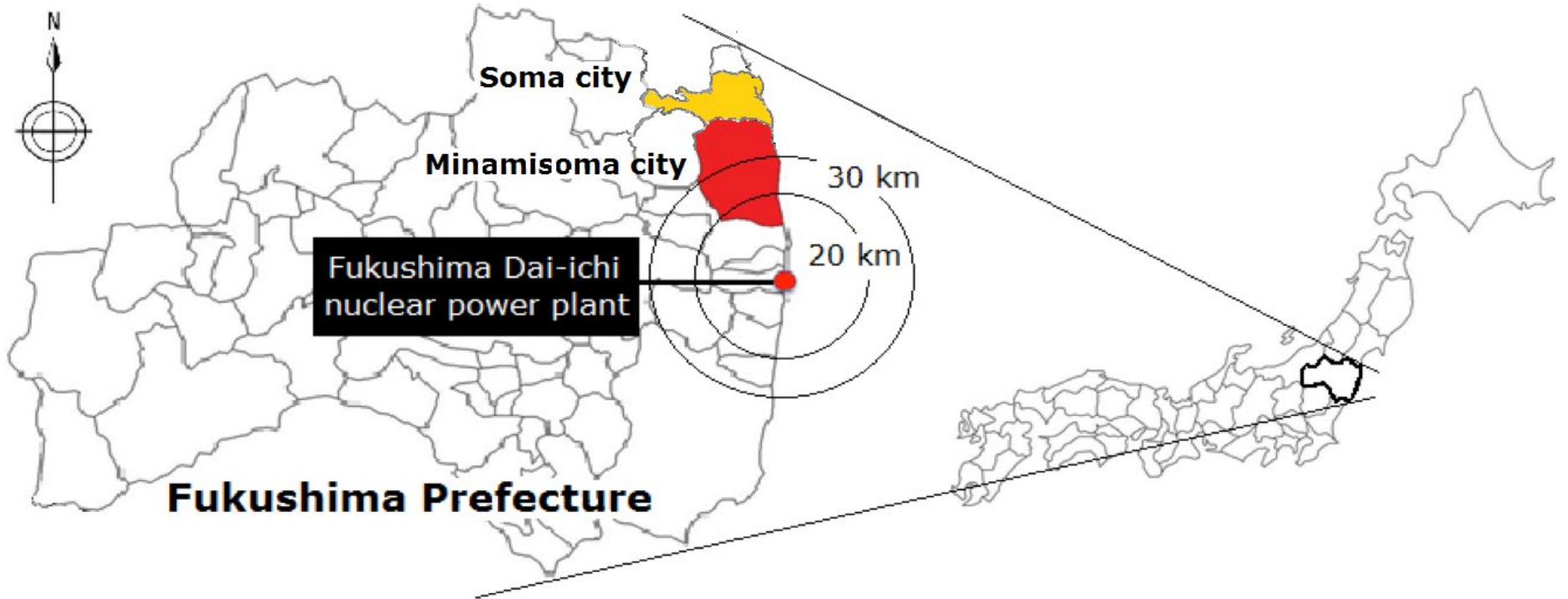


Overview of Secondary Health Issues After the Fukushima Incident

Department of Radiation Health Management
Fukushima Medical University School of Medicine
Masaharu TSUBOKURA

Multi-faceted disaster of Earthquake, Tsunami and...



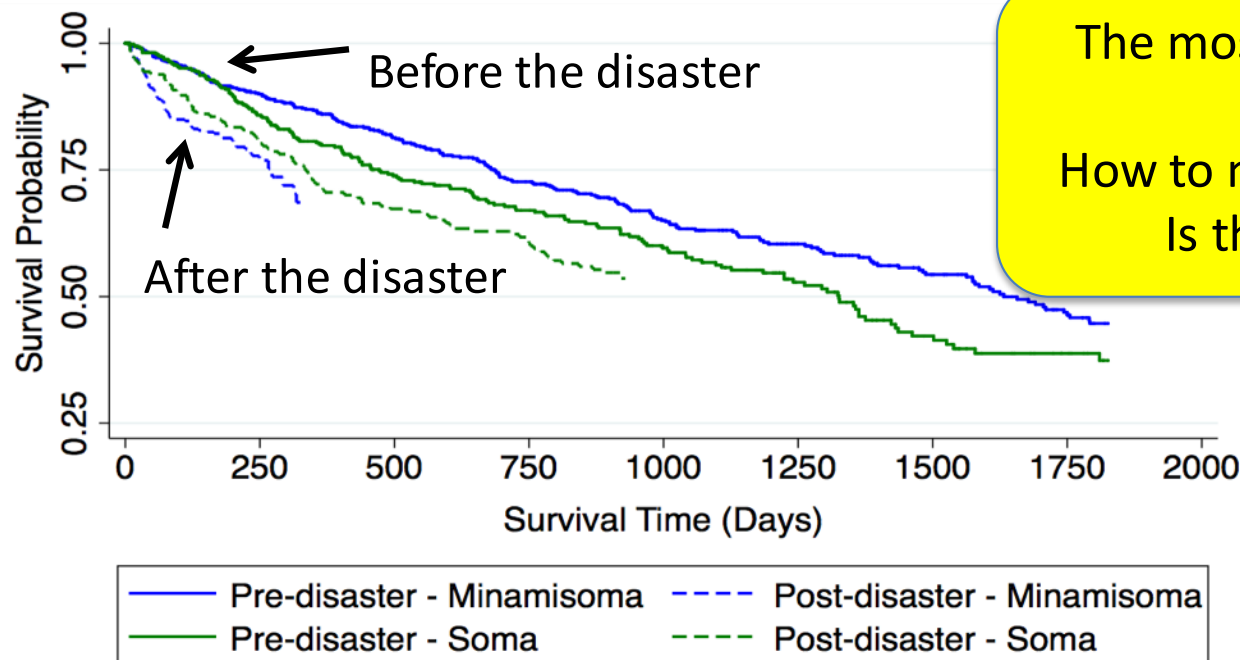
A wide range of health risks necessary to consider among people in radioactively contaminated areas

- Radiation exposure
- Risk of evacuation
- Psychological and mental health
- Lifestyle diseases
- Family separation
- Changes in the local/home environment
- Aging-population/depopulation/social isolation
- Changes in clinical services, nursing care supply, and the accessibility of the hospitals
- Changes in the healthcare supply and demand
- Health disturbance among new residents from outside (decontamination/restoration workers)
- Social concerns and media (prejudice based on radiation exposure)

1. Individual
2. Family
3. Infrastructure
4. Society

The risk of death among residents of nursing homes increased after the evacuation.

- The relative risk of death for nursing home residents during the post-disaster period was 2.68 times higher than that in the pre-disaster period in Minamisoma City. *1
- In several facilities, approximately 25% of residents died within 90 days after the evacuation.*2
- The risk of death may increase by staying in the area with limited medical resources. *3



The most common cause of death was pneumonia.
How to maintain patient access to care?
Is this caused by oral hygiene?

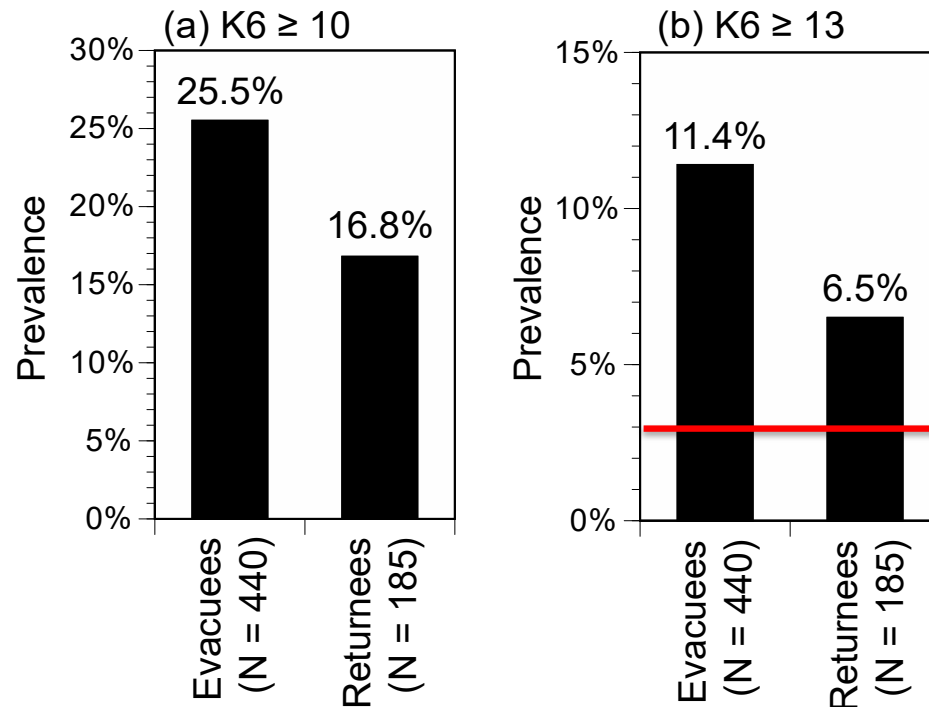
1. Nomura, Tsubokura et al. PLoS One. 2013;8(3):e60192.
2. Nomura, Tsubokura et al. PrevMed. 2016 Jan;82:77-82.
3. Shimada, Tsubokura et al. BMJ Open. 2018 Jul 28;8(7):e021482.

A wide range of health risks necessary to consider among people in radioactively contaminated areas (cont.)

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- Risk of evacuation
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- Health disturbance among new residents from outside (decontamination/restoration workers)
- Risk perception, social concerns, and media (prejudice based on radiation exposure)

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Psychological distress among returnees were lower than that among evacuees but higher compared to the national average.



Returnees as a whole are in a better mental state than evacuees. However, the mental state of the returnees is worse than the national average.*1

National average

Need for continuous support

- Although returning and restoring the original life effectively reduces the mental burden, the low mental load of the person who returned may be the cause and not the result of the return.
- Mental state suddenly deteriorates after the evacuation order was lifted in some cases.*2
- Lower subjective well-being among people who moved to the restoration public housing.*3
- A 2nd spike in the number of suicides has been observed in the former evacuation zone.*4

1. Murakami, Tsubokura et al. Tohoku J Exp Med. 2019 Jan;247(1):13-17.
2. Hori, Tsubokura et al. submitting

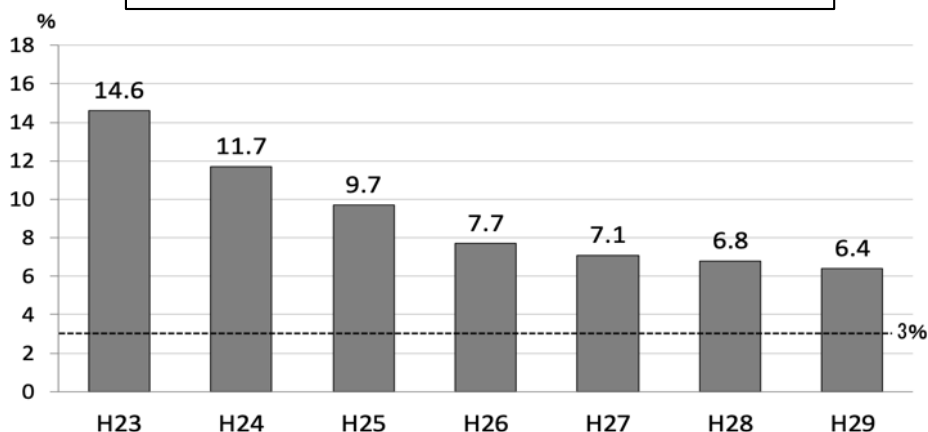
3. Moriyama, Tsubokura et al. Int J Environ Res Public Health. 2019 Jul 28;16(15).
4. Orui et al. 日本公衆衛生学雑誌 2019; 66(8): 407-416.

Fukushima Health Management Survey (FHMS)

- Basic Survey: estimating residents' external doses for the four months after the accident.
- Thyroid Examination: targeting all residents who were around 18 years old or younger as of March 11, 2011.
- Comprehensive Health Checkup: targeting people who used to reside in evacuation areas, conducted to achieve the prevention, early detection, and treatment of lifestyle-related diseases that may be caused by changes in their living circumstances.
- Mental Health and Lifestyle Survey: targeting people from evacuation areas to offer support to disaster victims to ease anxiety and emotional trauma.
- Pregnancy and Birth Survey: targeting pregnant women who have worries over various things, including radiation fears concerning childbirth and child-rearing.

Psychological distress and deterioration of life-style diseases: Fukushima Health Management Survey (FHMS)

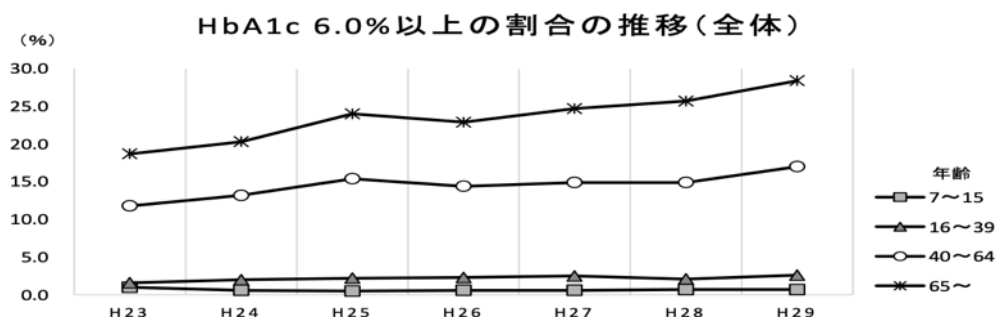
Percentage of those who need help with depression or anxiety



- Although the percentage was high at 14.6% in 2011, it has improved by 2014, moving around 7% since then.

- Compared to the ratio (3%) for the general population who was not affected by the disaster, it still shows a high value.

Impaired glucose tolerance



- The ratio of HbA1c, 6.0% or more, significantly increased in 16-39-year-olds in 2017 compared to 2011, but there was no significant change compared to 2016.

- For those aged 40 and above, the percentage in 2017 increased significantly compared to 2011 and 2016.

Changes in the family environment

- In Minamisoma city, the risk of delay in breast cancer diagnosis was significantly higher for those living without their children. *1
- Without adequate family and social support, it is difficult to live and receive adequate treatment in the former evacuation zone for end-stage cancer patients*2, psychiatric patients*3, and the handicapped*4.

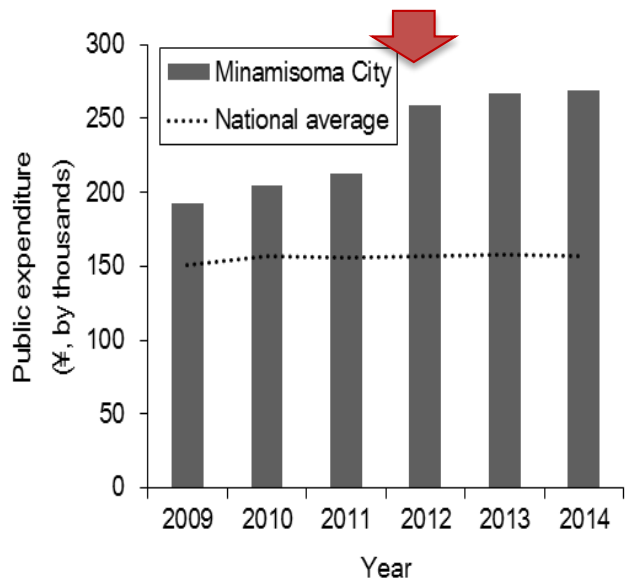
1. Ozaki, Tsubokura et al. BMC Cancer. 2017 Jun 19;17(1):423.
2. Ozaki, Tsubokura et al. Medicine (Baltimore). 2017 Nov;96(46):e8721.
3. Sonoda, Tsubokura et al. Case Rep Psychiatry. 2019 Apr 7;2019:3284153.
4. Sawano, Tsubokura et al. Medicine (Baltimore). 2019 Jul;98(27):e16162.

Changes in the accessibility of hospitals

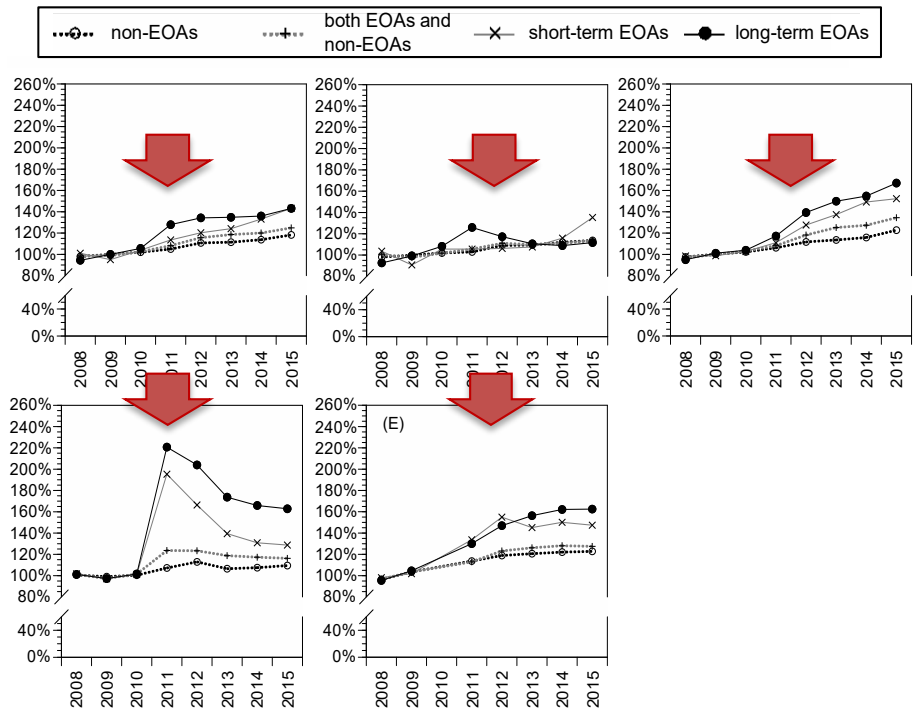
- Access to hemodialysis in rural areas is vulnerable to external factors in the long-term after a nuclear incident. *5
- In the Futaba region, total patient transport time increased by 22 minutes due to numerous hospital closures after the incident.*6
- In the Soma region, total patient transport time increased but returned to the normal level within 3 months after the incident. *7

5. Nishikawa, Tsubokura et al. Oxf Med Case Reports. 2018 Jul 19;2018(7):omy040.
6. Nishikawa, Tsubokura et al. BMJ Open. 2019 Feb 9;9(2):e023836.
7. Morita, Tsubokura et al. BMJ Open. 2016 Sep 28;6(9):e013205.

Increases in expenditure on healthcare per capita compared to before the Fukushima incident



The average public expenditure on nursing care per older person increased by 30%. (\$2,210 vs \$1,693)*1



Temporal changes in expenditure in four evacuation categories in Fukushima.*2
 (A) Total (B) Inpatient (C) Outpatient (D) Dental (E) Long-term care

Possible causes of increased costs

- Aging society and nuclear families due to evacuation of young people
 → Decrease in “informal care” *3
- Deterioration of physical function and increase in diseases requiring care *4
- Inducing demand associated with free medical and nursing care costs *5

1. Morita, Tsubokura et al. JECH 2016 Jul;70(7):738.
 2. Hasegawa, Tsubokura et al. Tohoku J Exp Med. 2019 Jun;248(2):115-123
 3. Sawano, Tsubokura et al. Medicine 2019 Jul;98(27):e16162
 4. Ishii, Tsubokura et al. Prev Med Rep. 2015 Oct 30;2:916-9.
 5. Morita et al. PlosOne 2019 Sep 25;14(9):e0218835.

Health disturbance among new residents from outside

- Many decontamination workers are in poor health, possibly associated with lower social capital.*1
- Legionellosis*2 and bee stings*3 among decontamination workers handling soil in unpopulated places.
- Tetanus caused by injuries during reconstruction work.*4

1. Sawano, Tsubokura et al. BMJ Open. 2016 Dec 14;6(12):e013885.
2. Sawano, Tsubokura et al. J Occup Health. 2018 May 25;60(3):271-274.
3. Ozaki, Tsubokura et al. Disaster Med Public Health Prep. 2017 Oct;11(5):545-551.
4. Morita, Tsubokura et al. Disaster Med Public Health Prep. 2014 Dec;8(6):467-8.

Stigmatization, prejudice, and media coverage

- School bullying of affected children and adolescents*5
- Dissemination of “fake” health information by stakeholders *6
- Monopoly of information within SNS media by a few influencers *7

5. Sawano, Tsubokura et al. J Radiat Res. 2018 May 1;59(3):381-384.
6. Sawano, Tsubokura et al. QJM. 2019 Jul 1;112(7):479-481.
7. Tsubokura et al. PLoS One. 2018 Sep 7;13(9):e0203594.

Countermeasures for the isolation of the elderly after the Fukushima disaster in Soma City

- Japan's public health interventions have historically been holistic, community-driven enterprises, involving multidisciplinary doctors, local governments, industries, and funders, cohesively working to meet the needs identified by local communities.



Community housing project called *Idobata-Nagaya*

- Communal living space with a shared laundry facility, a common room for meals, and where residents can check on each other's health and wellbeing.
- Consists of 5 buildings with 58 personal rooms.



Park named *Honebuto* (meaning 'bone-strength')

- Built in the center of public restoration housing for easy access.
- Consists of 3 pieces of exercise equipment for measuring body flexibility and 5 pieces of equipment for exercise.
- Specialized non-barrier disabled-access systems for elderly with a wheelchair or walking stick.

Summary

- There is a range of health risks in need of serious considerations after a nuclear power plant accident.
- The risk of death associated with the evacuation marked high during the first month after the disaster among residents of nursing homes.
- Medium and long-term problems emerged from a large-scale change in people's way of life such as social isolation, an aging population, loss of motivation in life, and conflicts among different generations.
- It is necessary to establish achievable tasks from the various problems and keep finding challenges that could be tackled with current manpower.