City.

Method 1
Postal distribution and on-site collection of the JAGES questionnaire (including earthquake-related items, Iwanuma City version) for 5,058 respondents of the JAGES 2010 after the earthquake (2013, 2016, 2019)

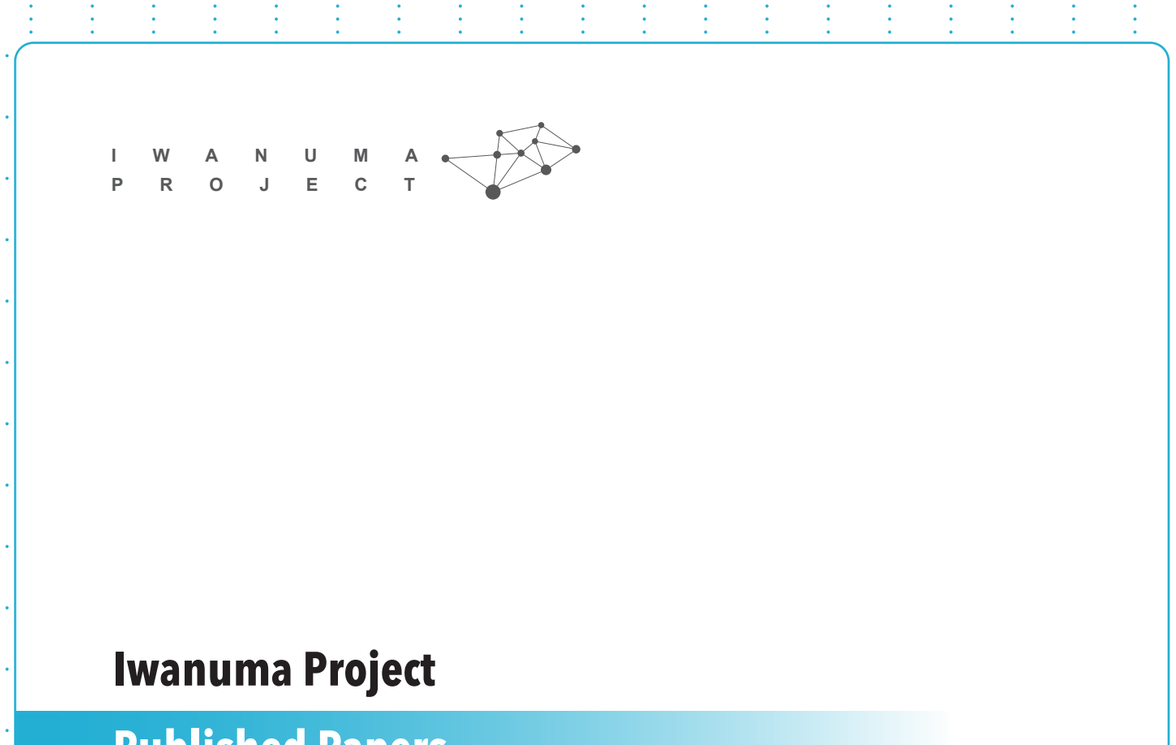
Method 2
Interview with public health nurses, local welfare officers, Council of Social Welfare staff, residents, etc.

I W A N U M A
P R O J E C T

Iwanuma Project

Published Papers 2021.6

The Iwanuma Project focuses on the impacts of social capital – both preceding the disaster and after the disaster – on the physical and mental health of survivors.
We have classified the published papers into four phases of the disaster:
"Pre-Earthquake," "Pre- and Post-Earthquake,""Post-Earthquake," and "Long-term Effects."



Published Papers [Index]

Pre-Earthquake	1 **Optimists are more resilient after the earthquake**	•Optimists have fewer depressive and post-traumatic stress symptoms after a disaster
	2 **Social support before the earthquake reduced the risk of developing depressive symptoms by 30%**	•Social support before the earthquake reduced the risk of developing depressive symptoms by 30%
	3 **Unexpected higher risk of PTSD among people who did not experience early life adversity**	•Post-traumatic stress disorder (PTSD) after the earthquake became more pronounced in those who did not experience adverse childhood experiences
Pre- and Post-Earthquake	4 **Pre-disaster community social ties prevent incident posttraumatic stress disorder (PTSD)**	•Relationship between pre-disaster community social ties, disaster experiences, and the risk of developing PTSD
	5 **Bonding, bridging and linking social capital – Qualitative study of public health nurses**	•Clarifying human connections among public health nurses, external organizations, and disaster survivor groups
	6 **Maintaining social ties through group relocation**	•The relationship between methods of relocation and social ties
	7 **Predictors of sleep problems in disaster survivors**	•People facing financial hardship after a disaster had up to 1.47 times higher risk of sleep disorders
	8 **Increased participation in exercise and hobby groups help to reduce depressive symptoms in disaster survivors**	•Increased participation in exercise and hobby groups reduces depressive symptoms
	9 **Physical activity helps to prevent depressive symptoms in older disaster survivors**	•Relationships with changes in depressive symptoms pre- and post-disaster
	10 **Community-level social capital mitigates progression of cognitive disability after a disaster**	•Social ties mitigate the impact of disaster experiences on post-disaster cognitive disability
	11 **Depressive symptoms and higher mortality on the day of the disaster**	•Mortality risk during disaster is four times higher for those with depressive symptoms. Post-disaster mortality risk reduced by about half through interaction with friends.
	12 **Individual-level social ties mitigate post-earthquake progression of cognitive disability**	•Social ties mitigate the progression of dementia due to a disaster
	13 **Community social capital helps to preserve functional independence in older survivors**	•In areas with high social participation, the negative health impact of housing damage was reduced
	14 **Positive effects on mental health of group relocation into temporary housing**	•Survivors who underwent group allocation to temporary housing were significantly more likely to report receiving social support than those who underwent lottery allocation
	15 **Review article: Disaster resilience in older populations**	•Increasing levels of symptoms of dementia depending on the severity of damage to housing
	16 **Socializing with neighbors post-earthquake reduces depressive symptoms**	•Relationship between changes in neighborhood relationships and the degree of severity of depressive symptoms
	17 **Relocation affects social relationships in areas receiving displaced survivors**	•Changes in community relations (trust) among nonrelocated Iwanuma City residents
	18 **Worsening financial status increases risk of tooth loss after disaster**	•People severely affected by the earthquake were more likely to lose their teeth
	19 **Decreased social capital does not explain post-disaster increased depressive symptoms**	•Decrease in social support and social capital after the disaster does not explain the increase in depressive symptoms among disaster survivors
Post-Earthquake	20 **Predictors of worsened depressive symptoms after disaster**	
	21 **Access to medical care is key to preserving functional independence**	•Relationship between disaster experiences and decline in functional independence
	22 **Residential relocation linked to increased obesity due to changed food environment**	
	23 **Long-term effects of total destruction of one' s house on cardiometabolic risks**	•Degree of property damage and changes in cardiometabolic profiles before and after the earthquake (2010–2013)
	24 **Relocation to prefabricated housing doubled the risk of depression**	•Odds ratios of depression according to type of post-disaster housing
	25 **Post-disaster mental health as a predictor of mortality**	•Post-disaster depressive symptoms, post-traumatic stress disorder (PTSD), and mortality rates
	26 **Housing damage is associated with increased cognitive disability**	•Association between severity of housing damage and increased cognitive disability score
	27 **Increased risk of developing arthritis associated with disaster trauma**	
	28 **Risk of increased BMI due to relocation to temporary housing**	•Empirical evidence on the relationship between property damage/relocation to temporary housing and increased BMI
Long-Term Impact	29 **Persistent impact of housing loss on cognitive disability 6 years after disaster**	•Persistent impact of housing loss on cognitive disability 6 years after disaster
	30 **Long-term trends in mental health after disaster**	•Trajectories of post-traumatic stress symptoms and depression, 2.5 and 5.5 years after the disaster •Individual symptoms of mental illness changed pre- and post-earthquake; however, prevalence in community did not
	31 **Relocation linked with increased cardiometabolic risks**	•Correlation between neighborhood environment and lifestyle-related diseases
	32 **Long-term relationship between a traumatic experience and health**	•The long-term health impacts of an earthquake may have been underestimated
	33 **Predictors of persistent mental health problems 6 years after disaster**	•Predictors of persistent versus delayed post-traumatic stress symptoms •Unemployment and deterioration of financial status due to the earthquake affect persistent and delayed onset PTSS
	34 **6-year followup study of the health impacts of residential relocation**	•Group relocation to disaster relief housing increases the risk of obesity and depression

Pre-Earthquake Papers on the effects of pre-earthquake factors on post-earthquake health

Pre- and Post-Earthquake Papers on the effects of the changes in factors from before to after the earthquake on post-earthquake health

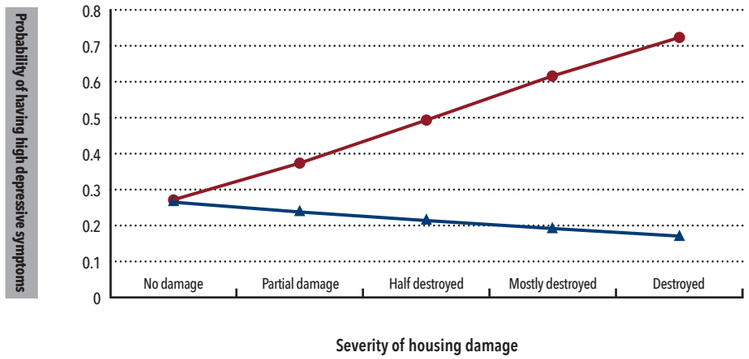
Post-Earthquake Papers on the effects of post-earthquake factors on health

Long-Term Impact Papers on the effects of factors on health more than 5.5 years after the earthquake

1 Optimists are more resilient after the earthquake

Pre-earthquake

Optimists have fewer depressive and post-traumatic stress symptoms after a disaster



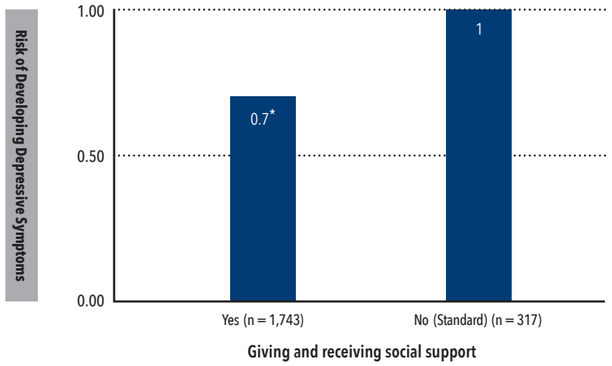
Gero K, Aida J, Shirai K, Kondo K, Kawachi I: Dispositional optimism and disaster resilience: A natural experiment from the 2011 Great East Japan Earthquake and tsunami. Soc Sci Med. 2021 Mar; 273:113777. doi: 10.1016/j.socscimed.2021.113777.

Dispositional optimism - the general belief that good things will happen - is considered a key asset for the preservation of mental health after a traumatic life event. However, it has been hypothesized that in extreme situations such as major disasters where positive expectations cannot overcome the grim reality on the ground, being optimistic might be a disadvantage. Gero et al. (2021) tested this mismatch hypothesis, exploring whether higher pre-disaster dispositional optimism is associated with higher posttraumatic stress (PTS) and depressive symptoms among 962 individuals who experienced the 2011 Great East Japan Earthquake and Tsunami. The results show that higher pre-disaster dispositional optimism was associated with lower odds of developing depressive and PTS symptoms 2.5 years after the earthquake. Further, high dispositional optimism buffered the adverse impact of housing damage on depressive symptoms, but not on PTS symptoms. In contrast to the mismatch hypothesis, the results suggest that dispositional optimism is a resilience resource among survivors of a disaster.

2 Social support before the earthquake reduced the risk of developing depressive symptoms by 30%

Pre-earthquake

Social support before the earthquake reduced the risk of developing depressive symptoms by 30%



There was 30% lower risk of developing depressive symptoms after the disaster if persons had given or received social support before the disaster.

We adjusted for age, sex, income, living alone, and the effects of house damage and losing loved ones.
* indicates a statistically significant association.

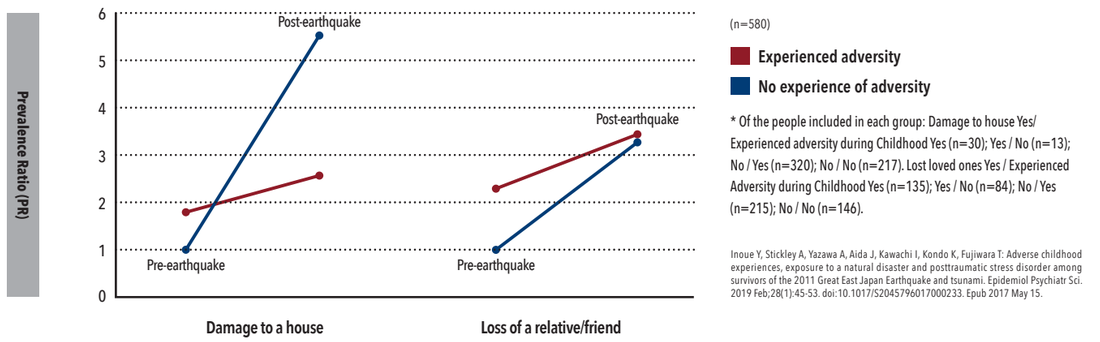
Sasaki Y, Aida J, Tsuji T, Koyama S, Tsuboya T, Saito T, Kon do K, Kawachi I: Pre-disaster social support is protective for onset of post-disaster depression: Prospective study from the Great East Japan Earthquake & tsunami. Sci Rep. 2019 Dec 19;9(1):19427. doi:10.1038/s41598-019-55953-7.

Sasaki et al. (2019) examined whether pre-disaster social support functions as a disaster preparedness resource to mitigate post-disaster depressive symptoms among older survivors of the 2011 Great East Japan Earthquake and Tsunami. Based on JAGES Iwanuma data from 2010 and 2013, 2,242 older adults who did not have depressive symptoms in the 2010 survey were analyzed. In the follow-up survey in 2013, 16.2% of those surveyed developed depressive symptoms. Survivors who had all four types of social support (giving and receiving emotional and instrumental support) prior to the disaster experienced a lower risk of developing depressive symptoms than those who did not have such support, even after adjusting for demographic and disaster-damage-related variables. This result demonstrates that social support in daily life might help older adults maintain psychological health following disasters.

3 Unexpected higher risk of PTSD among people who did not experience early life adversity

Pre-earthquake

Post-traumatic stress disorder (PTSD) after the earthquake became more pronounced in those who did not experience adverse childhood experiences



* Of the people included in each group: Damage to house Yes/ Experienced adversity during Childhood Yes (n=30); Yes / No (n=13); No / Yes (n=320); No / No (n=217). Lost loved ones Yes / Experienced Adversity during Childhood Yes (n=135); Yes / No (n=84); No / Yes (n=215); No / No (n=146).

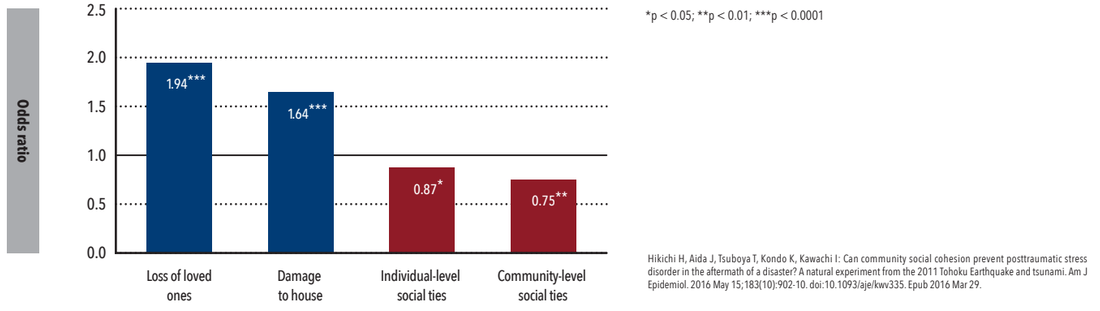
Inoue Y, Stickley A, Yazawa A, Aida J, Kawachi I, Kondo K, Fujiwara T: Adverse childhood experiences, exposure to a natural disaster and posttraumatic stress disorder among survivors of the 2011 Great East Japan Earthquake and tsunami. Epidemiol Psychiatr Sci. 2019 Feb;28(1):45-53. doi:10.1017/S2045796017000233. Epub 2017 May 15.

Post-traumatic stress disorder (PTSD) is a disorder where a person undergoes something intensely distressing, the memory of which stays with them, and they repeatedly relive it in a frightening manner. People who had not gone through an adverse experience during their childhood, such as losing a parent, were found to have significantly higher rate of PTSD in case of damage from the earthquake than those who had no such experience. Inoue et al. (2019) presented the results of such a study. In a 2013 survey of older adults in Iwanuma City, JAGES analyzed data from 580 people who answered questions about adverse experiences in their childhood, such as bereavement, abuse, and financial distress; 9.7% of people were found to have PTSD after the earthquake. People whose houses were damaged and those who lost relative/friend were also at high risk of PTSD. Damage to houses and the loss of loved ones due to disaster was linked to the onset of PTSD in those who had not faced adversity, whereas no such association was found for those who had undergone adversity.

4 Pre-disaster community social ties prevent incident posttraumatic stress disorder (PTSD)

Pre- and Post- Earthquake

Relationship between pre-disaster community social ties, disaster experiences, and the risk of developing PTSD



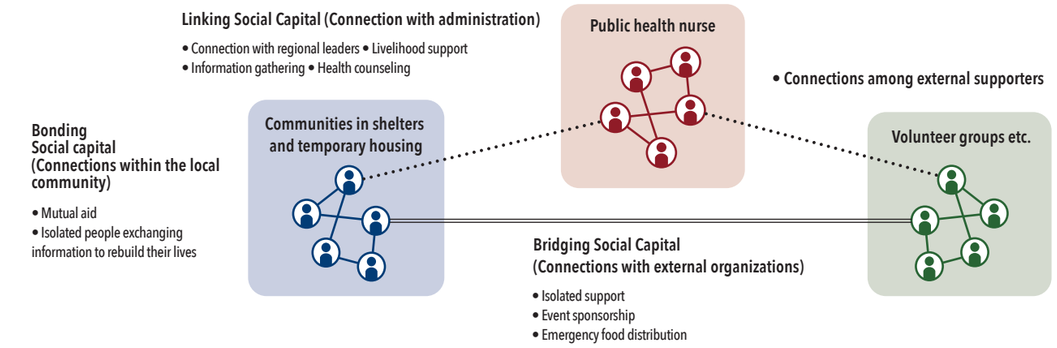
Hikichi H, Aida J, Tsuboya T, Kondo K, Kawachi I: Can community social cohesion prevent posttraumatic stress disorder in the aftermath of a disaster? A natural experiment from the 2011 Tohoku Earthquake and tsunami. Am J Epidemiol. 2016 May 15;183(10):902-10. doi:10.1093/aje/kwv335. Epub 2016 Mar 29.

In the aftermath of a disaster, the risk of posttraumatic stress disorder (PTSD) is high. We sought to examine whether the predisaster level of community social cohesion was associated with a lower risk of PTSD after the earthquake and tsunami in Tohoku, Japan, on March 11, 2011. The baseline for our natural experiment was established in a survey of older community-dwelling adults who lived 80 kilometers west of the epicenter 7 months before the earthquake and tsunami. A follow-up survey was conducted approximately 2.5 years after the disaster. We used a spatial Durbin model to examine the association of community-level social cohesion with the individual risk of PTSD. Among our analytic sample (n = 3,567), 11.4% of respondents reported severe PTSD symptoms. In the spatial Durbin model, individual- and community-level social cohesion before the disaster were significantly associated with lower risks of PTSD symptoms (odds ratio = 0.87, 95% confidence interval: 0.77, 0.98 and odds ratio = 0.75, 95% confidence interval: 0.63, 0.90, respectively), even after adjustment for depression symptoms at baseline and experiences during the disaster (including loss of loved ones, housing damage, and interruption of access to health care). Community-level social cohesion strengthens the resilience of community residents in the aftermath of a disaster.

5 Bonding, bridging and linking social capital – Qualitative study of public health nurses

Pre- and Post- Earthquake

Clarifying human connections among public health nurses, external organizations, and disaster survivor groups



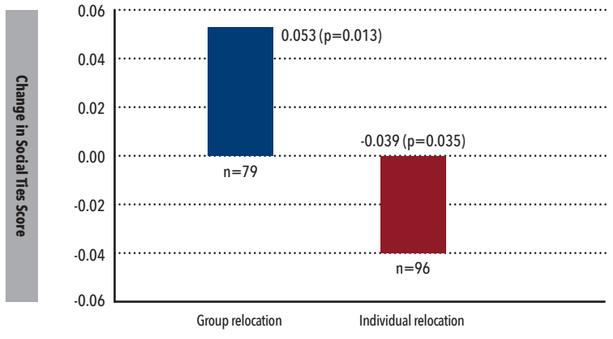
Hikichi H, Kondo K, Aida J, Kondo N: Social capital in disaster medicine Group interviews with public health nurses working in areas stricken by the Tohoku earthquake. Japanese Journal of Disaster Medicine 2015;20 (1):51-56.

In October 2013, Hikichi et al. (2015) conducted group interviews with 22 public health nurses in Miyagi prefecture involved in health care activities for disaster survivors. We obtained the following suggestions about the effects of social capital in affected areas. Social capital before the earthquake facilitated mutual aid among evacuees. They were able to share emergency food and drinks, and launched community groups to exchange information. One municipality in Miyagi prefecture established a meeting hall to prevent solitary death by improving social connections among victims. In other municipalities, survivors relocated to disaster relief housing in communities to preserve their pre-disaster social networks. Although some survivors had few acquaintances in the temporary housing complex, they could make connections by participating in social events. We also found that combinations of different types of social capital (bonding, bridging, and linking) could be more effective for the victims' health and livelihood. For example, public health nurses could support victims effectively by collecting information about their personalities and chronic diseases from neighbors. They would thus be able to conduct health care activities in cooperation with victims (linking social capital), by using social networks among victims (bonding social capital).

6 Maintaining social ties through group relocation

Pre- and Post- Earthquake

The relationship between methods of relocation and social ties



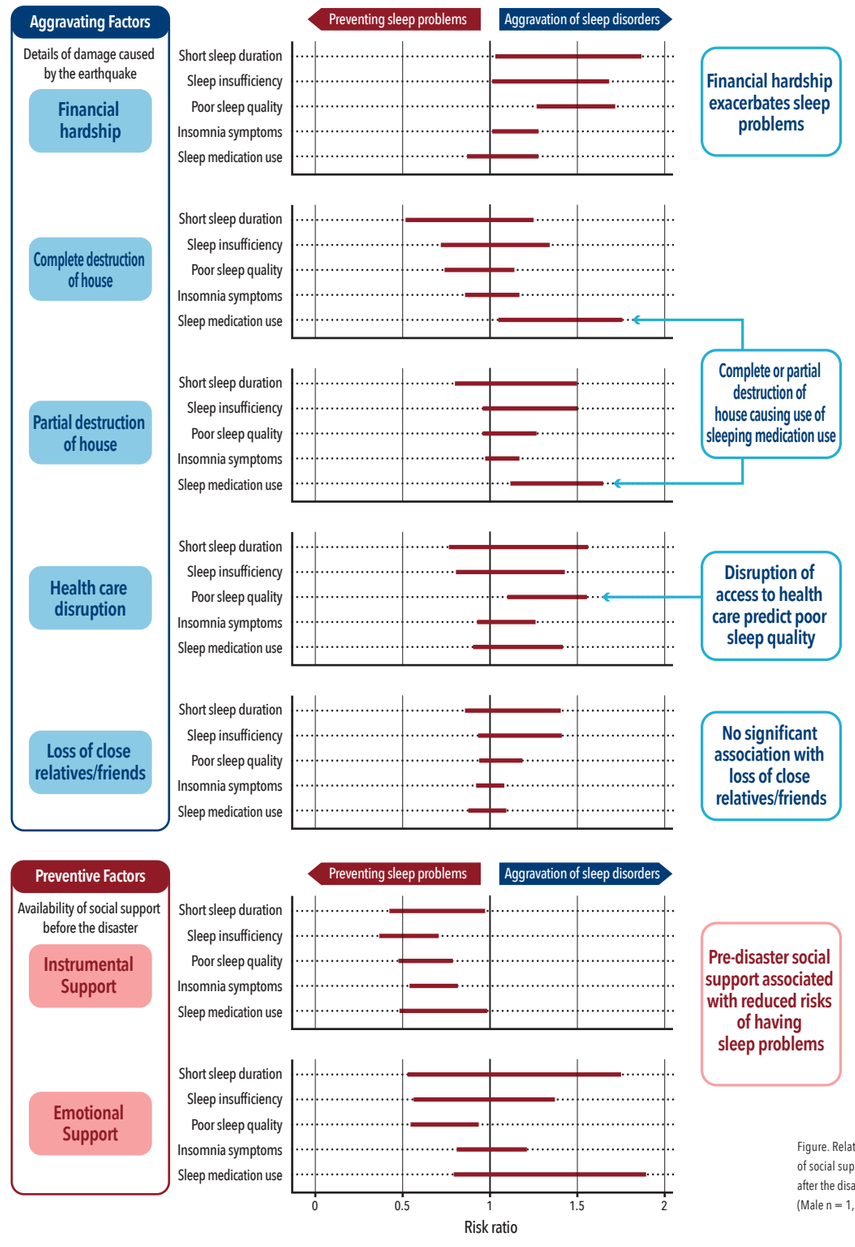
Hikichi H, Sawada Y, Tsuboya T, Aida J, Kondo K, Koyama S, Kawachi I: Residential relocation and change in social capital: A natural experiment from the 2011 Great East Japan Earthquake and tsunami. Sci Adv. 2017 Jul 26;3(7): e1700426. doi:10.1126/sciadv.1700426

Social connections in the community ("social capital") represent an important source of resilience in the aftermath of major disasters. However, little is known about how residential relocation due to housing destruction affects survivors' social capital. We examined changes in social capital among survivors of the 2011 Great East Japan Earthquake and Tsunami. People who lost their homes were resettled to new locations by two primary means: (i) group relocation to public temporary trailer housing or (ii) individual relocation, in which victims moved into government-provided housing by lottery or arranged for their own accommodation (market rental housing or private purchase/new construction). The baseline for our natural experiment was established seven months before the 11 March, 2011 disaster, when we conducted a survey of older community-dwelling adults who lived 80-km west of the earthquake epicenter. Approximately 2.5 years after the disaster, the follow-up survey gathered information about individual experiences of disaster as well as health status and social capital. Among 3421 people in our study, 79 people moved via group relocation to public temporary trailer housing, whereas 96 people moved on their own. The individual fixed-effects model showed that group relocation was associated with improved informal socializing and social participation (*B* coefficient = 0.053, 95% confidence interval: 0.011 to 0.095). In contrast, individual relocation was associated with declining informal socializing and social participation (*B* coefficient = −0.039, 95% confidence interval: −0.074 to −0.003). Group relocation, as compared to individual relocation, appeared to preserve social participation and informal socializing in the community.

7 Predictors of sleep problems in disaster survivors

Pre- and Post- Earthquake

People facing financial hardship after a disaster had up to 1.47 times higher risk of sleep disorders



Li X, Buxton OM, Hikichi H, Haneuse S, Aida J, Kondo K, Kawachi I: Predictors of persistent sleep problems among older disaster survivors: a natural experiment from the 2011 Great East Japan Earthquake and tsunami. Sleep. 2018 Jul 1;41(7): zsy084. doi:10.1093/sleep/zsy084.

(1) The value (risk ratio) in the figure:
-The greater the number is than one, and the more often sleep problems occur.
-The smaller the number is than one, lower the incidence of sleep problems.
(2) If the horizontal line does not intersect the vertical line with a risk ratio of one, the result is statistically significant.

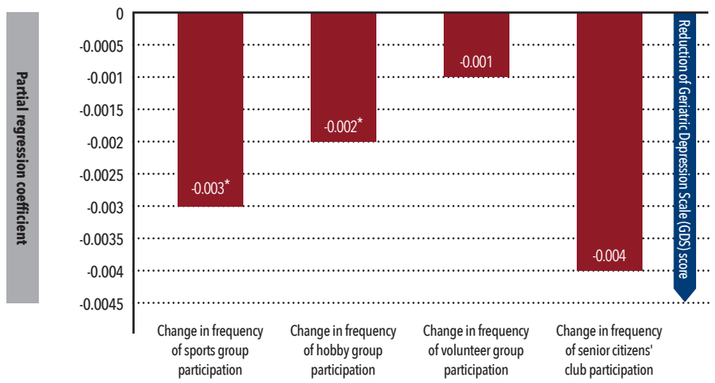
Figure. Relationship between earthquake experience / presence of social support before the disaster and sleep problems 3 years after the disaster.
(Male n = 1,542 female n = 2,005)

Sleep disorders are one of the most common health problems for people affected by natural disasters. Sleep disorders are reported to be associated with the development of chronic diseases such as Type 2 diabetes and cardiovascular disease, as well as psychiatric disorders. Li et al. (2018) analyzed data from the 2010 and 2013 JAGES surveys of older adults in Iwanuma City to find ways to alleviate sleep disturbances after the disaster. As of 2013, 41% of all respondents answered "experiencing insomnia symptoms," 27% answered they had "Poor sleep quality," and 22% reported "sleep medication use." Of the damage caused by the earthquake, "financial hardship," "damage to the house," and "health care disruption," were found to predict sleep problems. It was also found that instrumental support ("having someone to look after you") before the disaster was more conducive to alleviating sleep problems than emotional support ("having someone listened to your concerns and complaints.") This is the first study to follow-up on the actual state of sleep problems over a long period after a disaster. For older adults, the study showed that, in addition to the usual support systems, post-disaster financial support, house repairs, and medical support may be helpful in maintaining long-term health.

8 Increased participation in exercise and hobby groups help to reduce depressive symptoms in disaster survivors

Pre- and Post- Earthquake

Increased participation in exercise and hobby groups reduces depressive symptoms



Direction and strength of association with changes in depression pre- and post-earthquake (n = 3,567)

* p <0.05, statistically significant

Factors considered for statistical impact

Adjusted for age and sex, educational attainment, impaired ADL, change in drinking habits, change in smoking status, change in job status, dwelling house damage, death of family members, change in equivalent income, and change in IADL score.

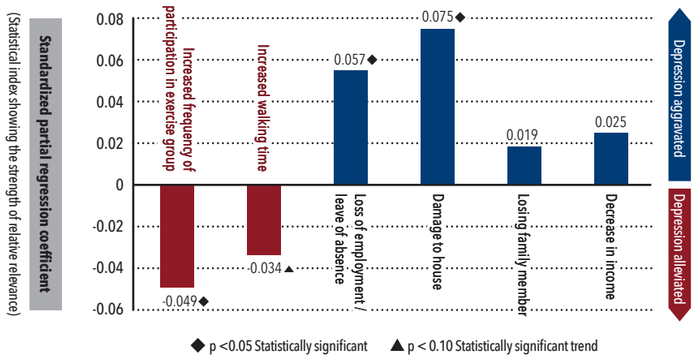
Zhang W, Tsuji T, Yokoyama M, Ide K, Aida J, Kawachi I, Kondo K: Increased frequency of participation in civic associations and reduced depressive symptoms: Prospective study of older Japanese survivors of the Great Eastern Japan Earthquake. Soc Sci Med. 2021 Mar 8; 276:11 3827. doi: 10.1016/j.socscimed.2021.113827.

We examined prospectively the association between changes in participation in civic associations and changes in depressive symptoms among older survivors of the 2011 Great Eastern Japan Earthquake. We analyzed questionnaire-based survey data on pre- and post-disaster participation in civic associations and depressive symptoms compiled for 3567 respondents aged 65 years and above. Changes in these symptoms were assessed using a 15-item Geriatric Depression Scale (GDS) as a continuous variable for 2010 and 2013. We investigated four types of civic associations: sports, hobby, voluntary groups, and senior citizens' clubs. Changes in participation were calculated by subtracting the participation frequency measured in 2010 from that measured in 2013. Applying 95% confidence intervals, we used linear regression models with imputation to estimate the age- and sex-adjusted and multivariate-adjusted standardized coefficients. The survivors' GDS scores increased by 0.13 points on average between the pre-disaster and post-disaster periods. Average changes in the participation frequencies of respondents in each group were respectively +0.36 days/year, −5.63 days/year, +0.51 days/year, and −1.45 days/year. Increased frequencies of participation in the sports and hobby groups were inversely associated with changes in GDS scores (B = −0.003, Cohen's f2 = 0.10, P = 0.01 and B = −0.002, Cohen's f2 = 0.08, P = 0.04, respectively). The associations did not differ depending on the experience of housing damage caused by the disaster. In contrast, we did not observe a significant association between changes in participation frequencies for voluntary groups or senior citizens' clubs and changes in GDS scores after multivariable adjustment. Depressive symptoms of older adults' post-disaster may be mitigated through increased frequency of participation in sports and hobby groups, though civic participation did not mitigate the adverse impact of disaster experiences on mental health.

9 Physical activity helps to prevent depressive symptoms in older disaster survivors

Pre- and Post- Earthquake

Relationships with changes in depressive symptoms pre- and post-disaster



How to mitigate the deterioration of depressive symptoms caused due to housing damage?

Frequency of participation in exercise groups 5-6 times / month"
or
Walking duration "75 minutes / day"
≒
Housing damage "1 Stage*" * None / Partial damage / Half-destroyed / Major partial damage/ Completely destroyed

(n=3,567)

For example, if a person with a "half-destroyed" house participates in an exercise group five to six times a month or walks about 75 minutes a day, their depressive symptoms would be alleviated to the same level as someone with "partial damage" to their house.

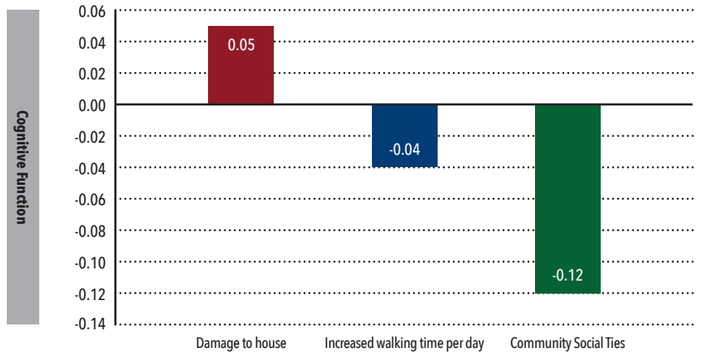
Tsuji T, Sasaki Y, Matsuyama Y, Sato Y, Aida J, Kondo K, Kawachi I: Reducing depressive symptoms after the Great East Japan Earthquake in older survivors through group exercise participation and regular walking: a prospective observational study. BMJ Open. 2017 Mar 3;7(3): e013706. doi:10.1136/bmjopen-2016-013706.

After the disaster, support activities were conducted in many areas to encourage people to exercise and walk to improve the health of those affected by the disaster. However, it was unclear what effect these activities would have. Therefore, Tsuji et al. (2017) analyzed data from JAGES' surveys of older people in Iwanuma City in 2010 and 2013. The study examined the relationship between the frequency of participation in exercise groups and the time spent walking per day, with depressive symptoms. They found that post-earthquake participation in exercise groups increased by an average of 1.9 days per year and walking time per day increased by 1.3 minutes compared to pre-earthquake. In both activities, the more the number increased, the more the depressive symptoms were alleviated. However, there was a positive relationship between the worsening of depressive symptoms and "loss of employment or leave of absence" and "damage to house." Based on the results, we estimated the amount of exercise and walking required to alleviate the worsening of depressive symptoms associated with damage to the house. For example, if people whose houses were "half-destroyed" joined an exercise group five or six times a month or walked 75 minutes a day, their depressive symptoms would be alleviated to the same level as those whose houses had "partial damage."

10 Community-level social capital mitigates progression of cognitive disability after a disaster

Pre- and Post- Earthquake

Social ties mitigate the impact of disaster experiences on post-disaster cognitive disability



(n=3,560)

Hikichi H, Aida J, Matsuyama Y, Tsuboya T, Kondo K, Kawachi I: Community-level social capital and cognitive decline after a natural disaster: A natural experiment from the 2011 Great East Japan Earthquake and tsunami. Soc Sci Med. 2018 Sep:111981. doi: 10.1016/j.socscimed.2018.09.057.

We examined prospectively whether community-level social capital can mitigate the adverse effects of natural disaster on cognitive decline in the aftermath of the 2011 Great East Japan Earthquake and Tsunami. The baseline for our natural experimental study was established seven months before the disaster in a survey of older community-dwelling adults who lived in Iwanuma City, Japan, located 80 km west of the epicenter. Two and a half years after the disaster, we conducted a follow-up survey of survivors to gather information about their individual experiences during the disaster (n = 3560; 82.1% follow-up rate). Our primary outcome was the level of cognitive disability (measured on an 8-level scale) assessed within people's homes. Factor analysis established two subscales of community social capital: a cognitive dimension (perceptions of community social cohesion) and a structural dimension (informal socializing and social participation). The prevalence of cognitive decline at follow-up (11.5%) was three times higher than at baseline (4.2%). Our multiple membership multilevel model indicated that pre- versus post-disaster increases in community-level informal socializing and social participation were associated with lower risk of cognitive decline (coefficient = -0.12, 95% confidence interval: -0.20 to -0.04). In addition, social capital mitigated the risk of cognitive decline due to housing damage (interaction effect coefficient = -0.07, 95% confidence interval: -0.14 to -0.01). Community-level informal socializing and social participation buffers the impact of housing damage on cognitive decline in the aftermath of natural disaster. Relocating residents together with other community members may help to preserve community social capital and improve the cognitive resilience of older survivors.

11 Depressive symptoms and higher mortality on the day of the disaster

Pre- and Post- Earthquake

Mortality risk during disaster is four times higher for those with depressive symptoms. Post-disaster mortality risk reduced by about half through interaction with friends.

		Mortality risk the day of the earthquake	Mortality risk the day after the earthquake
Distance from coastline	> 2000m	1	1
	1000 - 1999m	3.01(0.56, 16.16)	0.83(0.42, 1.65)
	500 - 999m	16.88(4.33, 65.84)	0.76(0.38, 1.51)
	0 - 499m	22.66(5.78, 88.84)	0.84(0.43, 1.68)
Household	Living alone	1	1
	Co-habiting with others, but not parent(s)	3.04(0.47, 19.74)	1.05(0.54, 2.06)
	Living with parent(s)	6.67(0.83, 53.71)	0.45(0.10, 2.12)
Social interactions (Interacted with friends)	Not meeting any friends	1	1
	Meeting some friends	2.06(0.51, 8.23)	0.46(0.26, 0.82)
Depressive symptoms	Normal	1	1
	Mild	0.79(0.29, 2.19)	1.39(0.81, 2.38)
	Moderate	1.14(0.29, 4.50)	1.45(0.62, 3.26)
	Severe	3.90(1.13, 13.47)	1.91(0.81, 4.50)
Activities of daily living	Independent	1	1
	Partially disabled	0.73(0.18, 2.89)	2.44(1.30, 4.56)
	Disabled	0.32(0.04, 2.64)	2.97(1.43, 6.14)

Note: Adjusted for age, sex, medical history, lifestyle, etc. Logistic regression analysis applied for mortality on the day. Analysis for the death from the next-day of the disaster, Cox proportional hazard model was applied.

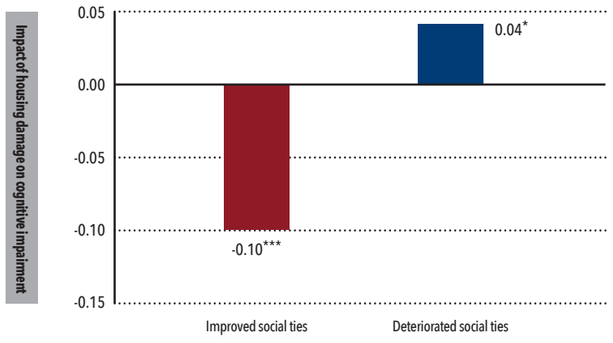
Aida J, Hikichi H, Matsuyama Y, Sato Y, Tsuboya T, Tabuchi T, Koyama S, Subramanian SV, Kondo K, Osaka K, Kawachi I: Risk of mortality during and after the 2011 Great East Japan Earthquake and tsunami among older coastal residents. Sci Rep. 2017 Nov 29;7(1):16591. doi:10.1038/s41598-017-16636-3.

The coastal area of Iwanuma City was hit by a massive tsunami about an hour after the earthquake. Aida et al. (2017) summarized the results of a study that found on the day of the disaster, the risk of death was about four times higher for older adults who had severe depression symptoms before the earthquake than for those who did not. They analyzed risks of mortality on the day of the disaster and from the next day of the disaster to May 2014 using the JAGES Iwanuma data of 860 older adults in the Tamaura area, Iwanuma city, which was flooded by the tsunami. On the day, 33 people died (mortality rate-3.8%). The mortality rate on the day of the disaster was as high as 12.8% for those who had severe depressive symptoms before the disaster, and their adjusted risk of death was about four times higher than for those who did not have any depressive symptoms. The mortality risk may have increased because the evacuation was delayed due to cognitive decline associated with depression, or because people gave up, thinking that evacuation would not save them. The mortality risk on the day of the disaster tended to also be higher for those with rich social interactions before the disaster. Among such people, actions such as trying to help a friend may have delayed evacuation from the tsunami. Additionally, 95 people died the day after the earthquake in May 2014. During this period, the risk of death for those with rich social interactions was about half that of those who did not. The results show the importance of helping people with severe depressive symptoms to minimize tardiness in evacuation, and assisting those who are isolated after the disaster.

12 Individual-level social ties mitigate post-earthquake progression of cognitive disability

Pre- and Post- Earthquake

Social ties mitigate the progression of dementia due to a disaster



Association between change in social ties and change in cognitive disability due to housing damage

* p <0.05, ** p <0.01, *** p <0.001

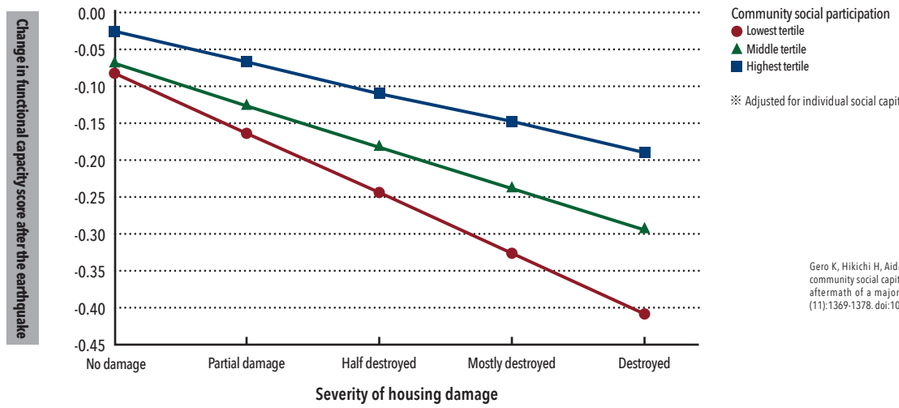
Hikichi H, Tsuboya T, Aida J, Matsuyama Y, Kondo K, Subramani an SV, Kawachi I: Social capital and cognitive decline in the aftermath of a natural disaster: a natural experiment from the 2011 Great East Japan Earthquake and tsunami. Lancet Planet Health. 2017 Jun;1(3): e105-e113. doi:10.1016/S2542-5196(17)30041-4.

In this natural experiment, the baseline for our study was established 7 months before the 2011 Great East Japan Earthquake and Tsunami in a survey of older community-dwelling adults who lived 80 km west of the epicentre (59·0% response rate). About 2 and a half years after the disaster, which occurred on March 11, 2011, the follow-up survey collected information about personal experiences of disaster as well as incidence of cognitive disability. Our primary outcome was cognitive disability (measured on an 8-level scale) assessed by in-home assessment. We obtained 5058 respondents at the baseline survey (59·0% response rate) and re-contacted 3594 survivors in the follow-up survey (82·1% follow-up rate). The experience of housing damage was associated with risk of cognitive impairment (coefficient 0·05 [95% CI 0·03 to 0·07]). Factor analysis of our analytical sample (n=3566) established two subscales of social capital: a cognitive dimension (perceptions of community social cohesion) and a structural dimension (informal socialising and social participation). Fixed effects regression indicated that improved informal socialising and social participation mitigated the risk of cognitive decline due to housing damage (coefficient −0·10 [95% CI −0·14 to −0·05]) and deteriorating informal socialising and social participation aggravated the effect of housing damage on cognitive decline (coefficient 0·04 [0·01 to 0·07]). Improved informal socialising and social participation reduces the risk of cognitive decline due to housing damage in the aftermath of natural disasters. Interventions to promote civic participation should be tried to promote cognitive resilience of older survivors.

13 Community social capital helps to preserve functional independence in older survivors

Pre- and Post- Earthquake

In areas with high social participation, the negative health impact of housing damage was reduced



Gero K, Hikichi H, Aida J, Kondo K, Kawachi I: Associations between community social capital and preservation of functional capacity in the aftermath of a major disaster. Am J Epidemiol. 2020 Nov 2;189 (11):1369-1378. doi:10.1093/aje/kwaa085.

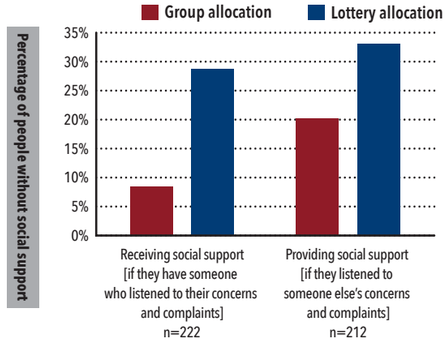
The strength of social connections in the community ("social capital") is hypothesized to be a crucial ingredient in disaster resilience. Gero et al. (2020) examined whether community-level social capital is correlated with the ability to maintain functional capacity among older Iwanuma City residents 2.5 years after the 2011 Great East Japan Earthquake and Tsunami. Functional capacity was measured by the Instrumental Activities of Daily Living scale, evaluating the survivors' ability to use public transportation, shop for daily necessities, prepare meals, pay bills, and manage deposits and withdrawals at a bank or post office independently. Three subscales of community-level social capital were assessed: social cohesion, social participation, and reciprocity. The results show that community-level social participation was associated with a lower risk of functional decline after disaster exposure. The average level of social participation in the community also mitigated the adverse impact of housing damage on functional status, suggesting a buffering mechanism.

14 Positive effects on mental health of group relocation into temporary housing

Pre- and Post- Earthquake

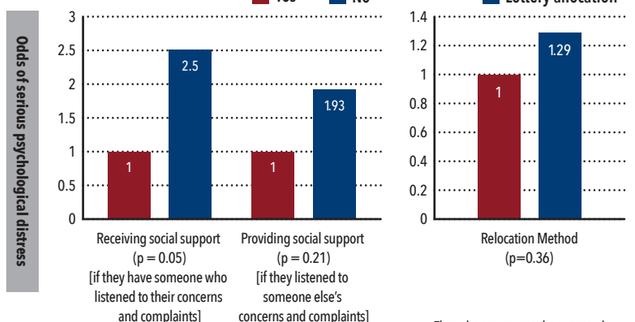
Survivors who underwent group allocation to temporary housing were significantly more likely to report receiving social support than those who underwent lottery allocation

Figure 1 Relationship between relocation methods and social support



Relocation to temporary housing together with pre-disaster community members was significantly associated with higher social support. (Receiving social support p = 0.003 Providing social support p=0.050)

Figure 2 Relationship between social support and serious psychological distress



The lack of receiving social support increases the risk of serious psychological distress.

Thus, the present results suggest that the method of resettlement to temporary housing is an important predictor of access to social support.

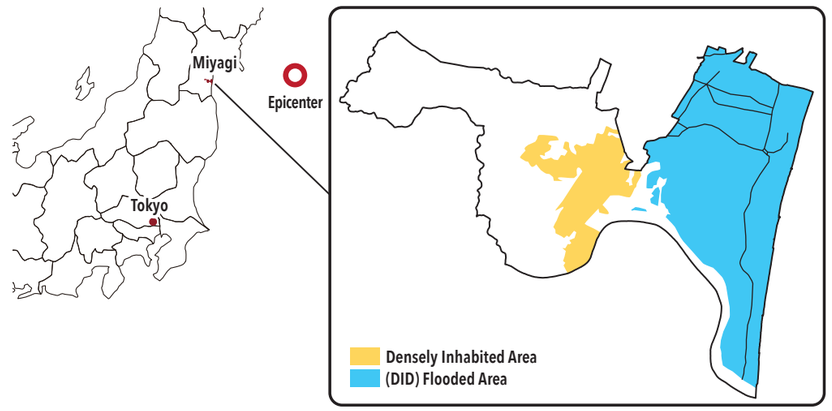
Koyama S, Aida J, Kawachi I, Kondo N, Subramanian SV, Ito K, Kobashi G, Masuno K, Kondo K, Osaka K: Social support improves mental health among the victims relocated to temporary housing following the Great East Japan Earthquake and tsunami. Tohoku J Exp Med. 2014 Nov;234 (3):241-7. doi:10.1620/tjem.234.241.

The victims of the Great East Japan Earthquake and Tsunami have been forced to live in temporary housing, by two different methods of resettlement: group allocation that preserved pre-existing local social ties and lottery allocation. Koyama et al. (2014) surveyed the effects of various factors, including the resettlement methods and social support, on mental health. Survivors who underwent group allocation to temporary housing (and were thus living in proximity to people who were their neighbors before the disaster) were significantly more likely to report receiving social support than those who underwent lottery allocation. Moreover, respondents who were receiving social support showed significantly lower psychological distress, although the resettlement approach was not significantly associated with distress.

15 Review article: Disaster resilience in older populations

Pre- and Post- Earthquake

Increasing levels of symptoms of dementia depending on the severity of damage to housing



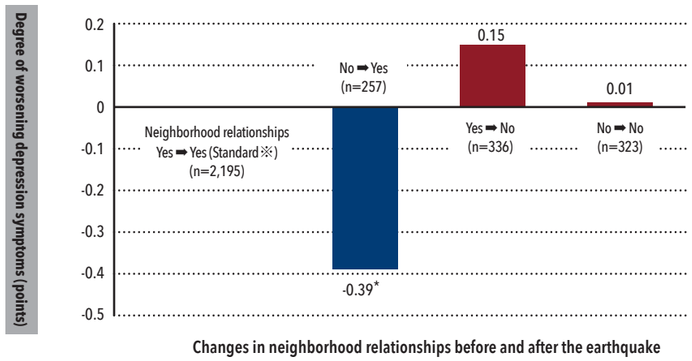
Kawachi I, Aida J, Hikichi H, Kondo K: Disaster resilience in aging populations: lessons from the 2011 Great East Japan Earthquake and tsunami. Journal of the Royal Society of New Zealand. 2020 Feb 4;50(2):263-278. doi:10.1080/03036758.2020.1722186.

Recovery after major disaster poses a unique set of challenges for the older population, including disruption of medical care for pre-existing conditions, functional limitations that impede recovery, and social isolation following involuntary resettlement. In this review, we summarize the lessons about disaster resilience that have been learned (so far) from a unique ongoing field study based in a community that was affected by the 2011 earthquake and tsunami in Japan. In the Iwanuma Study, baseline information about the health status and living conditions of older residents was collected seven months before the disaster. A follow-up survey was conducted 2.5 years after the disaster, allowing us investigate the risk and protective factors for a range of disaster-related health sequelae, including mental illness and cognitive disability. A consistent finding to emerge from our studies is the critical role of social connections (the "social capital" of a community) in protecting against the deleterious after-effects of psychological trauma and involuntary resettlement following the disaster. In contrast to the emphasis on investing in material infrastructure to prepare for disasters, a review of our studies suggests that repairing (or at least preserving) the social fabric of people's lives is a crucial ingredient in disaster resilience.

16 Socializing with neighbors post-earthquake reduces depressive symptoms

Pre- and Post- Earthquake

Relationship between changes in neighborhood relationships and the degree of severity of depressive symptoms



Note: adjusted for changes in age, gender, medical treatment, living alone, social participation, smoking habits, drinking habits, subjective economic status, and walking habits before and after the earthquake, as well as for the effects of relocation and losing loved ones.
* Indicates that there was a statistically significant association.

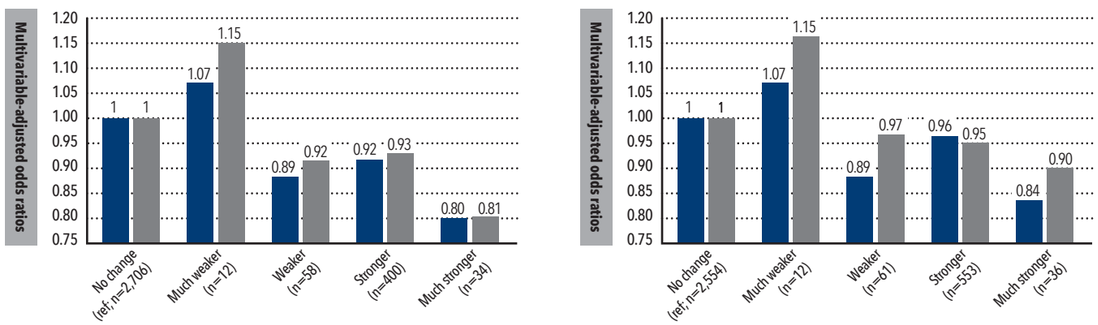
Sasaki Y, Tsuji T, Koyama S, Tani Y, Saito T, Kondo K, Kawachi I, Aida J: Neighborhood ties reduced depressive symptoms in older disaster survivors: Iwanuma study, a natural experiment. Int J Environ Res Public Health. 2020 Jan 3;17(1):337. doi:10.3390/ijerph17010337.

A study by Sasaki et al. (2020) found that older adults who increased neighborhood ties after the disaster were less likely to suffer from depressive symptoms. An analysis of data from a survey of 3,111 older adults in Iwanuma in 2010 and 2013 showed that those who increased neighborhood ties after the earthquake, had 0.39 points less likely to worsen depressive symptoms after the earthquake than those who had neighborhood ties before and after the earthquake. Increased neighborhood ties may have played a beneficial role in the mental health of the older survivors affected by natural disasters.

17 Relocation affects social relationships in areas receiving displaced survivors

Pre- and Post- Earthquake

Changes in community relations (trust) among nonrelocated Iwanuma City residents



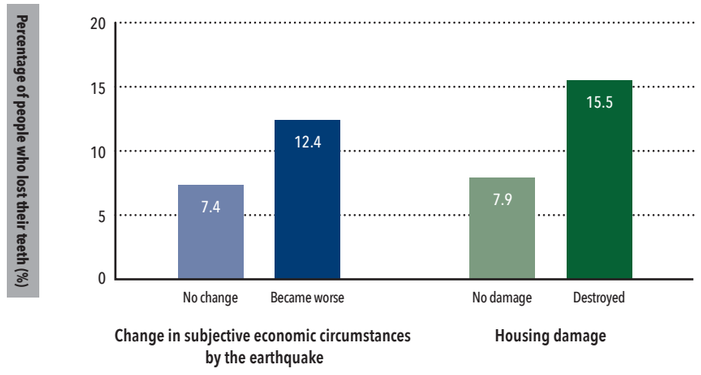
Gero K, Aida J, Kondo K, Kawachi I: Evaluation of trust within a community after survivor relocation following the Great East Japan Earthquake and tsunami. JAMA Netw Open. 2020 Nov;3(11): e2021166. doi:10.1001/jamanetworkopen.2020.21166.

Trust is a core component of social cohesion, facilitating cooperation and collective action in the face of adversity and enabling survivors to remain resilient. Residential stability is an important prerequisite of developing trusting relations among community members. However, little is known about whether the movement of internally displaced persons (IDPs) after a disaster might change community relations. Gero et al. (2020) explored perceived changes in trust after the 2011 Great East Japan Earthquake and Tsunami among 3250 nonrelocated residents of Iwanuma City. The results show that each standard deviation increase in the influx of internally displaced persons (1 SD = 11 IDPs) within 250 m of a resident's home address was associated with higher odds of a decrease in the resident's particularized (trusting people from the same community) and generalized trust (trusting people from other communities). Therefore, to avoid the erosion of social cohesion after a disaster, it may be crucial to provide opportunities for social interaction between old and new residents of communities.

18 Worsening financial status increases risk of tooth loss after disaster

Pre- and Post- Earthquake

People severely affected by the earthquake were more likely to lose their teeth



* N = 2,332 (the graph included only those without missing information)
* Tooth loss: Fewer numbers of teeth in responses from 2013 than 2010
* Subjective economic deterioration and housing damage due to the disaster were significantly associated with tooth loss after adjusting for sex, age, education, income, pre-disaster health status, post-disaster mental stress, and loss of loved ones.

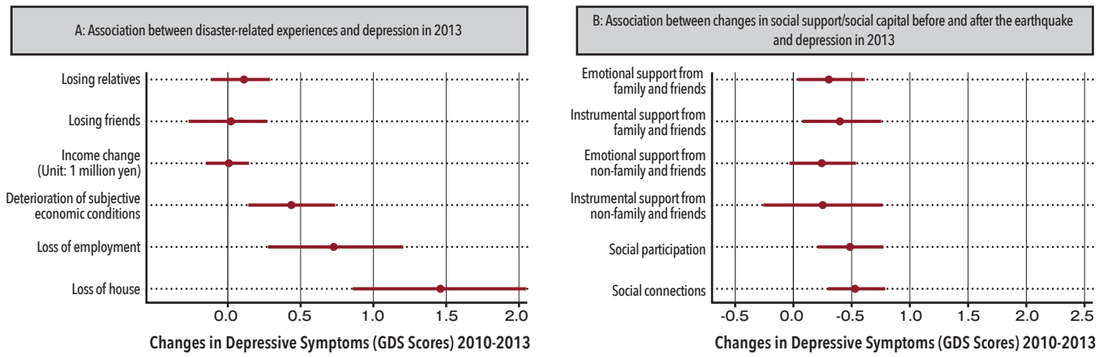
Matsuyama Y, Aida J, Tsuboya T, Hikichi H, Kondo K, Kawachi I, Osaka K: Are lowered socioeconomic circumstances causally related to tooth loss? A natural experiment Involving the 2011 Great East Japan Earthquake. Am J Epidemiol. 2017 Jul 1;186(1):54-62. doi:10.1093/aje/kwx059.

A study by Matsuyama et al. (2017) found older people who were severely affected by the earthquake were more likely to lose their teeth. Housing damage and worsening economic conditions due to the disaster were the risk factors. The study analyzed pre- and post-disaster data (2010 and 2013, N = 3,039) and showed that 8.2% of the study participants lost their teeth after the disaster. Subjective economic deterioration and housing damage due to the disaster were associated with tooth loss. After statistically adjusting for sex, age, education, income, pre-disaster health status, post-disaster mental stress, and loss of loved ones, subjective economic deterioration and housing damage due to the disaster were significantly associated with 8.1% and 1.7% increases in the probability of tooth loss, respectively. Disaster survivors were more likely to have poor oral health. Measures to support oral hygiene, such as distributing toothbrushes and having space for brushing teeth in evacuation centers, are required.

19 Decreased social capital does not explain post-disaster increased depressive symptoms

Pre- and Post- Earthquake

Decrease in social support and social capital after the disaster does not explain the increase in depressive symptoms among disaster survivors



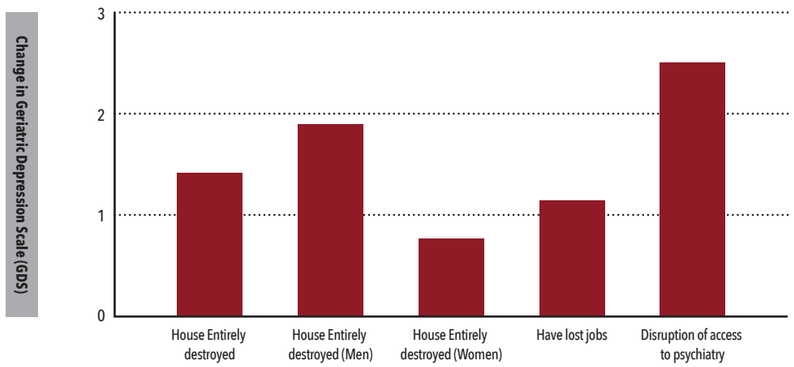
Note: Adjusted for the effects of municipality of residence, age, gender, education, income, IADL, and marital status in 2010.

Shiba K, Yazawa A, Kino S, Kondo K, Aida J, Kawachi I: Depressive symptoms in the aftermath of major disaster: Empirical test of the social support deterioration model using natural experiment. Wellbeing, Space and Society. 2020 Jan 1; 1:100006. doi: 10.1016/j.wss.2020.100006.

Depressive symptoms are known to increase among survivors who have experienced trauma after a major disaster. Post-disaster decrease in social capital has been claimed to be one potential cause. However, Shiba et al. (2020) used follow-up data from approximately 3,500 survivors of the 2011 Great East Japan Earthquake and tsunami to investigate whether post-disaster changes in social capital mediates the association between disaster traumas and increased depressive symptoms using statistically rigorous methods. They found that social capital did not explain the trauma- depression associations.

20 Predictors of worsened depressive symptoms after disaster

Post-earthquake



* Values on the Y-axis show the reduced scores on the depressive symptom scale for older adults (15-item version of the geriatric depression scale)
* Total destruction of house, loss of work, and barriers to psychiatric consultation (failure to see a psychiatrist) had a statistically significant impact on the worsening of depression three years after the disaster.

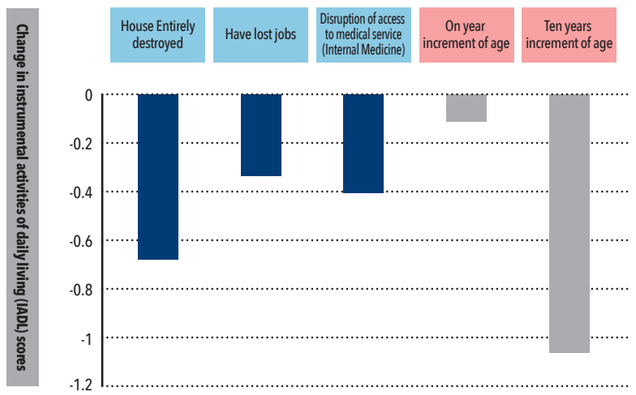
Tsuboya T, Aida J, Hikichi H, Subramanian SV, Kondo K, Osaka K, Kawachi I: Predictors of depressive symptoms following the Great East Japan Earthquake: A prospective study. Soc Sci Med. 2016 Jul; 161:47-54. doi: 10.1016/j.socscimed.2016.05.026. Epub 2016 May 20.

A unique feature of our study was the availability of information about mental health status pre-dating the disaster. Our sample comprised community-dwelling survivors aged 65 and older, who responded to surveys in 2010 (i.e. one year before the disaster) and in 2013 (n = 3464). We categorized disaster exposure according to three types of experiences: loss of family/friends, property damage, and disruption in access to medical service. Our main outcome was change in depressive symptoms, measured by the 15-item geriatric depression scale (GDS). Among the participants, 917 (26.5%) reported losing a family member to the disaster, while a further 537 (15.5%) reported losing a friend. More than half of the participants reported some damage to their homes. After adjusting for demographics and baseline mental health, people whose homes were completely destroyed had significantly elevated depressive symptom scores three years later (+1.22 points, 95%CI: 0.80, 1.64, $p < 0.0001$). Disruption of psychiatric care was also associated with change in GDS scores (+2.51 points, 95%CI: 1.28, 3.74, $p < 0.0001$). By contrast, loss of family/friends was no longer associated with GDS after 3 years; +0.18 points (95%CI: -0.018, 0.37, $p = 0.08$) for loss of family, and -0.045 points (95%CI: -0.28, 0.19, $p = 0.71$) for loss of friends. Three years after the disaster, survivors of the 2011 earthquake and tsunami appeared to have recovered from the loss of loved ones. By contrast, property loss and disruption of psychiatry care were associated with persistent adverse impact on mental health.

21 Access to medical care is key to preserving functional independence

Post-earthquake

Relationship between disaster experiences and decline in functional independence



(n=3,547)

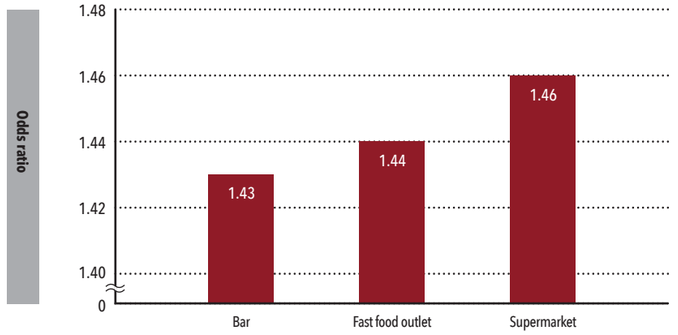
The value on the Y-axis is the decline in the level of independence score of older adults (13-item version of Instrumental Activities of Daily Living, IADL).
House damage (entirely destroyed), loss of job, and disruption of access to medical service were associated with significant adverse impact on decline in physical and cognitive functions.

Tsuboya T, Aida J, Hikichi H, Subramanian SV, Kondo K, Osaka K, Kawachi I: Predictors of decline in IADL functioning among older survivors following the Great East Japan Earthquake: A prospective study. Soc Sci Med. 2017 Mar;176:34-41. doi: 10.1016/j.socscimed.2017.01.022. Epub 2017 Jan 18.

We described associations between the type of disaster experience and change in instrumental activities of daily living among older adult survivors before and after a terrible disaster. The study took advantage of a "natural experiment" afforded by the Japan Gerontological Evaluation Study (JAGES), a nationwide cohort study established in 2010, seven months prior to the earthquake and tsunami. A follow-up survey was conducted in 2013. This study was conducted in Iwanuma, which was directly struck by a tsunami. Our sample comprised community-dwelling aged survivors in Iwanuma who responded to questions about personal circumstances and functional status both before and after the disaster (N = 3547). Individual experiences of earthquake and tsunami damage were used as an exposure variable. The outcome was changes in self-reported 13-item instrumental activities of daily living (IADL), which was assessed both before and after the disaster. Among the participants, 931 reported losing family member(s) to the disaster, while a further 549 reported losing friend(s). More than half of the participants reported damage to their houses while approximately 1 in 8 lost their car(s). The multivariable OLS regression revealed that complete house loss and disruption of internal medicine were associated with significantly worse IADL: −0.67 points (95%CI: −0.99, −0.34) for entirely destroyed homes; −0.40 points (95% CI: −0.71, −0.092) for disruption of internal medicine. By contrast, loss of family/friends/pets/cars and disruption to the other medical service were not associated with decline in IADL. Complete house loss and disruption of access to internal medicine after a disaster were associated with significant adverse impacts on declines in physical and cognitive functions 2.5 years after the disaster, while loss of family/friends was not.

22 Residential relocation linked to increased obesity due to changed food environment

Post-earthquake



Note: Odds ratios mean the risks of being obese significantly associated with each 1 km shortening of the distance to the nearest food establishment

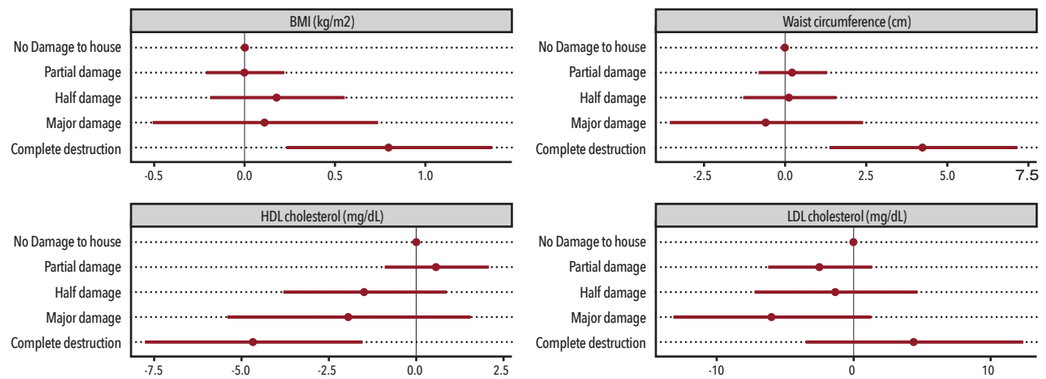
Hikichi H, Aida J, Kondo K, Tsuboya T, Kawachi I: Residential relocation and obesity after a natural disaster: A natural experiment from the 2011 Japan Earthquake and tsunami. Sci Rep. 2019 Jan;9(1):374. doi:10.1038/s41598-018-36906-y.

Natural disasters are often associated with forced residential relocation; thereby, affected people experience a change in food environment that results in an increased body mass index. However, there are some studies that have examined whether a change in food environment causes risks of obesity after a natural disaster. To address this question, we leveraged a natural experiment of residential relocation in the aftermath of the 2011 Japan Earthquake and Tsunami. Our baseline data came from a nationwide cohort study of older community-dwelling adults conducted 7 months prior to the disaster. By chance, one of the field sites (Iwanuma City, Miyagi Prefecture) was directly in the line of the tsunami. Approximately 2.5 years after the disaster, we ascertained the residential addresses and health statuses of 3,594 survivors aged 65 years or older (82.1% follow-up rate). Fixed effects multinomial logistic regression showed that shortened distances to food outlets/bars increased the risks of transitioning from BMI in the normal range (18.5–22.9) to obesity (≥25.0) (Odds ratios: 1.46 for supermarkets; 1.43 for bars; 1.44 times for fast food outlets). Radically changed food access after a natural disaster may raise the risk of obesity among older survivors.

23 Long-term effects of total destruction of one's house on cardiometabolic risks

Post-earthquake

Degree of property damage and changes in cardiometabolic profiles before and after the earthquake (2010–2013)



n=1,195. Estimates of changes in values before and after the earthquake are indicated by •.
If the lines around it do not cross 0, it indicates that the difference was statistically significant.

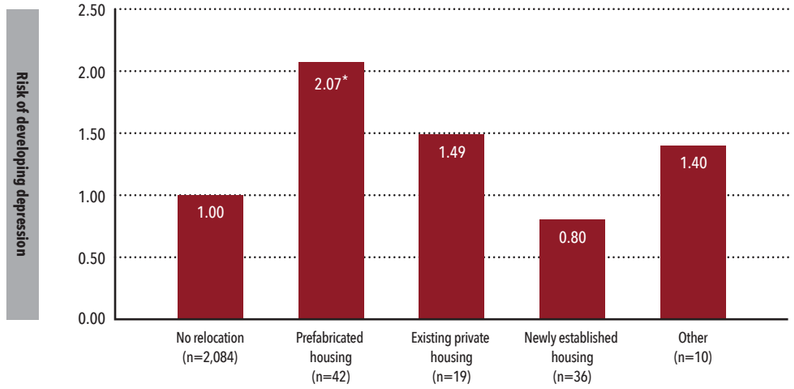
Shiba K, Hikichi H, Aida J, Kondo K, Kawachi I: Long-term associations between disaster experiences and cardiometabolic risk: A natural experiment from the 2011 Great East Japan Earthquake and tsunami. Am J Epidemiol. 2019 Jun 1;188(6):1109-1119. doi:10.1093/aje/kwz065.

Older adults, whose homes were completely destroyed by the disaster (versus no property damage), had worse cardiometabolic profiles two and a half years after the disaster. Shiba et al. (2019) conducted such a study that revealed the long-term health effects of a natural disaster. They combined data from 2010 and 2013, from the survey of older adults in Iwanuma by JAGES, with data from health check-ups carried out by the city, and analyzed data from 1,195 individuals. People whose homes were destroyed had a higher body mass index (BMI) by 0.81,kg/m2 and waist circumference by 4.26 cm than those whose homes were not damaged, and their HDL cholesterol was 4.77 mg/dl lower. There was no association between losing a family/friend or minor property damage and cardiometabolic profiles, which suggests the long-term associations between home loss and the outcomes may be due to circumstances specific to those whose homes were completely destroyed, such as relocation to temporary housing.

24 Relocation to prefabricated housing doubled the risk of depression

Post-earthquake

Odds ratios of depression according to type of post-disaster housing



Note: Adjusted for the impact of age, gender, subjective health, educational history, income, living alone, losing close loved ones due to the earthquake, and damage to the house.
※* Indicates that there was a statistically significant association.
* The analysis included 2,242 people who did not have depressive symptoms at the time of the 2010 survey.

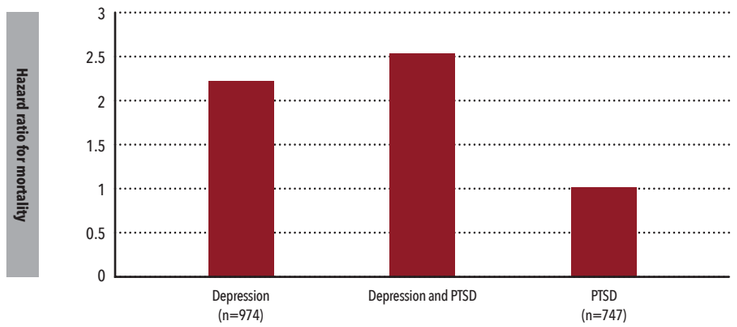
Sasaki Y, Aida J, Tsuji T, Miyaguni Y, Tani Y, Koyama S, Matsuyama Y, Sato Y, Tsuboya T, Nagamine Y, Kameda Y, Saito T, Kakimoto K, Kondo K, Kawachi I: Does type of residential housing matter for depressive symptoms in the aftermath of a disaster? Insights from the Great East Japan Earthquake and tsunami. Am J Epidemiol. 2018 Mar;187 (3):455-464. doi:10.1093/aje/kwx274.

Many people were forced to relocate because they lost their homes due to the earthquake. No previous research has analyzed relocation and psychological problems of survivors using pre- and post-disaster data. The JAGES analyzed data from a survey of 3,567 older adults in Iwanuma City, conducted in 2010 (before the earthquake) and in 2013 (after the earthquake). The study examined the association between relocation and the risk of developing depressive symptoms after the disaster. The results showed no difference in the risk of developing depressive symptoms between those who did not relocate and those who relocated to existing private housing or newly established housing. However, the risk of developing depressive symptoms after the disaster doubled for those who moved to prefabricated housing. It suggests that older adults moving to prefabricated housing may lead to the risk of developing depressive symptoms.

25 Post-disaster mental health as a predictor of mortality

Post-earthquake

Post-disaster depressive symptoms, post-traumatic stress disorder (PTSD), and mortality rates



* The figure shows the hazard ratios for mortality among people who had depression alone, depression and PTSD together, and PTSD alone (relative to people who have neither depression nor PTSD).

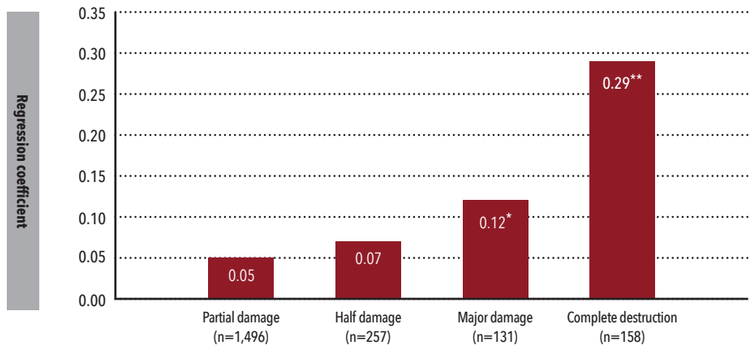
Li X, Aida J, Hikichi H, Kondo K, Kawachi I: Association of postdisaster depression and posttraumatic stress disorder with mortality among older disaster survivors of the 2011 Great East Japan Earthquake and tsunami. JAMA Network Open. 2019;2 (12): e1917550. doi:10.1001/jamanetworkopen.2019.17550.

To assess whether postdisaster depression and PTSD were associated with mortality in older disaster survivors, this cohort study was conducted. Prospective data were retrieved from older Japanese adults in Iwanuma City, Miyagi Prefecture, which was directly affected by the 2011 Great East Japan Earthquake and Tsunami. Mortality data were obtained by linkage to the national long-term care insurance database. Cox proportional hazards regression models were adjusted for predisaster sociodemographic characteristics, health behaviors, social cohesion, predisaster depression, and disaster experiences. In adjusted models, depression was associated with more than double the risk of mortality (hazard ratio, 2.29; 95% CI, 1.54-3.42); PTSD was not associated with increased risk of mortality (hazard ratio, 1.10; 95% CI, 0.73-1.64). When evaluating the association of the 4-category comorbid depression and PTSD variable with mortality, survivors with depression only (HR, 2.24; 95% CI, 1.43-3.49), as well as those with comorbid depression and PTSD (HR, 2.54; 95% CI, 1.50-4.27), were at increased risk of death during the follow-up period compared with those with neither depression nor PTSD. Depression, but not PTSD, was associated with mortality during 3.3 years of follow-up among older disaster survivors. These findings suggest that long-term mental health consequences of natural disasters may exist and that treating depression in older survivors of disasters may be beneficial.

26 Housing damage is associated with increased cognitive disability

Post-earthquake

Association between severity of housing damage and increased cognitive disability score



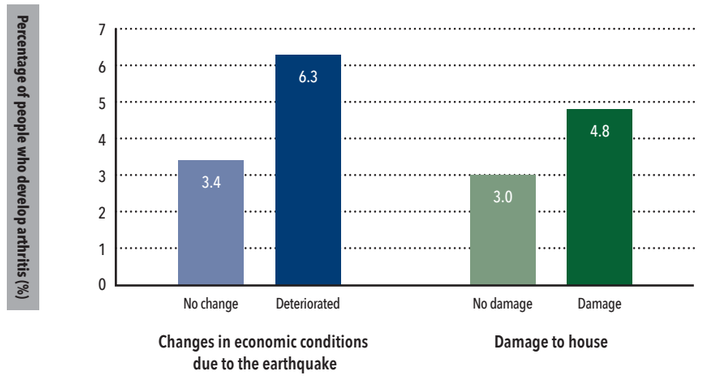
* p < 0.05
** p < 0.01 indicates statistical significance

Hikichi H, Aida J, Kondo K, Tsuboya T, Matsuyama Y, Subramani an SV, Kawachi I: Increased risk of dementia in the aftermath of the 2011 Great East Japan Earthquake and tsunami. Proc Natl Acad Sci USA. 2016 Nov 8;113 (45):E6911-E6918. doi:10.1073/pnas.1607793113. Epub 2016 Oct 24.

No previous study has been able to examine the association by taking account of risk factors for dementia before and after the disaster. We prospectively examined whether experiences of a disaster were associated with cognitive decline in the aftermath of the 2011 Great East Japan Earthquake and Tsunami. The baseline for our natural experiment was established in a survey of older community-dwelling adults who lived 80 km west of the epicenter 7 months before the earthquake and tsunami. Approximately 2.5 years after the disaster, the follow-up survey gathered information about personal experiences of disaster as well as incidence of dementia from 3,594 survivors (82.1% follow-up rate). Our primary outcome was dementia diagnosis ascertained by in-home assessment during the follow-up period. Among our analytic sample (n = 3,566), 38.0% reported losing relatives or friends in the disaster, and 58.9% reported property damage. Fixed-effects regression indicated that major housing damage and home destroyed were associated with cognitive decline: regression coefficient for levels of dementia symptoms = 0.12, 95% confidence interval (CI): 0.01 to 0.23 and coefficient = 0.29, 95% CI: 0.17 to 0.40, respectively. The effect size of destroyed home is comparable to the impact of incident stroke (coefficient = 0.24, 95% CI: 0.11 to 0.36). The association between housing damage and cognitive decline remained statistically significant in the instrumental variable analysis. Housing damage is an important risk factor for cognitive decline among older survivors in natural disasters.

27 Increased risk of developing arthritis associated with disaster trauma

Post-earthquake



Those who were affected by the earthquake had a higher incidence of arthritis after the disaster (n=2,360)

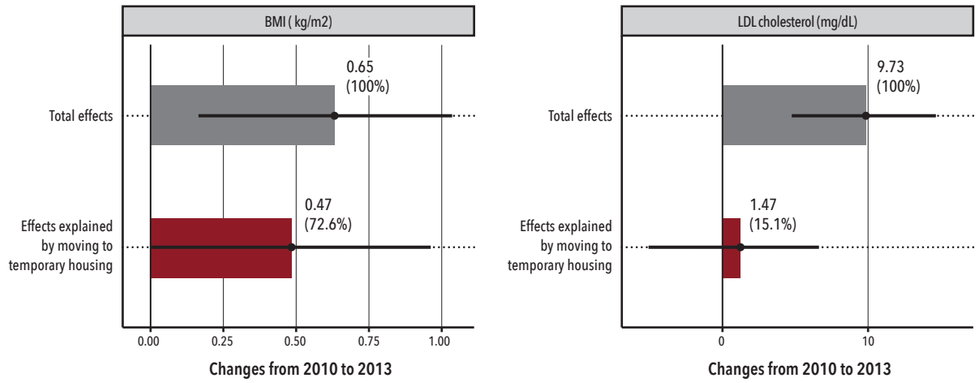
Ikeda T, Aida J, Kawachi I, Kondo K, Osaka K: Causal effect of deteriorating socioeconomic circumstances on new-onset arthritis and the moderating role of access to medical care: A natural experiment from the 2011 Great East Japan Earthquake and tsunami. Soc Sci Med. 2020 Nov;26 4:113385. doi: 10.1016/j.socscimed.2020.113385. Epub 2020 Sep 25.

The results show the importance of identifying and treating people with arthritis in the initial stages after a disaster. It has been reported that the health effects of the disaster are long-term and wide-ranging. However, no study has ever examined whether it affects the onset of arthritis. We analyzed follow-up data from 2,360 older adults aged 65 and over before (2010) and after (2013) the earthquake to examine the impact of the disaster and the onset of arthritis. Results showed a 16% increase in the risk of developing arthritis in the group with worse economic conditions compared to the group with no change in economic conditions. Similarly, the risk of arthritis onset was 8% higher in the group that experienced total destruction of the home compared to those with no housing damage. Injuries caused by the earthquake were not only external but also extended to the tissue within the joints. These types of injuries in the joints immediately after such an earthquake are thought to result in the onset of chronic arthritis. Therefore, in addition to assessing external injuries, checking for injuries that cannot be easily visually confirmed, such as joint tissue injury, in evacuation shelters immediately after the earthquake, is thought to be important for early detection and treatment.

28 Risk of increased BMI due to relocation to temporary housing

Post-earthquake

Empirical evidence on the relationship between property damage/relocation to temporary housing and increased BMI



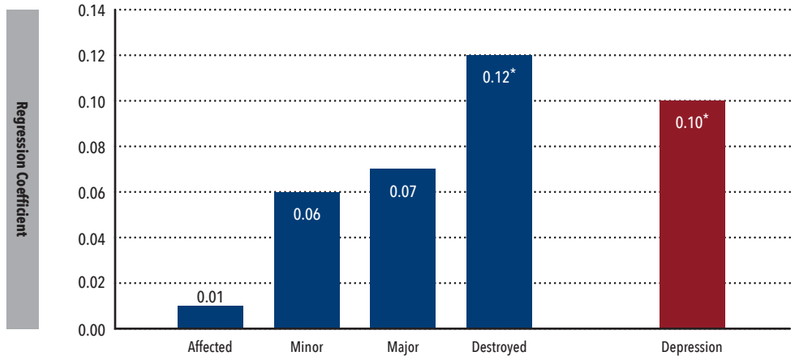
Shiba K, Aida J, Kondo K, Nakagomi A, Arcaya M, James P, Kawachi I: Mediation of the relationship between home loss and worsened cardiometabolic profiles of older disaster survivors by post-disaster relocation: A natural experiment from the Great East Japan Earthquake and tsunami. Health & Place. 2020 Nov 1; 66:102456. doi: 10.1016/j.healthplace.2020.102456.

After the Great East Japan Earthquake in 2011, there was an increased risk of metabolic syndrome in people who experienced property damage; however, the underlying mechanism was unclear. Shiba et al. (2020) analyzed pre- and post-disaster (2010 and 2013) data from approximately 1,165 older survivors aged 65 years and over affected by the Great East Japan Earthquake and demonstrated that 72.6% of the effect on worsening BMI was mediated by property damage and relocation to temporary housing. Potential explanations include changes in the neighborhood environment, such as the proximity to restaurants or the difficulty of cooking in the new living environment; however, further research is needed to determine if there is a link between moving to temporary housing and increased BMI.

29 Persistent impact of housing loss on cognitive disability 6 years after disaster

Long-term Impact

Persistent impact of housing loss on cognitive disability 6 years after disaster



(n=2,810)
* p <0.01 statistically significant association with cognitive decline

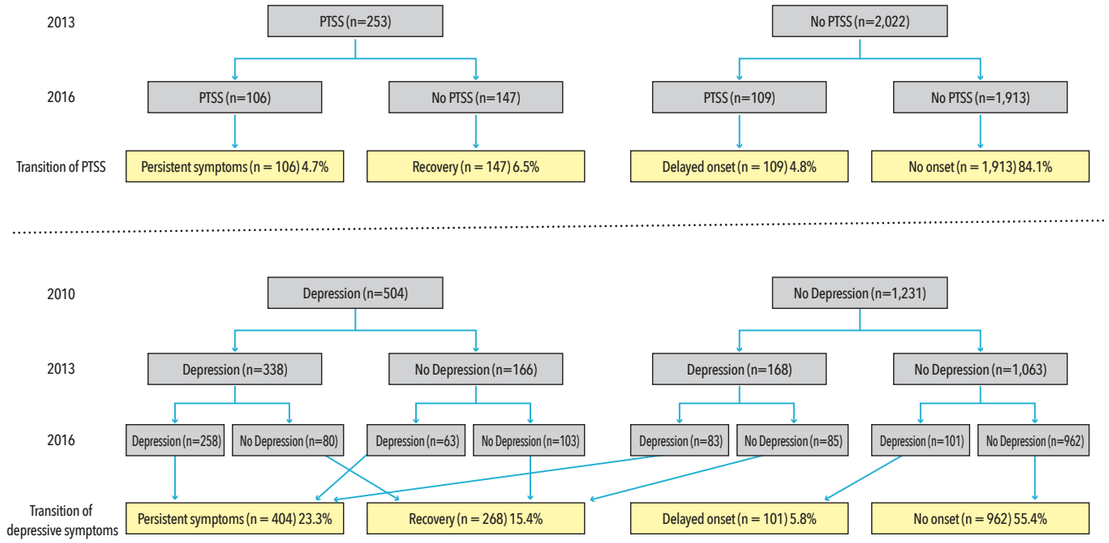
Hikichi H, Aida J, Kondo K, Kawachi I: Persistent impact of housing loss on cognitive decline after the 2011 Great East Japan Earthquake and tsunami: Evidence from a 6-year longitudinal study. Alzheimers Dement. 2019 Aug;15(8):1009-1018. doi: 10.1016/j.jalz.2019.04.016. Epub 2019 Aug 1.

We previously established that housing loss and residential dislocation in the 2011 Japan earthquake and tsunami was a risk factor for cognitive decline among older survivors. The present study extends the follow-up of survivors to six years. The baseline for our natural experiment was established in a survey of older community-dwelling adults who lived 80 km west of the epicenter seven months before the earthquake and tsunami. Two follow-up surveys were conducted approximately 2.5 and 5.5 years after the disaster to ascertain the housing status and cognitive decline from 2810 older individuals (follow-up rate through three surveys: 68.4%). The experience of housing loss was persistently associated with cognitive disability (coefficient = 0.14, 95% confidence interval: 0.04 to 0.23). Experiences of housing loss continued to be significantly associated with cognitive disability even six years after the disaster.

30 Long-term trends in mental health after disaster

Long-term Impact

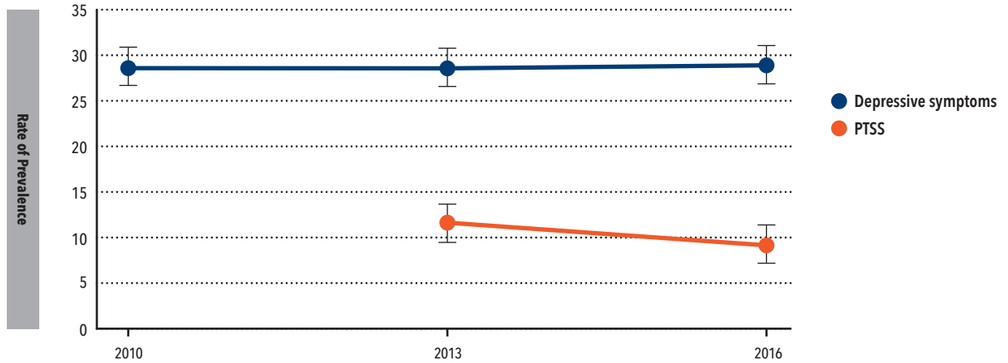
Trajectories of post-traumatic stress symptoms and depression, 2.5 and 5.5 years after the disaster



Kino S, Aida J, Kondo K, Kawachi I: Long-term trends in mental health disorders after the 2011 Great East Japan Earthquake and tsunami. JAMA Netw Open. 2020 Aug 3;3(8): e2013437. doi:10.1001/jamanetworkopen.2020.13437.

Severe emotional trauma, such as the loss of a relative or damage to one's home in a disaster, can lead to post-traumatic stress symptoms (PTSS), such as sudden flashes of painful memories, and depression. Kino et al. (2020) analyzed the results of the JAGES surveys of older adults in Iwanuma City in 2010, 2013, and 2016 to examine the long-term effects of the disaster on mental health; 13.6% of people who had no depressive symptoms before the disaster had depressive symptoms in 2013. By 2016, 50% of them had recovered. In contrast, the number of people with PTSS was 11% of the total as of 2013. As of 2016, 60% had recovered, while 40% still had PTSS.

Individual symptoms of mental illness changed pre- and post-earthquake; however, prevalence in community did not

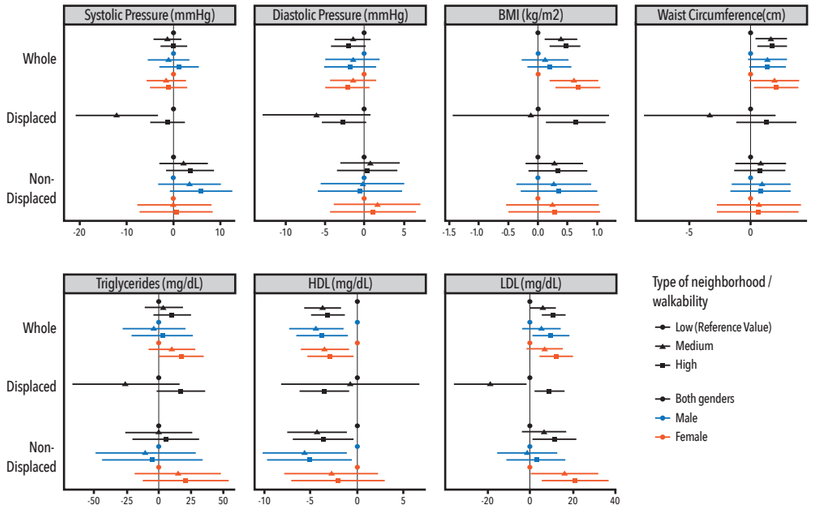


Post-traumatic stress symptoms (PTSS) and depression are common among survivors of major disasters. However, few studies have followed participants over an extended period to identify the symptoms of mental illness or to document the prevalence of mental illness symptoms in the community. In a study of 2,781 older adult survivors in Iwanuma City, about half of older adults who reported PTSS and depression had recovered 5.5 years after the disaster, while about half were still reporting symptoms more than five years later. However, for the region as a whole, the prevalence of depression was found constant between pre- and post-disaster data. This suggests that the region itself has the "capacity to be flexible and resilient in the face of adversity and difficulty."

31 Relocation linked with increased cardiometabolic risks

Long-term Impact

Correlation between neighborhood environment and lifestyle-related diseases



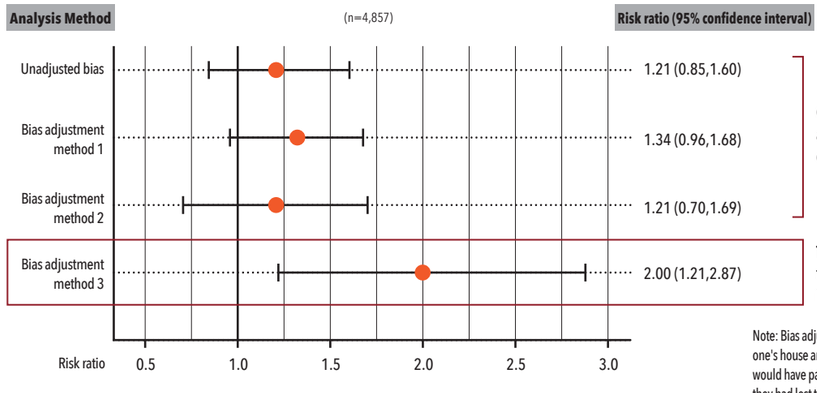
Some people who lost their homes to the tsunami in the coastal areas of Iwanuma were first displaced to temporary housing, and then moved to public permanent housing approximately 4 km further away from the temporary housing. Shiba et al. (2020) found that moving from a place far from supermarkets, restaurants, and pachinko parlors to a place near those destinations worsened the risks of metabolic syndrome.
The JAGES analyzed survey data from 2010, 2013, and 2016 of older adults in Iwanuma, which was linked with the results of health check-up records. The relationships between environmental changes associated with moving and cardiometabolic profiles were examined. Residential areas were rated on a scale of "high," "medium," and "low" based on the density of shops and other factors. Moving from "low" to "high" was associated with worse cardiometabolic profiles: BMI increased by 0.46, waist circumference increased by 1.8 cm, LDL cholesterol increased, and there was a decrease in HDL cholesterol. BMI increased only for females. Thus, the effects of efforts to maintain the health of survivors, such as promoting physical activities, may be cancelled out by the adverse effect of environmental changes associated with relocation.

Shiba K, Hanazato M, Aida J, Kondo K, Arcaya M, James P, Kawachi I: Cardiometabolic profiles and change in neighborhood food and built environment among older adults: A natural experiment. Epidemiology. 2020 Nov;31(6):758-767. doi:10.1097/EDE.0000000000001243.

32 Long-term relationship between a traumatic experience and health

Long-term Impact

The long-term health impacts of an earthquake may have been underestimated



Conventional analytical methods do not appear to link loss of housing and depressive symptoms.

The people who lost their homes had a twice as high risk of depressive symptoms in 2016

Note: Bias adjustment method three assess the health effects of losing one's house among a subset of the affected population (people who would have participated in the survey 5.5 years later, regardless of whether they had lost their homes).

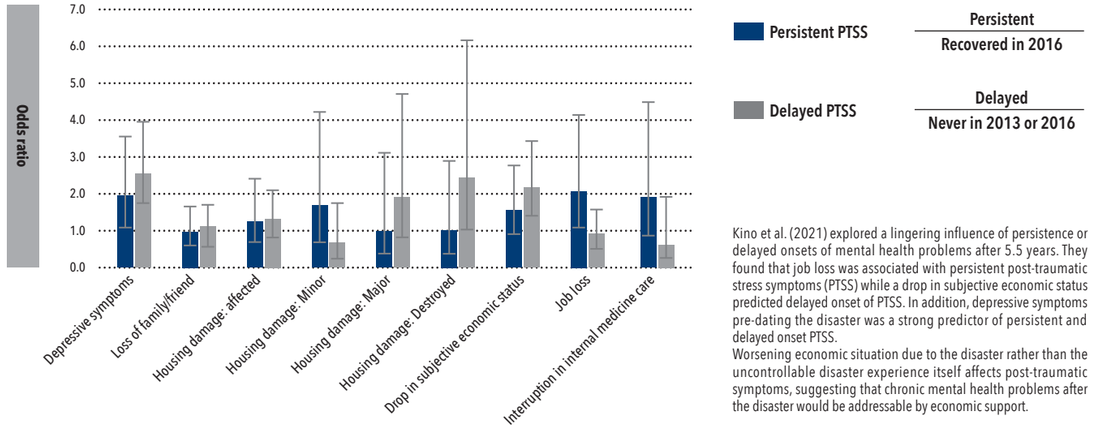
Shiba K, Kawahara T, Aida J, Kondo K, Kondo N, James P, Arcaya M, Kawachi I: Causal inference in studying the long-term health effects of disasters: Challenges and potential solutions. Am J Epidemiol. 2021 Mar 17. doi:10.1093/aje/kwab064.

Several studies reported that trauma caused by disasters has long-term negative effects on health. However, analyzing data acquired after an earthquake using conventional statistical methods can lead to bias and underestimation. We therefore used follow-up data from about 4,800 survivors of the Great East Japan earthquake to compare the differences in the estimated long-term effects of disaster-related home loss on health. The results showed the link between the traumatic experience of the disaster and subsequent health problems was likely underestimated. For instance, they demonstrated that people who experienced home loss (versus no home loss) had a two times higher risk of depressive symptoms five and a half years after the earthquake. The result indicates that negative effects do not diminish in the long-term; thus, continued health supports for survivors is necessary.

33 Predictors of persistent mental health problems 6 years after disaster

Long-term Impact

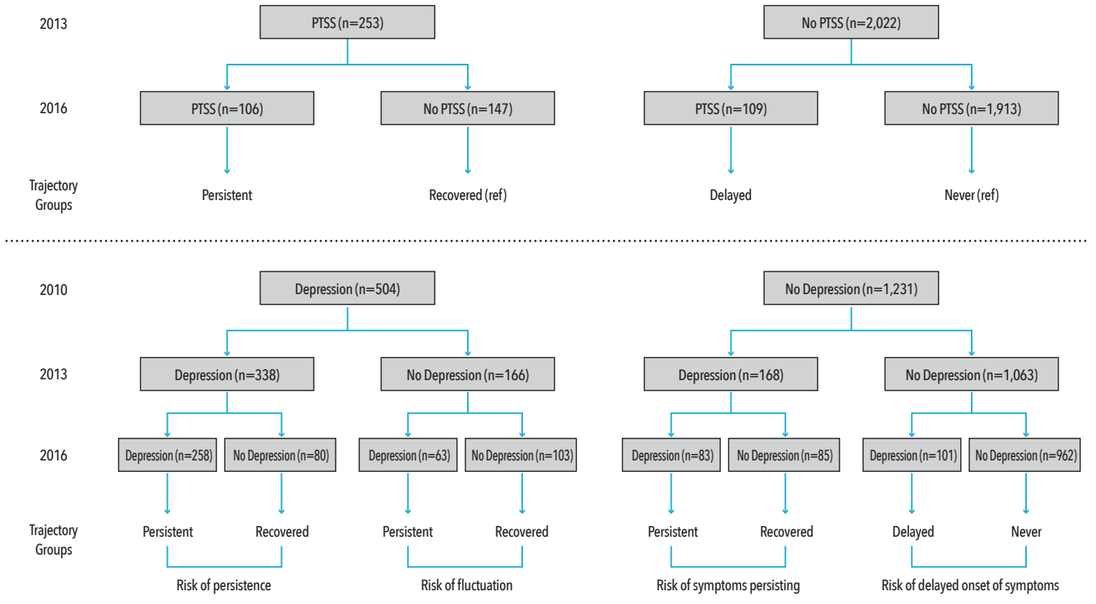
Predictors of persistent versus delayed post-traumatic stress symptoms



Kino et al. (2021) explored a lingering influence of persistence or delayed onsets of mental health problems after 5.5 years. They found that job loss was associated with persistent post-traumatic stress symptoms (PTSS) while a drop in subjective economic status predicted delayed onset of PTSS. In addition, depressive symptoms pre-dating the disaster was a strong predictor of persistent and delayed onset PTSS.
Worsening economic situation due to the disaster rather than the uncontrollable disaster experience itself affects post-traumatic symptoms, suggesting that chronic mental health problems after the disaster would be addressable by economic support.

Kino S, Aida J, Kondo K, Kawachi I: Persistent mental health impacts of disaster. Five-year follow-up after the 2011 Great East Japan Earthquake and tsunami: Iwanuma Study. J Psychiatr Res. 2021 Apr; 136:452-459. doi: 10.1016/j.jpsychires.2020.08.016. Epub 2020 Aug 23.

Unemployment and deterioration of financial status due to the earthquake affect persistent and delayed onset PTSS

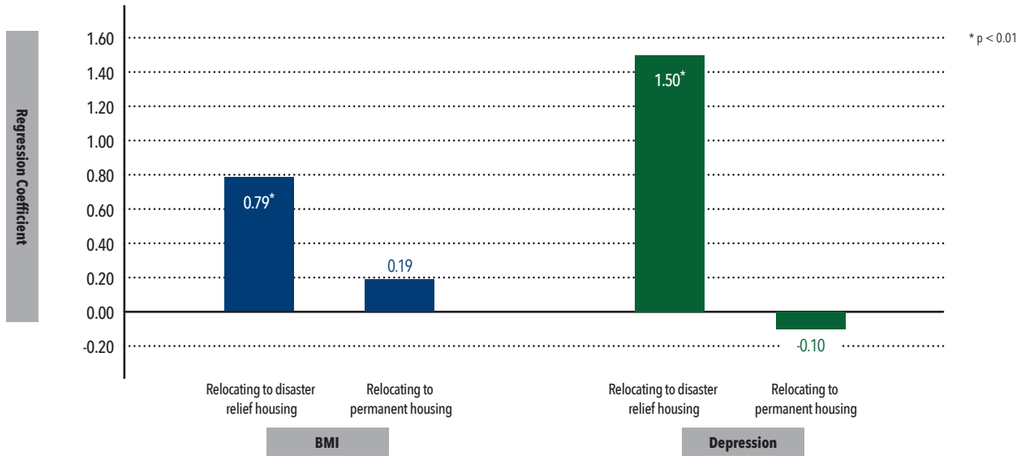


Few studies have tracked the long-term mental health outcomes following major disasters. Therefore, they sought to document the trajectories of depressive symptoms and PTSS in the aftermath of the 2011 Great East Japan earthquake and tsunami. Among people without pre-disaster depressive symptoms, 13.6% had developed depressive symptoms 2.5 years after the disaster. Of these, half of those had recovered and half had persisted at the 5.5-year follow-up. Exactly 11.1% of survivors reported PTSS in 2013; of these, 58% recovered by 2016, while 4.8% experienced delayed onset.
The experience of job loss and drop in subjective economic status appeared to exert a lingering influence on the persistence or delayed onset of PTSS.

34 6-year followup study of the health impacts of residential relocation

Long-term Impact

Group relocation to disaster relief housing increases the risk of obesity and depression



Hikichi H, Aida J, Kondo K, Kawachi I. Six-year follow-up study of residential displacement and health outcomes following the 2011 Japan Earthquake and tsunami. Proc Natl Acad Sci U S A. 2021 Jan 12;118(2): e2014226118. doi: 10.1073/pnas.2014226118.

Studies examining the long-term health consequences of residential displacement following large-scale disasters remain sparse. Following the 2011 Japan Earthquake and Tsunami, victims who lost their homes were resettled by two primary means: 1) group relocation to public housing or 2) individual relocation, in which victims moved into public housing by lottery or arranged for their own accommodation. Little is known about how the specific method of residential relocation affects survivors' health. We examined the association between residential relocation and long-term changes in mental and physical well-being. Our baseline assessment predated the disaster by 7 months. Two follow-up surveys were conducted approximately 2.5 and 5.5 years after the disaster to ascertain the long-term association between housing arrangement and health status. Group relocation was associated with increased body mass index and depressive symptoms at 2.5-year follow-up but was no longer significantly associated with these outcomes at 5.5-year follow-up. Individual relocation at each follow-up survey was associated with lower instrumental activities of daily living as well as a higher risk of cognitive impairment. Our findings underscore the potential complexity of long-term outcomes associated with residential displacement, indicating both positive and negative impacts on mental versus physical dimensions of health.

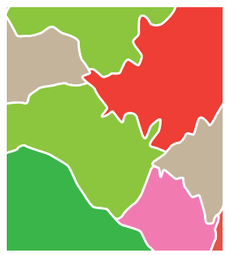
JAGES HEART 2019

Development of disaster preparedness "visualization" system

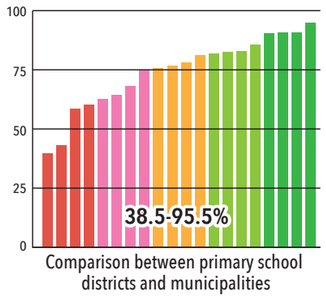
JAGES built a "visualization" system for regional analysis using health and lifestyle survey data.
The name of the system is "Community-based Management Support System (JAGES HEART)."

It performs visualizations like those given below

Which regions are vulnerable to disasters?

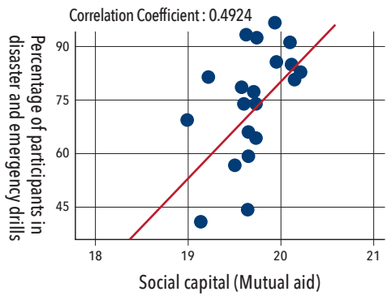


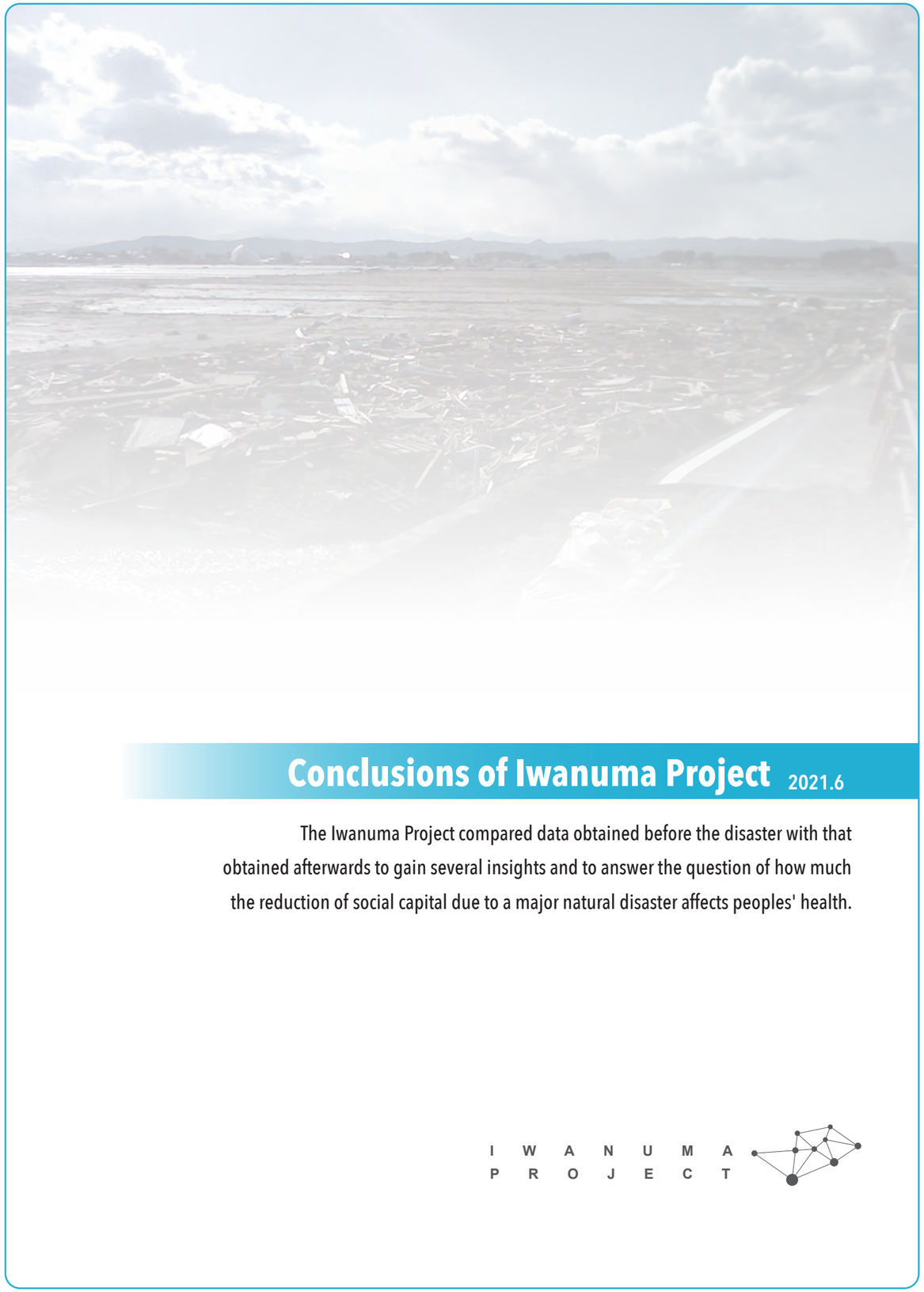
Participants in disaster and emergency drills (%)



Comparison between primary school districts and municipalities

The more social capital a community has, the more prepared it is for disaster





Conclusions of Iwanuma Project 2021.6

The Iwanuma Project compared data obtained before the disaster with that obtained afterwards to gain several insights and to answer the question of how much the reduction of social capital due to a major natural disaster affects peoples' health.

I W A N U M A
P R O J E C T

Implications of the Iwanuma Project

–Steps to maintain social connections–

We found numerous links between areas with rich social capital (connections between people) and better health pre- and post-disaster. It suggests that increasing social capital before a disaster can lesad to disaster mitigation

Pre- and post-disaster factors that increase the risk of health deterioration after a disaster:

Risk factors that aggravated health after the earthquake

Factors before the earthquake

- Distance from coastline (mortality risk on day of disaster)
- Severe depression before the earthquake (mortality risk on the day of the earthquake)
- Dependence on others before the earthquake (mortality risk from the day after the earthquake)

Pre-disaster (Preparedness stage) Factors for disaster mitigation

Factors after the earthquake

- Damage to the house (depression, PTSD, loss of teeth, loss of independence, risk of dementia)
- Loss of loved ones (PTSD)
- Facing the disaster without having experienced adversity (PTSD)
- Loss of loved ones
- Declining economic conditions (loss of teeth)
- Difficulty in seeking medical attention immediately after the disaster (depression, declining degree of independence)
- Relocation to temporary housing (depression)

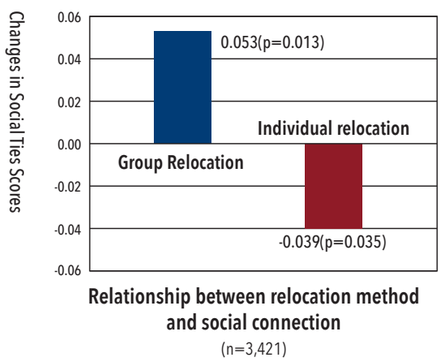
Post-disaster Factors for disaster mitigation

Method of relocation to temporary housing post-disaster affects health

Longitudinal panel data for post-disaster relocation of socially connected groups 2010–2013

1 Social ties increase with group relocation

(Hikichi, 2017 No. 6)

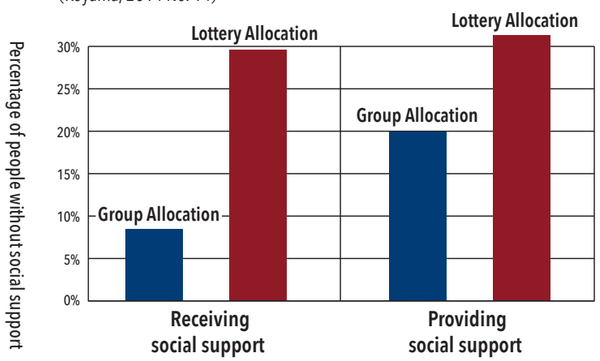


Relationship between relocation method and social connection

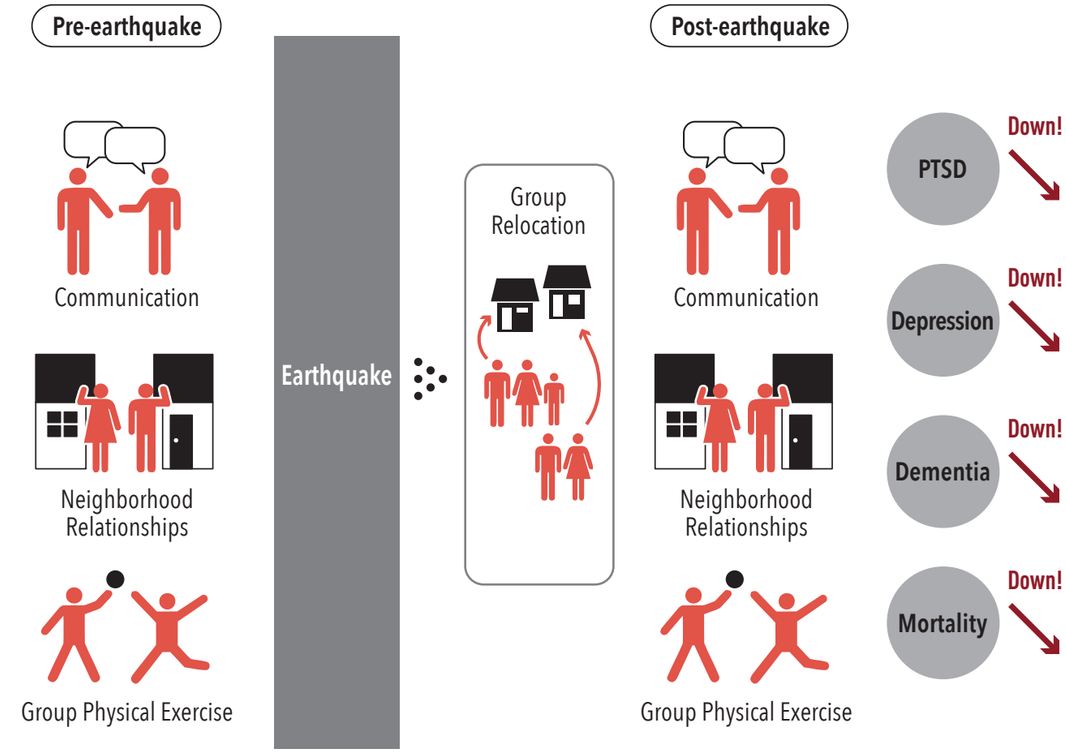
(n=3,421)

2 Lottery (compared to group) allocation was associated with less providing/receiving social support.

(Koyama, 2014 No. 14)



The higher the pre- and post-disaster social capital, the lower the health risk after a disaster.



- Neighborhoods with strong pre-earthquake ties are likely to have lower post-earthquake health risks.
- Group relocation of communities, rather than individual or lottery relocation, lowers post-disaster health risks.

Implications of the Iwanuma Project

Increasing social capital before and after the disaster is the key to disaster mitigation.

- Developing social capital in daily life in preparation for earthquakes and disasters
- Taking measures such as group relocation to maintain social capital after the disaster

The higher the social capital, the higher the resilience to disaster

- **Developing social capital in daily life in preparation for earthquakes and disasters.**
- **Taking measures, such as group relocation, to maintain social capital after the disaster.**

Three types of Social Capital

Bonding Type
Refers to the bond between people who have something in common.
While strong bonds are created inside groups, there is also an aspect of exclusivity.

Bridging Type
Bonding type refers to ties within the same area, whereas the bridging type refers to looser ties with the outside world.
Connecting with the external world provides added information and resources.

Linking Type
The link between the general public and authority represented by the administration.
It is the relationship of trust that exists between people who cross the boundaries of social power and authority.

External Connections

Social capital can be strengthened by allowing people from different regions to interact, instead of staying within one region.

Exercise and Hobbies

Social capital can be improved among local residents through exercise and hobby group activities, festivals, and other events in which participation can occur.

Temporary Housing

Group relocation to temporary housing after an earthquake is more likely to bring people closer together and has less impact on health when compared to individual relocation by lottery.

Public Space

It is possible to provide public spaces that are accessible to a wider range of local residents by focusing on places where people are likely to congregate, such as town halls, community centers, schools, and parks.

Places for Experience

In addition to creating places, it is important to offer a variety of events, experiences, and activity programs in parks and sports facilities.

Neighborhood Environment

The study demonstrated that a neighborhood environment in which local residents can go out, exercise, communicate, and shop on a daily basis has a positive impact on health.