Foreign Press Center Press Briefing
FMU presentation 2016

Five years after the Fukushima Daiichi Nuclear power plant accident

Health consequences after the accident

Koichi Tanigawa

Fukushima Medical University

公立大学法人
福島県立医科大学
FUKUSHIMA MEDICAL UNIVERSITY

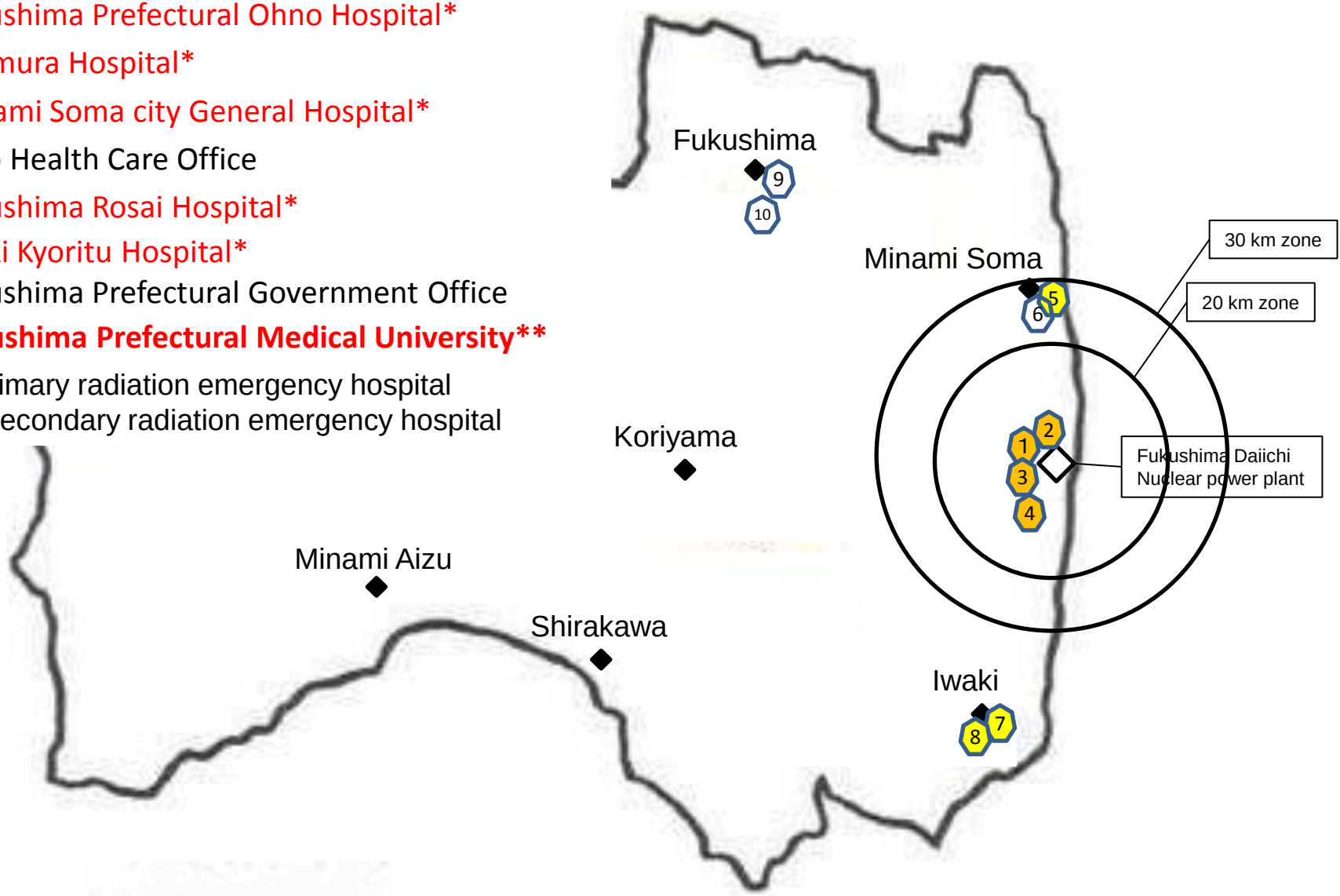
Today's Topics

1. Health consequences in the acute phase after the accident
2. Fukushima Health Management Survey and mid-term health consequences of the accident
3. Lessons learned in the Fukushima accident and the future roles of Fukushima Medical University

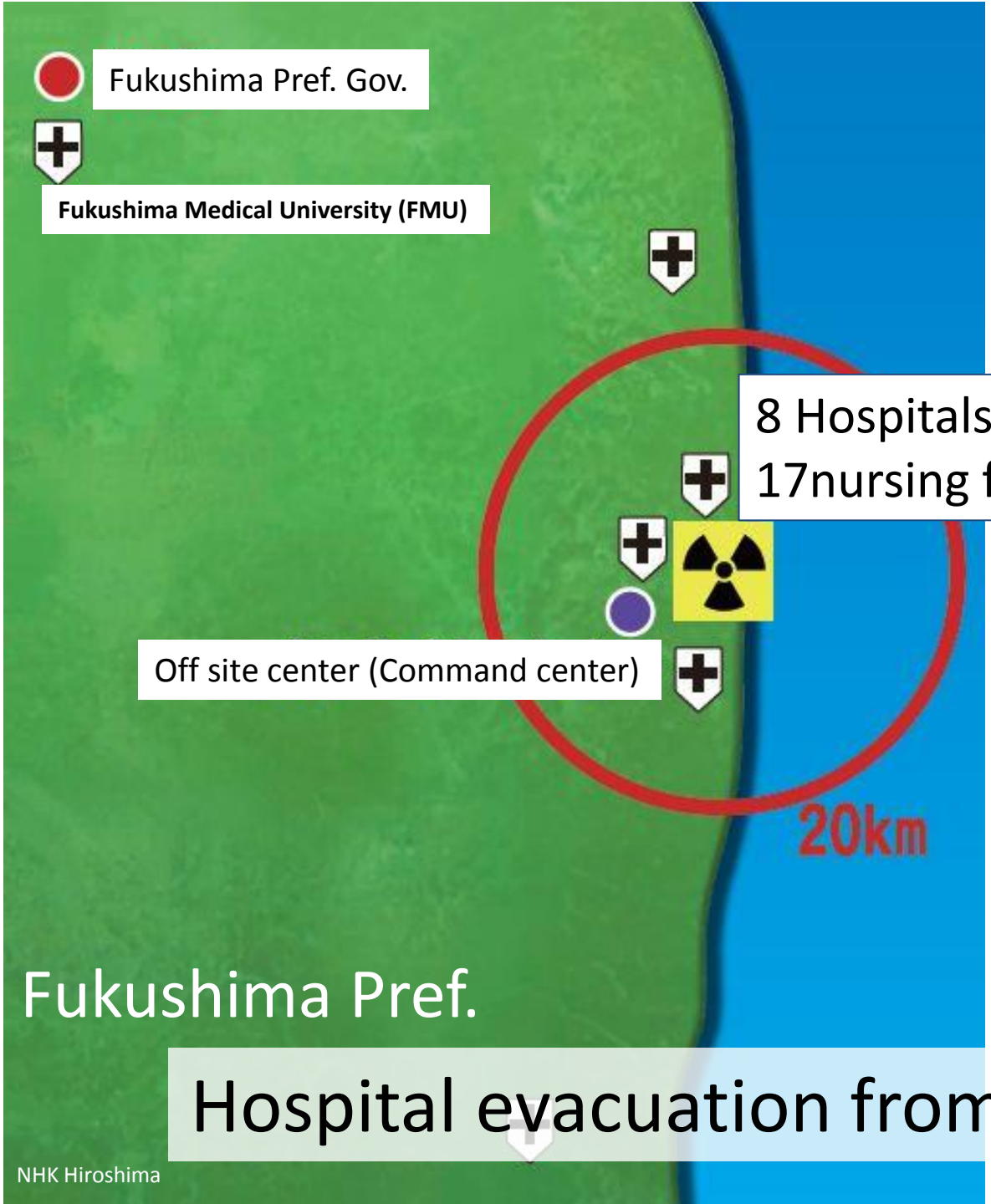
1. Health consequences in the acute phase after the accident

1 Fukushima Nuclear Disaster Management Center
2 Futaba Kosei Hospital*
3 Fukushima Prefectural Ohno Hospital*
4 Imamura Hospital*
5 Minami Soma city General Hospital*
6 Soso Health Care Office
7 Fukushima Rosai Hospital*
8 Iwaki Kyoritu Hospital*
9 Fukushima Prefectural Government Office
10 **Fukushima Prefectural Medical University****

* Primary radiation emergency hospital
** Secondary radiation emergency hospital



The radiation emergency hospitals in Fukushima before March 11th, 2011



Hospital evacuation from 20 km zone

NHK Hiroshima

Most of the patients hospitalized within 20 km zone were transported by SDF helicopters or charted buses to shelters in Fukushima Prefecture by March 15th.
However, no medical personnel attended during or after evacuation (no care, medicine, even water/food). Significant difficulties were encountered to find facilities to accept those patients. In addition, appropriate medical care was not available at shelters.

In the Fukushima Daiichi Nuclear Power Plant accident, what we have seen,

- Difficulties in reallocating patients forced them to stay in the confined space of the transporting vehicles for long hours without any care, even water and food.
- At least 50 patients died during or soon after evacuation. Suspected causes of deaths include deterioration of underlying medical problems, hypothermia and dehydration*.
- No significant contamination was found in the evacuated patients despite the fact that 48 hours had already passed since the first explosion. Ill-prepared evacuation increased the health risk of hospitalized patients or the elderly**.

* Tanigawa K, et al. Loss of life after evacuation: lessons learned from the Fukushima accident. Lancet 2012:379(10):889-891.

** Murakami M, et al. Was the Risk from Nursing-Home Evacuation after the Fukushima Accident Higher than the Radiation Risk? PLoS One. 2015 Sep 11;10(9):e0137906. doi: 10.1371/journal.pone.0137906.

Failure of Radiation Emergency Medical System

Fukushima Nuclear Disaster Management Center

(C-spine injury, susp)

(Fukushima Medical U.)

(Fx of the clavicle, scaple)

(Dislocation of shoulder J)

(Contusion of the thigh)

(Laceration of the thigh)

(National Institute of Radiological Sciences)

(Plant clinics at Fukushima Daini NPP)

(Contusion of the ankle)

(Contusion of the chest and abdomen)

(Contusion of the back)

(Contusion of the back and abdomen)

(Contusion of the back, ankle)

Date	Injury	Severity	Triage	Contamination	Cause	Methods of transportation	Received hospitals
March 11th	fracture of lower extremities	severe	not done	no	earthquake	ambulance	hospital in Koriyama
	laceration on head	minor	not done	no	earthquake	facility vehicle	Ono Hospital (designated hospital)
March 12th	subarachnoid hemorrhage	severe	not done	no		facility vehicle	hospital in Koriyama
	open fracture of the femur	moderate	not done	no	explosion	facility vehicle	initially treated at a clinic (non-designated facility) and transferred to a hospital in Koriyama
	contusion of lower extremity	minor	not done	no	explosion	facility vehicle	treated at a clinic (non-designated facility)
	contusion of upper extremity	minor	not done	no	explosion	facility vehicle	treated at a clinic (non-designated facility)
	contusion	minor	not done	no	explosion	facility vehicle	treated at a clinic (non-designated facility)
	severe tinnitus	minor	not done	no	explosion	facility vehicle	treated at a clinic (non-designated facility)
	headache, nausea	minor	not done	no		facility vehicle	treated at OFC
March 14th	fracture of clavicle, scapula	moderate	done at OFC	yes	explosion	ambulance	FMU
	dislocation of shoulder joint	moderate	done at OFC	no	explosion	SDF vehicle	treated at OFC
	laceration of thigh	moderate	done at OFC	no	explosion	SDF helicoptor	NIRS
	contusion on thigh	minor	done at OFC	no	explosion	SDF vehicle	treated at OFC
	laceration of foot	moderate	not done	yes	explosion	facility vehicle	initially treated at Fukushima No2 NPP, transferred to FMU on March 15th
	laceration of foot	moderate	not done	yes	explosion	facility vehicle	initially treated at Fukushima No2 NPP, transferred to FMU on March 15th
	contusion on chest	minor	not done	yes	explosion	facility vehicle/SDF helicoptor	initially treated at Fukushima No2 NPP, transferred to FMU on March 16th
	contusion on chest, upper extremity	minor	not done	no	explosion	facility vehicle	initially treated at Fukushima No2 NPP, transferred to FMU on March 15th
	contusion on foot	minor	not done	no	explosion	facility vehicle	treated at Fukushima No2 NPP
	contusion on elbow	minor	not done	no	explosion	facility vehicle	treated at Fukushima No2 NPP
	contusion on upper extremity	minor	not done	no	explosion	facility vehicle	treated at Fukushima No2 NPP

SDF, Self Defense Force; FMU, Fukushima Medical University; OFC, off-site center; NIRS, National Institute for Radiological Sciences; NPP, nuclear power plant

Injuries caused by the earthquake and explosions (March 11-14, 2011)

Tanigawa K, Hasegawa A. Medical Perspective: 3.1 prehospital emergency medical response. In: Tanigawa K, Chhem RK, eds. Radiation disaster medicine: perspective from the Fukushima nuclear accident. New York: Springer, 2013: 30–57.

As for emergency medical response to the explosion,

- Marked difficulties were observed in finding hospitals to provide care for injured workers with or without contamination.
- Fortunately, non of them suffered life-threatening injuries. However, collapse of the Radiation Emergency Medical System may have resulted in preventable death for those with severe trauma.

Tanigawa K, Hasegawa A. Medical Perspective: 3・1 prehospital emergency medical response. In: Tanigawa K, Chhem RK, eds. Radiation disaster medicine: perspective from the Fukushima nuclear accident. New York: Springer, 2013: 30–57.

Psychological consequences for disaster workers

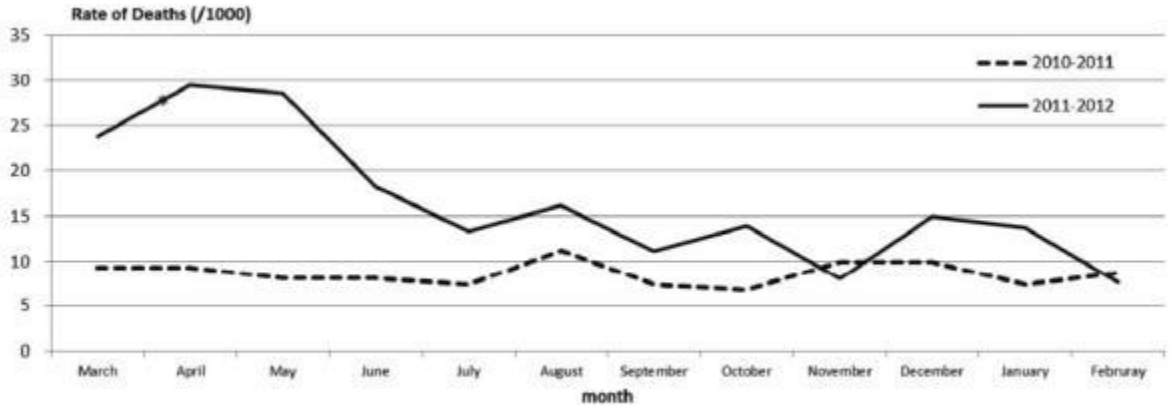
- Following the Fukushima accident, TEPCO workers came under public criticism. Those workers were stigmatized and discriminated against.
- In a study conducted 2–3 months after the disaster, TEPCO workers who had suffered discrimination or slurs were two to three times more likely to have adverse psychological consequences than those without such exposure.
- A follow-up study showed both immediate and long-lasting psychological effects of discrimination.

Hasegawa A, Tanigawa K, Ohtsuru A, et al. Health effects of radiation and other health problems in the aftermath of nuclear accidents, with an emphasis on Fukushima. Lancet. 2015 Aug 1;386(9992):479-88. doi: 10.1016/S0140-6736(15)61106-0.

Disaster-related Death

- According to the report on disaster related death (DRD*) in the Great East Japan Earthquake issued by the Reconstruction Agency of Japan (2012), 2,688 people died at shelters or temporary houses by 31 March 2013; these were DRDs. About 90% of DRDs were over 66 years old, and more than one third died within 1 month after the earthquake.
- The number of deaths among three Tohoku prefectures was the highest in Fukushima (1914 deaths).

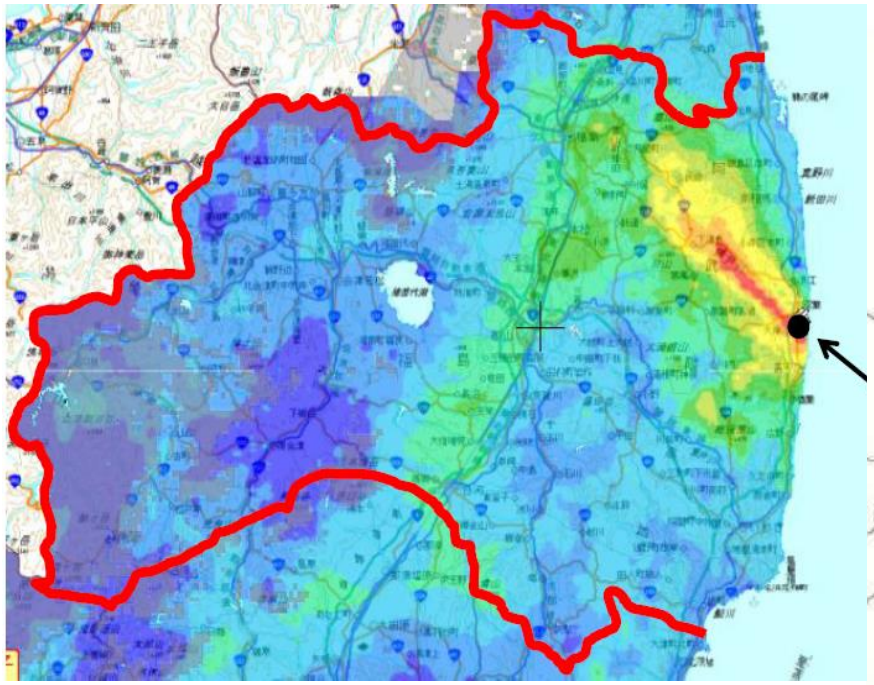
  * DRD is defined as a death caused by the deterioration of underlying medical problems due to poor medical access or illnesses arising from poor living environments, such as temporary shelters, in a disaster.

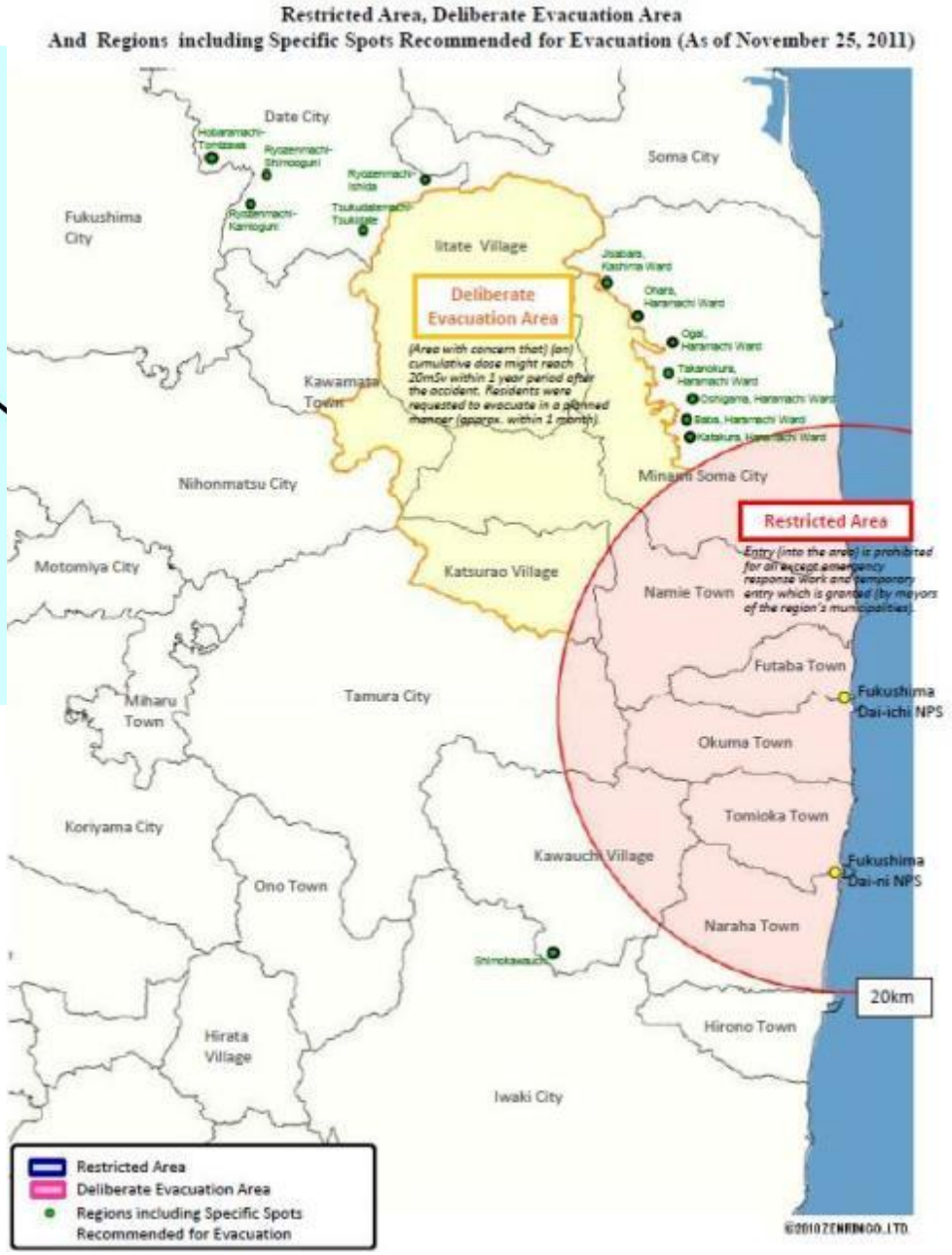


Changes of mortality rates among the institutionalized elderly before and after the Fukushima NPP accident.

Comparison of mortality rates among institutionalized elderly between 2010 and 2011

Yasumura S, et al. Excess mortality among relocated institutionalized elderly after the Fukushima nuclear disaster. Public Health, 2013, 127:2:186 – 188.





- Population of Fukushima prefecture at the time of the accident:
  2,055,325 residents
- Number of evacuees:
  164,845 residents including voluntary evacuation (approx. 20,000) as of May, 2011

2. Fukushima Health Management Survey and mid-term health consequences of the accident

Fukushima Health Management Survey, May 2011

Objectives:

- To monitor long-term health condition of resident in Fukushima and to promote their health
- To investigate whether a long-term low-dose radiation exposure has an effect on their health

Contents:

1. Basic survey (subjects: 2 million all resident in Fukushima)
2. Detailed surveys
    - Thyroid Ultrasound Examination (370,000; 0-18 y/o)
    - Comprehensive Health Check (210,000 ; designated areas)
    - Mental Health and Lifestyle Survey (210,000 ; designated areas)
    - Pregnancy and Birth Survey(16,000)

Yasumura S, Hosoya M, Yamashita S, et al, and the Fukushima Health Management Survey Group. Study protocol for the Fukushima Health Management Survey. *J Epidemiol* 2012;**22:** 375–83.

Fukushima Health Management (FHM) Survey

External Exposure Estimation

Basic Survey

Subjects: Residents (2 million) as of March 11, 2011
Method: Self-administered questionnaire survey
Content: Details of whereabouts and daily routine from March 11 onwards to estimate exposure.

Follow-ups

'Health Management File'

☆To keep health checkup records
☆To provide information on radiation

Database

◆ To provide long-term monitoring of residents' health
◆ To guide treatment
◆To inform and guide future generations

- Whole Body Counter
- Dosimeter

Health Status Assessment

Detailed Surveys

Thyroid Ultrasound Examination

Subjects: Residents aged 18 years or younger
Content: Ultrasound examination Survey period: Three years

Comprehensive Health Check

Subjects: Residents in evacuation zones
Content: General health checkup items with differential leukocyte count

Subjects: Residents outside evacuation zones
Content: General health checkup items

Promotion of municipal and workplace health checkups

Additional health checkups
to reach residents not included in current services

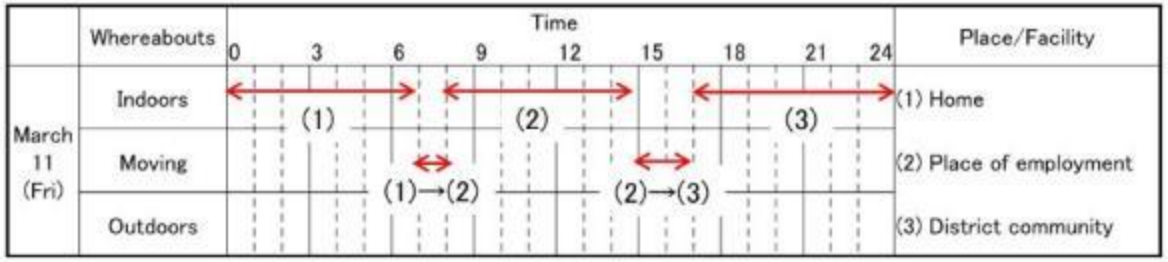
Mental Health and Lifestyle Survey

Pregnancy and Birth Survey

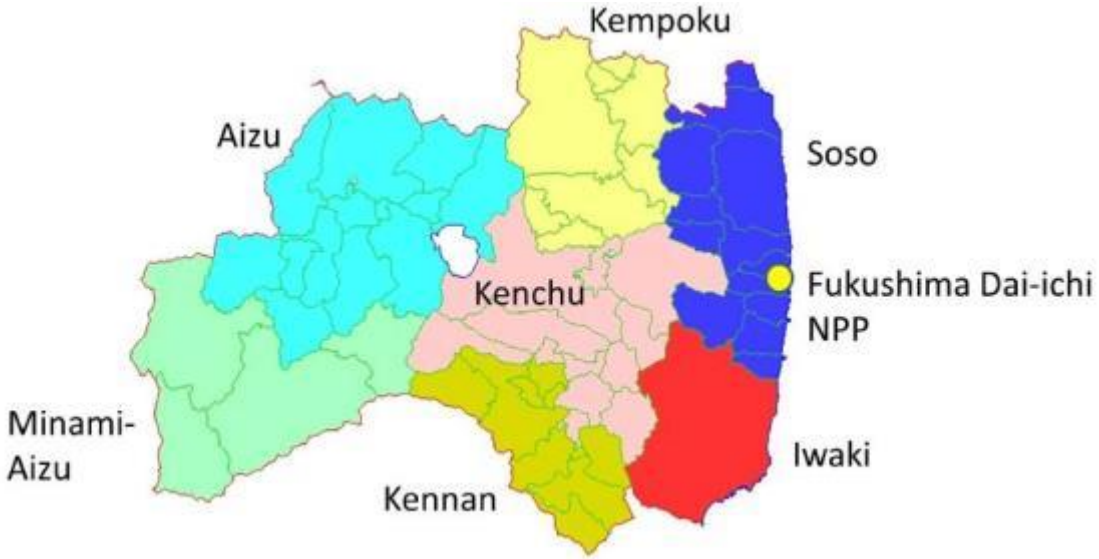
Consultation and support Follow-up Treatment

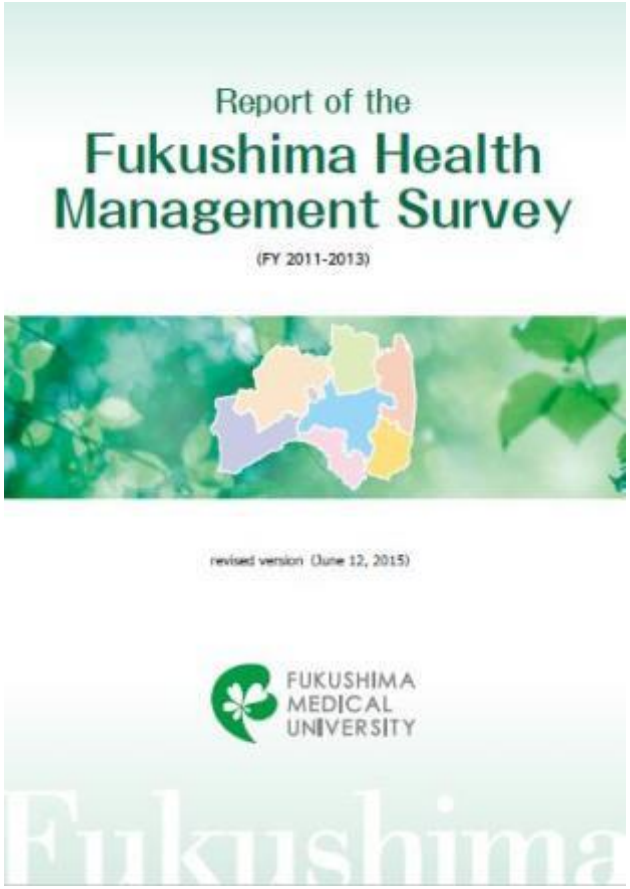
Curtesy of Prof. Seiji Yasumura

Basic Survey



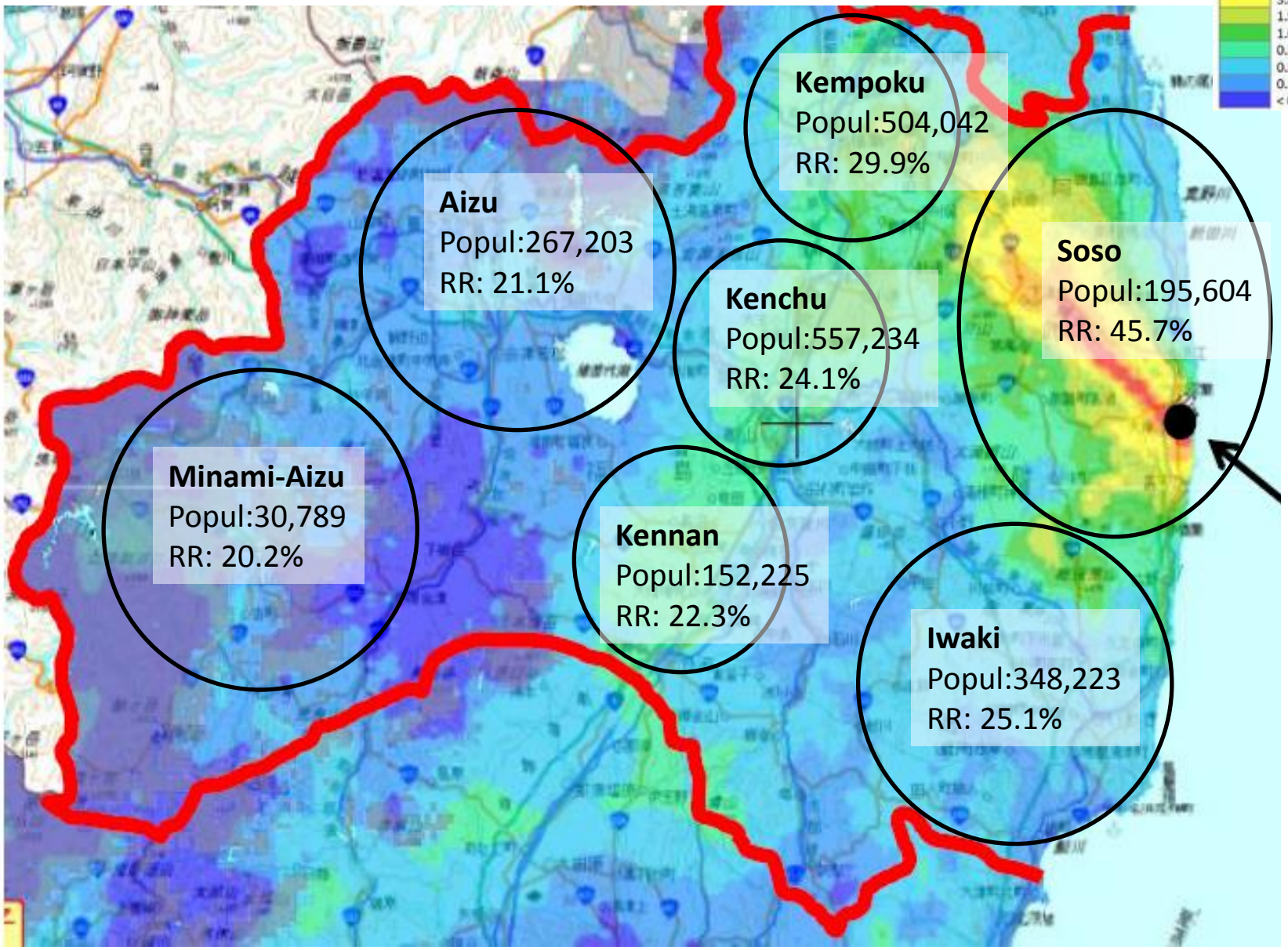
An example form for writing records of moves and activities in the Basic Survey questionnaire





http://fmu-global.jp/?wpdmdl=1032

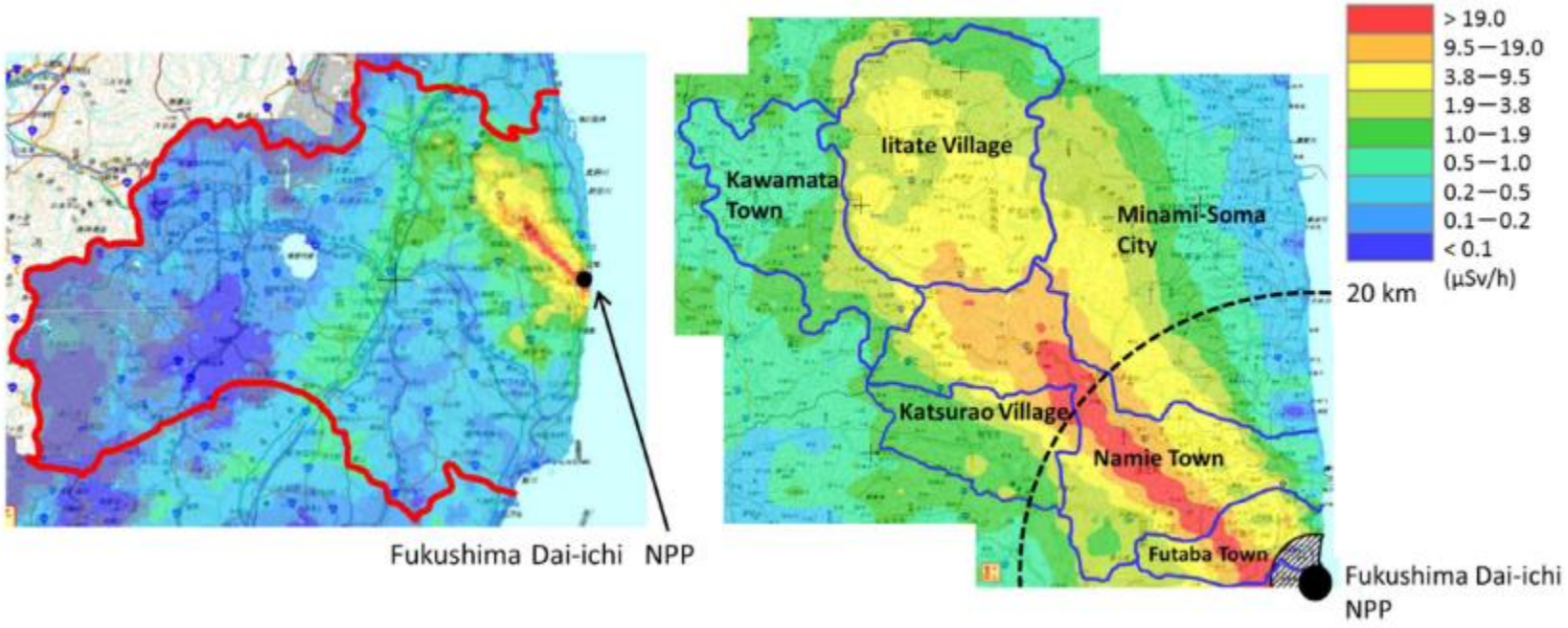
Basic survey response rates (March 31, 2015)



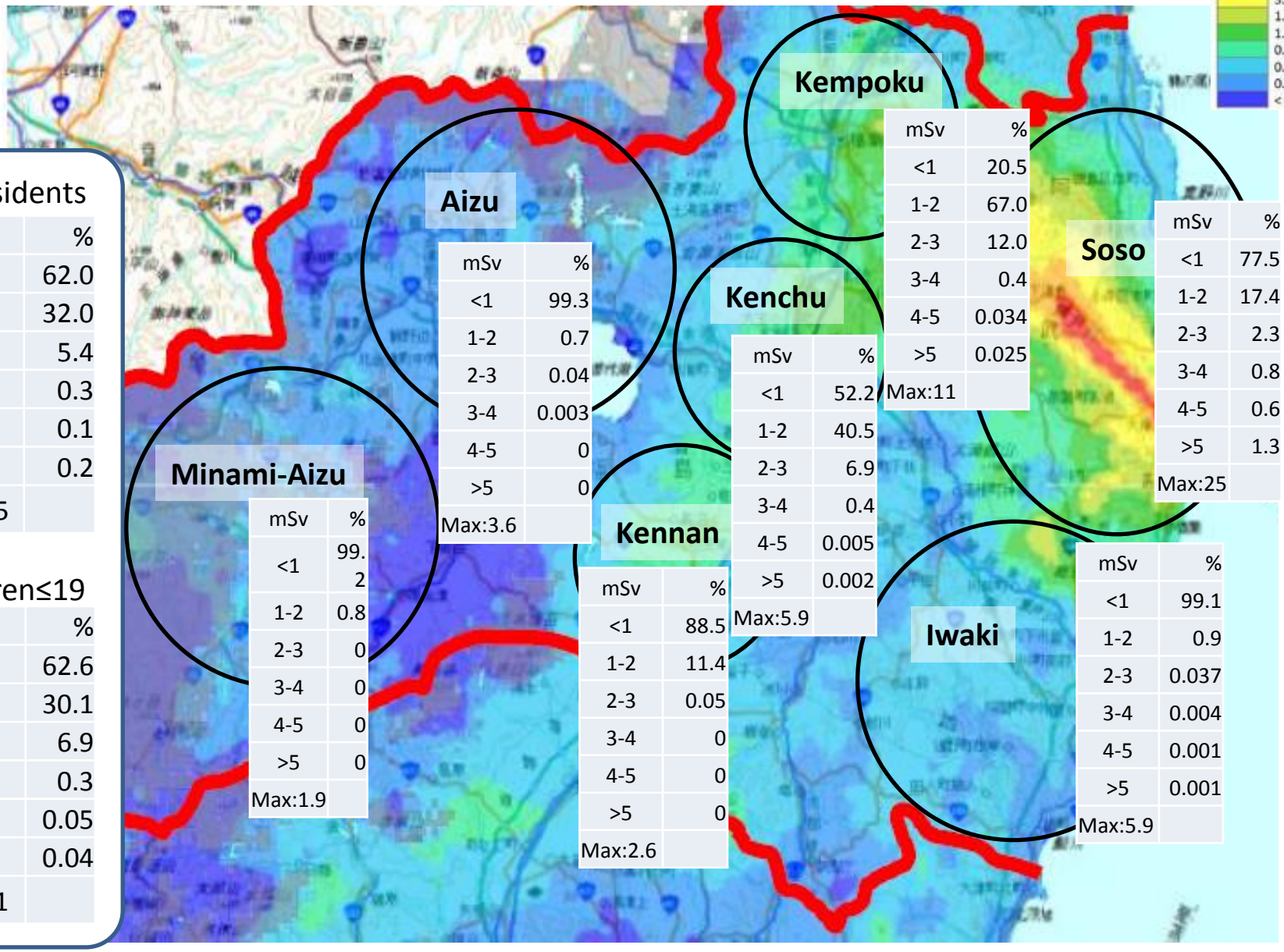
Sci Rep. 2015 Aug 4;5:12712. doi: 10.1038/srep12712.

The Fukushima Health Management Survey: estimation of external doses to residents in Fukushima Prefecture.

Ishikawa T, Yasumura S, Ozasa K, Kobashi G, Yasuda H, Miyazaki M, Akahane K, Yonai S, Ohtsuru A, Sakai A, Sakata R, Kamiya K, Abe M.



Estimated effective dose in each area



All residents

mSv	%
<1	62.0
1-2	32.0
2-3	5.4
3-4	0.3
4-5	0.1
>5	0.2
Max:25	

Children≤19

mSv	%
<1	62.6
1-2	30.1
2-3	6.9
3-4	0.3
4-5	0.05
>5	0.04
Max:11	

Aizu

mSv	%
<1	99.3
1-2	0.7
2-3	0.04
3-4	0.003
4-5	0
>5	0
Max:3.6	

Kempoku

mSv	%
<1	20.5
1-2	67.0
2-3	12.0
3-4	0.4
4-5	0.034
>5	0.025
Max:11	

Soso

mSv	%
<1	77.5
1-2	17.4
2-3	2.3
3-4	0.8
4-5	0.6
>5	1.3
Max:25	

Kenchu

mSv	%
<1	52.2
1-2	40.5
2-3	6.9
3-4	0.4
4-5	0.005
>5	0.002
Max:5.9	

Minami-Aizu

mSv	%
<1	99.2
1-2	0.8
2-3	0
3-4	0
4-5	0
>5	0
Max:1.9	

Kennan

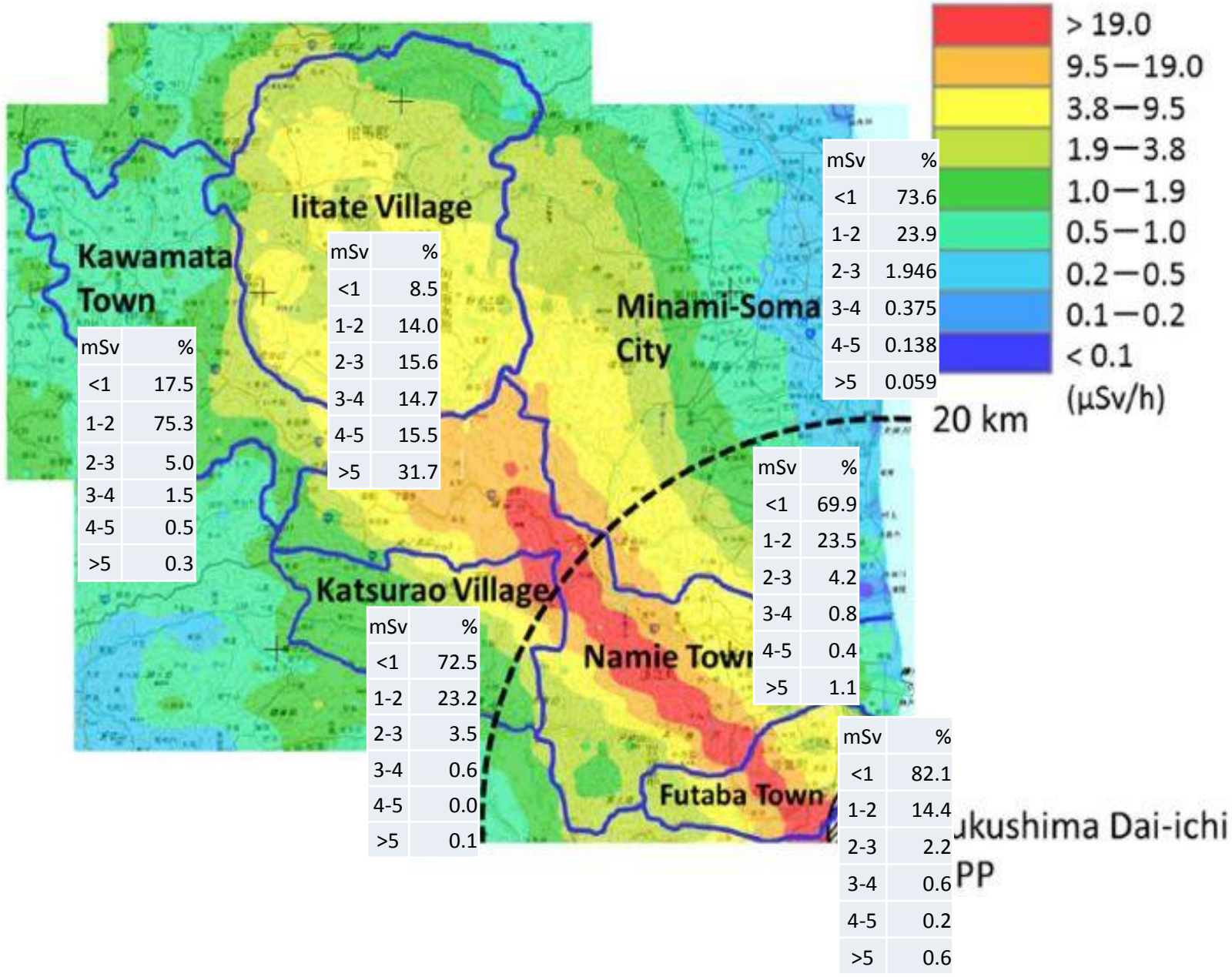
mSv	%
<1	88.5
1-2	11.4
2-3	0.05
3-4	0
4-5	0
>5	0
Max:2.6	

Iwaki

mSv	%
<1	99.1
1-2	0.9
2-3	0.037
3-4	0.004
4-5	0.001
>5	0.001
Max:5.9	

Ishikawa T, et al. The Fukushima Health Management Survey: estimation of external doses to residents in Fukushima Prefecture. Sci Rep. 2015 Aug 4;5:12712. doi: 10.1038/srep12712.

Estimated effective dose in Soso area



mSv	%
<1	17.5
1-2	75.3
2-3	5.0
3-4	1.5
4-5	0.5
>5	0.3

mSv	%
<1	8.5
1-2	14.0
2-3	15.6
3-4	14.7
4-5	15.5
>5	31.7

mSv	%
<1	73.6
1-2	23.9
2-3	1.946
3-4	0.375
4-5	0.138
>5	0.059

mSv	%
<1	69.9
1-2	23.5
2-3	4.2
3-4	0.8
4-5	0.4
>5	1.1

mSv	%
<1	72.5
1-2	23.2
2-3	3.5
3-4	0.6
4-5	0.0
>5	0.1

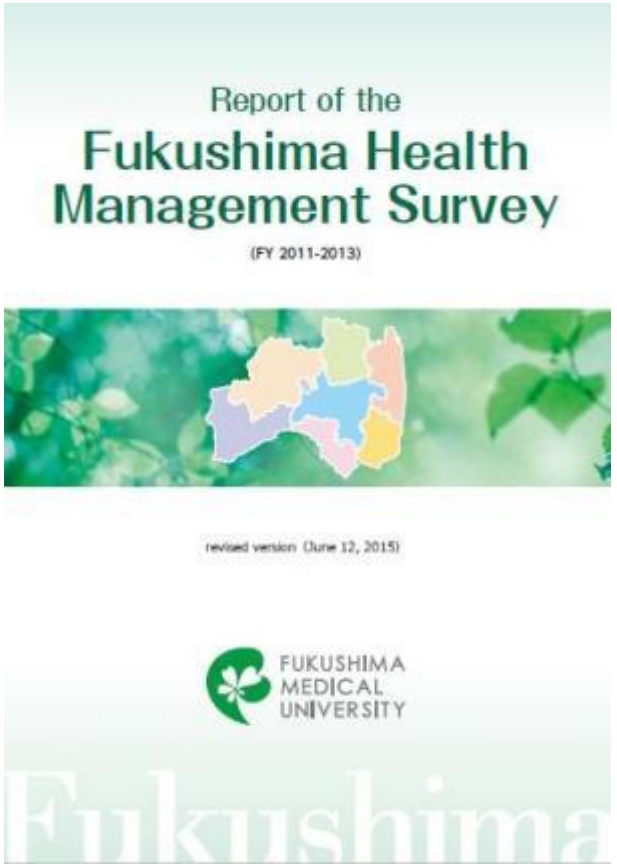
mSv	%
<1	82.1
1-2	14.4
2-3	2.2
3-4	0.6
4-5	0.2
>5	0.6

Summary of Basic Survey

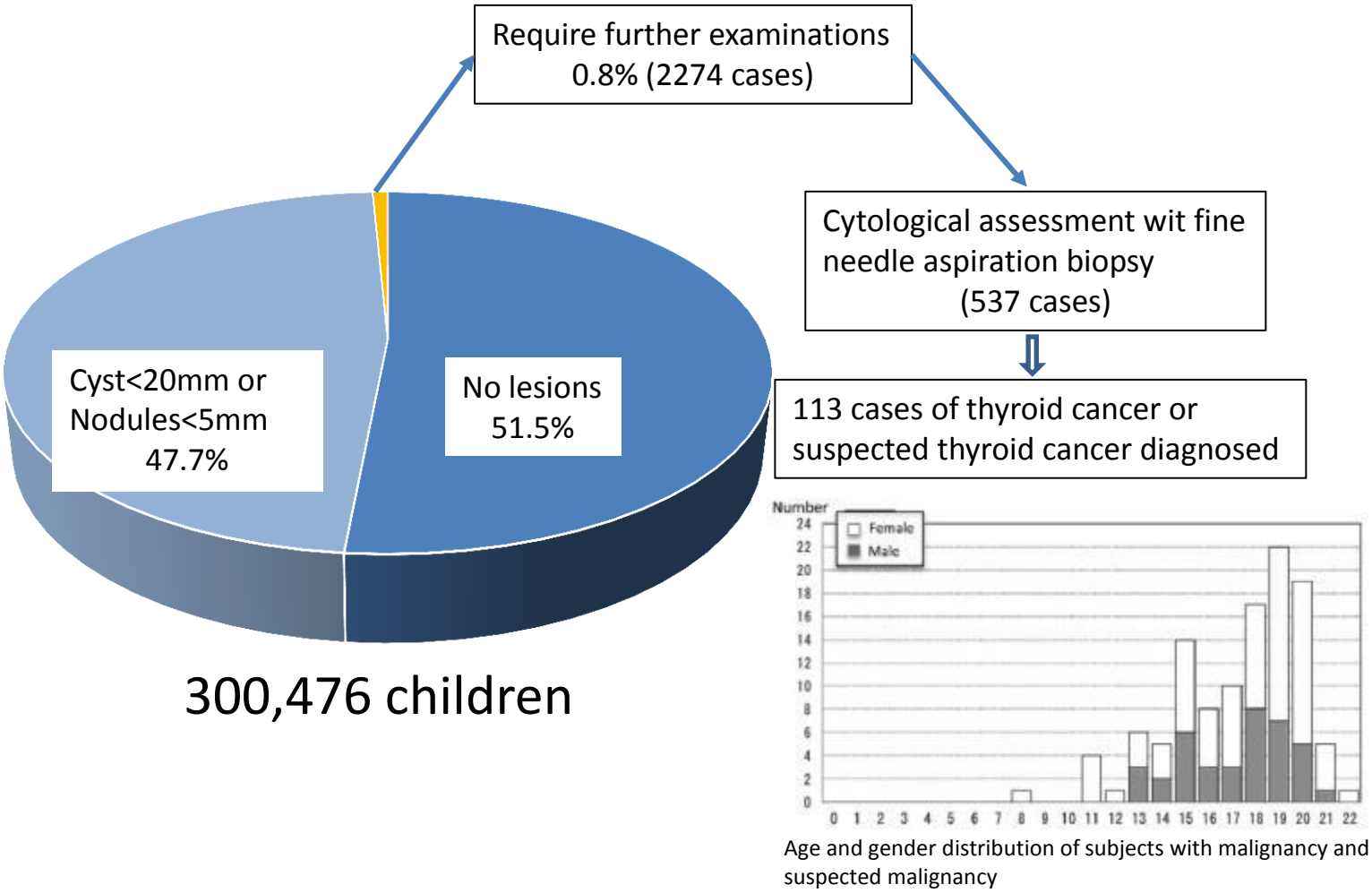
- While most of the previous dose estimation studies were based on typical scenarios of evacuation and time spent inside/outside, the Basic Survey estimated doses considering individually different personal behaviors. Thus, doses for some individuals who did not follow typical scenarios could be revealed.
- Even considering such extreme cases, the estimated external doses were generally low and no discernible increased incidence of radiation-related health effects is expected.

Ishikawa T, et al. The Fukushima Health Management Survey: estimation of external doses to residents in Fukushima Prefecture. Sci Rep. 2015 Aug 4;5:12712. doi: 10.1038/srep12712.

Thyroid Ultrasound Examination



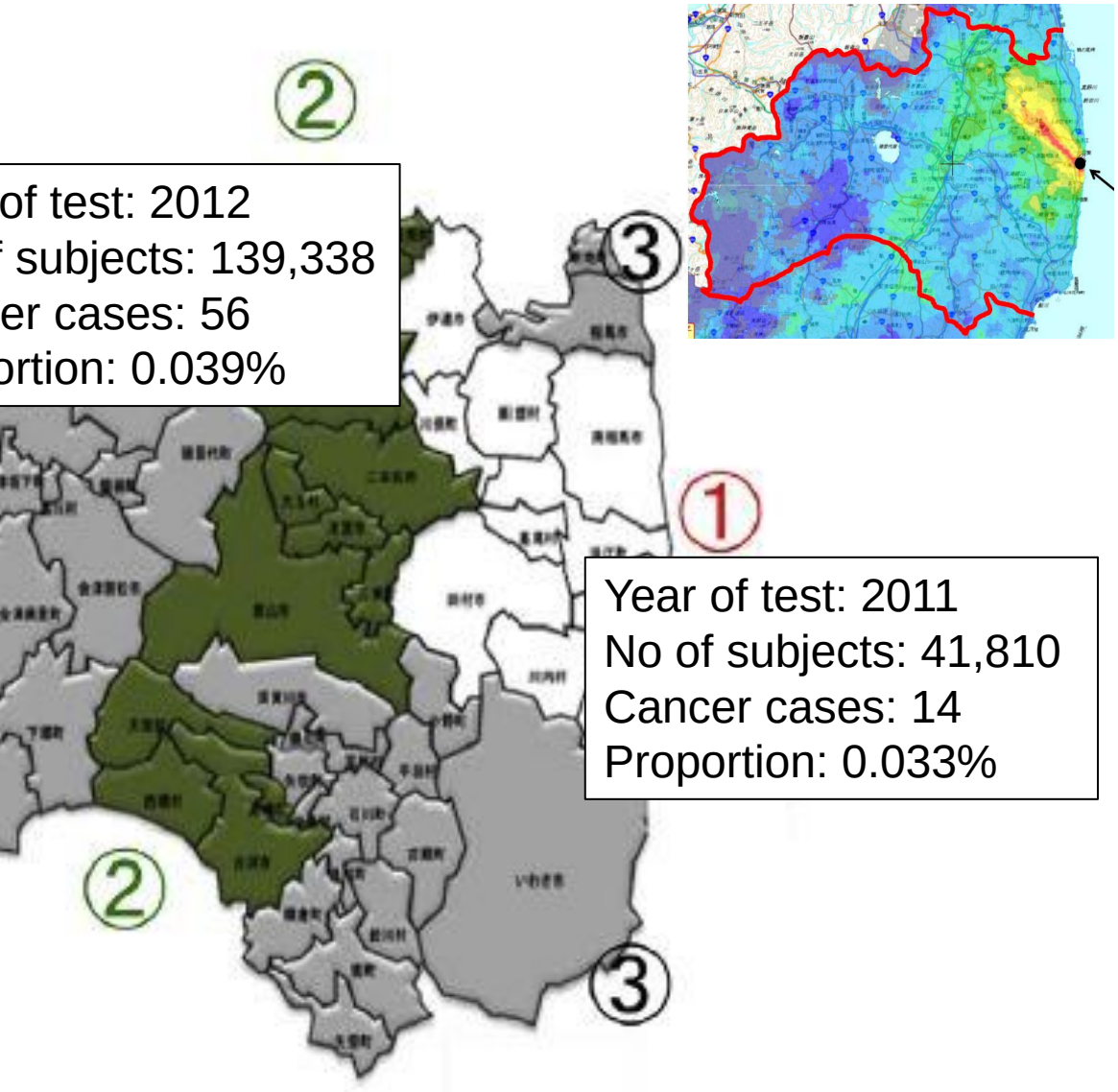
http://fmu-global.jp/?wpdmdl=1032



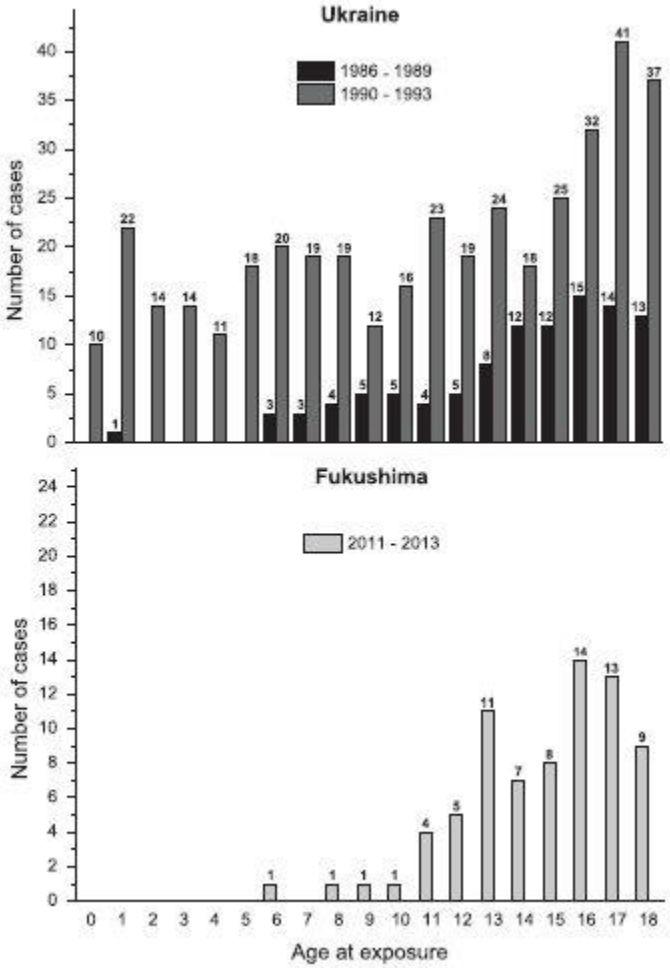
Age and gender distribution of subjects with malignancy and suspected malignancy

Results of the first round Thyroid Ultrasound Examination during the first 4 years after the accident

Suzuki S. Childhood and adolescent thyroid cancer in Fukushima after the Fukushima Daiichi Nuclear power plant accident: 5 Years On. Clin Oncol. 2016 in press.

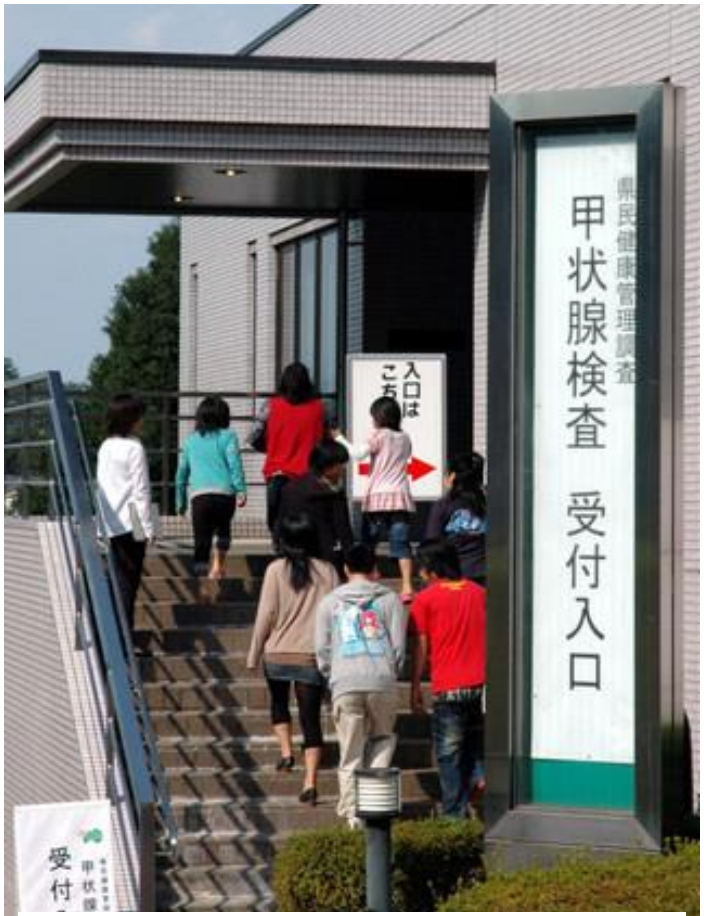


Prevalence of thyroid cancer of suspected cancer in 3 main regions



Distribution of thyroid cancer patients by age at exposure diagnosed during the period of latency (1986–1989) and after it (1990–1993) in Ukraine, and patients with verified or suspicious thyroid cancer in Fukushima diagnosed during 2011–2013. Numbers above the bars correspond to the number of patients of a given age at exposure. Note that comparison of the absolute number of cases between the two regions of radiological accidents would be inappropriate because of differences in population size and screening protocols, in particular a more systematic approach, higher population coverage, and advanced ultrasound equipment in Fukushima.

Tronko MD, et al. Age distribution of childhood thyroid cancer patients in Ukraine after Chernobyl and in Fukushima after the TEPCO-Fukushima Daiichi NPP accident. Thyroid. 2014 Oct;24(10):1547-8.



Venue of thyroid ultrasound examination

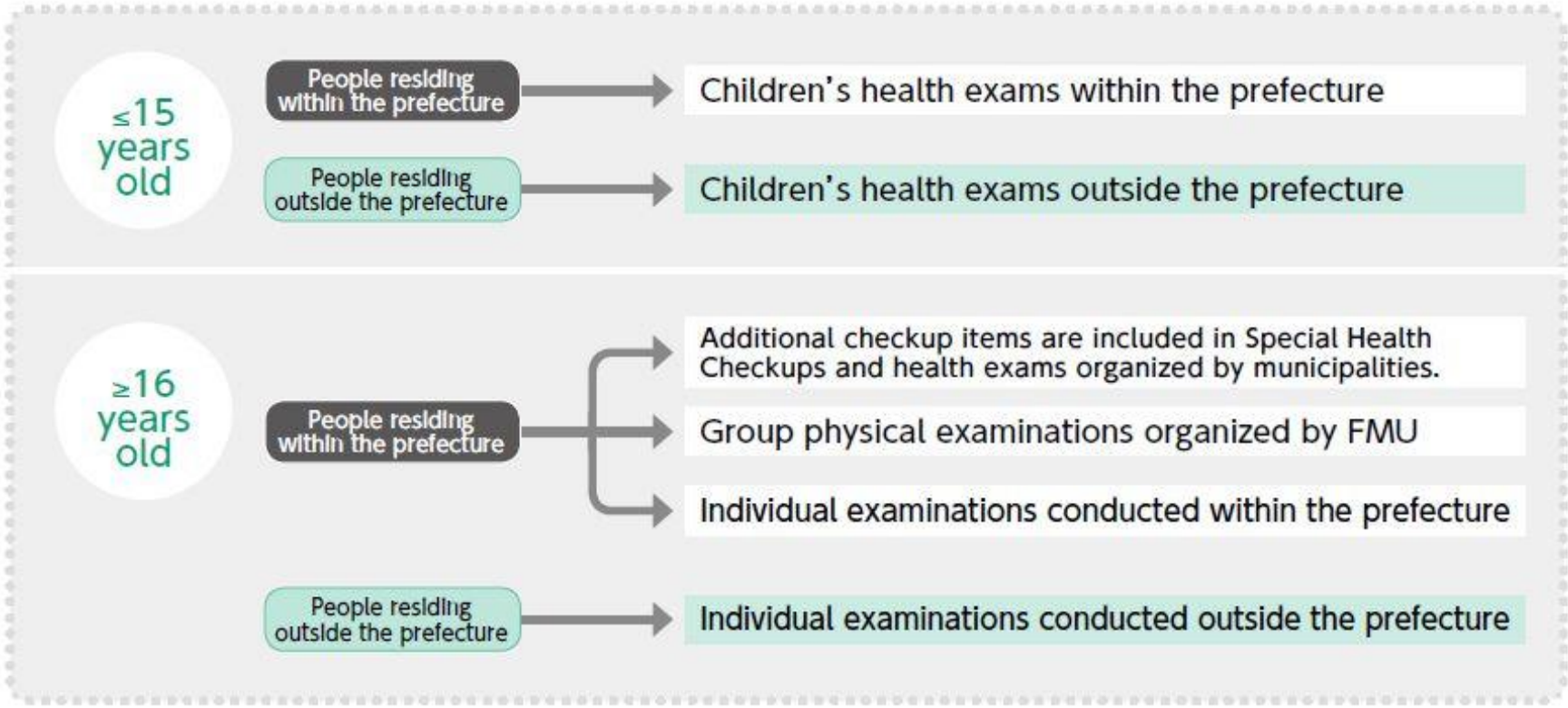
Difficulties of risk communication arose in the thyroid screening program of the Fukushima Health Management Survey, which was initially expected to reduce excessive anxiety. Contrary to expectation, screening results caused unnecessary concerns among people who were examined. In addition, the apparent increase in thyroid cancer prevalence that results from screening has caused public anxiety about the health effects of radiation.

Ohtsuru A, et al. Nuclear disasters and health: lessons learned, challenges, and proposal. Lancet 2015; 386: 489-97.

Summary of Thyroid Ultrasound Examination

- Radiation doses in Fukushima were extremely low and most of the target population for the thyroid examination received doses below 1 mSv. In addition, the youngest age group (0-5 years) at the time of the accident has shown no occurrence of cancer to date. Further, the latency for radiation induced thyroid cancer is 4-5 years; only 4 years have passed since the accident.
- Because above mentioned reasons, the thyroid cancers identified in this survey so far are unlikely to be due to radiation exposure, and are more likely to be the result of screening using highly sophisticated ultrasound techniques.
- While attention should be given to the bias of screening effects and possibility of over-treatment, proper communication is imperative to support individual autonomous decision making on the basis of sound scientific knowledge and appropriate risk perception about thyroid cancer and radiation exposure.

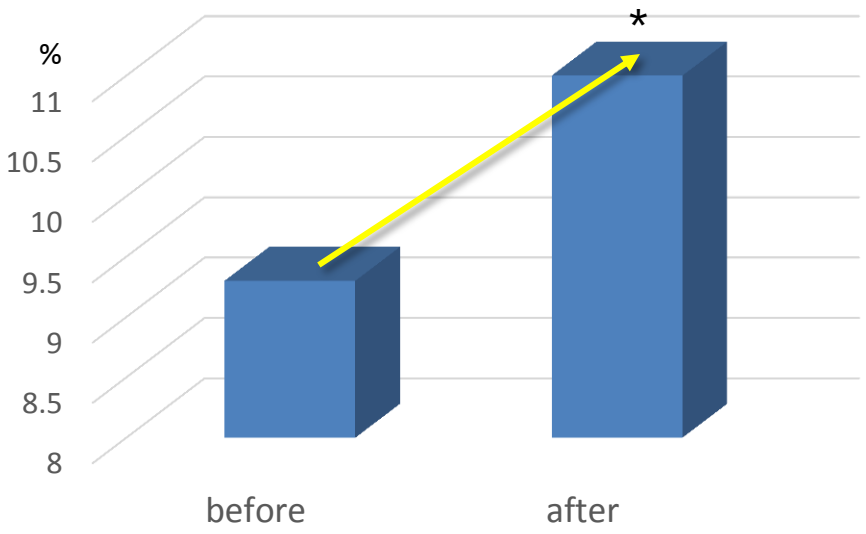
Comprehensive Health Check



Changes in the results of Comprehensive Health Check

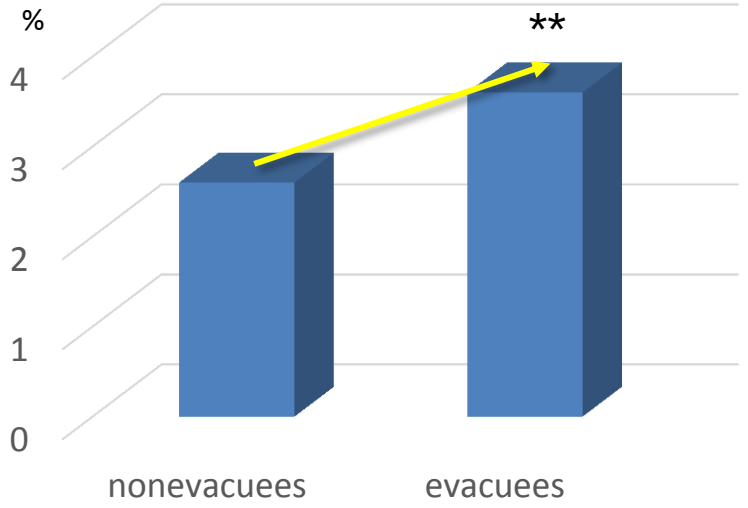
	Obesity* (BMI ≥25 kg/m2)		Impaired glucose tolerance** (HbA1c ≥6.5%)		Hepatic dysfunction*** (ALT of ≥51 U/L)		Hypertension (Diastolic pressure of ≥90 mmHg)	
	Male	Female	Male	Female	Male	Female	Male	Female
FY 2008	30%	31%	4.1%	2.9%	4.3%	1.8%	16.4%	11.6%
FY 2009	30%	30%	4.5%	2.8%	4.0%	1.8%	15.4%	9.6%
FY 2010	30%	28%	4.4%	2.7%	3.8%	1.7%	15.7%	10.3%
FY 2011	42%	34%	7.0%	3.4%	11.0%	4.4%	19.7%	11.6%
FY 2012	38%	33%	5.1%	2.7%	7.7%	3.9%	15.8%	10.1%

http://fmu-global.jp/?wpdmdl=1032



Changes in the prevalence of diabetes before and after the disaster

*p<0.0001



Incidence of diabetes in non-diabetic group evacuees and nonevacuees after the disaster

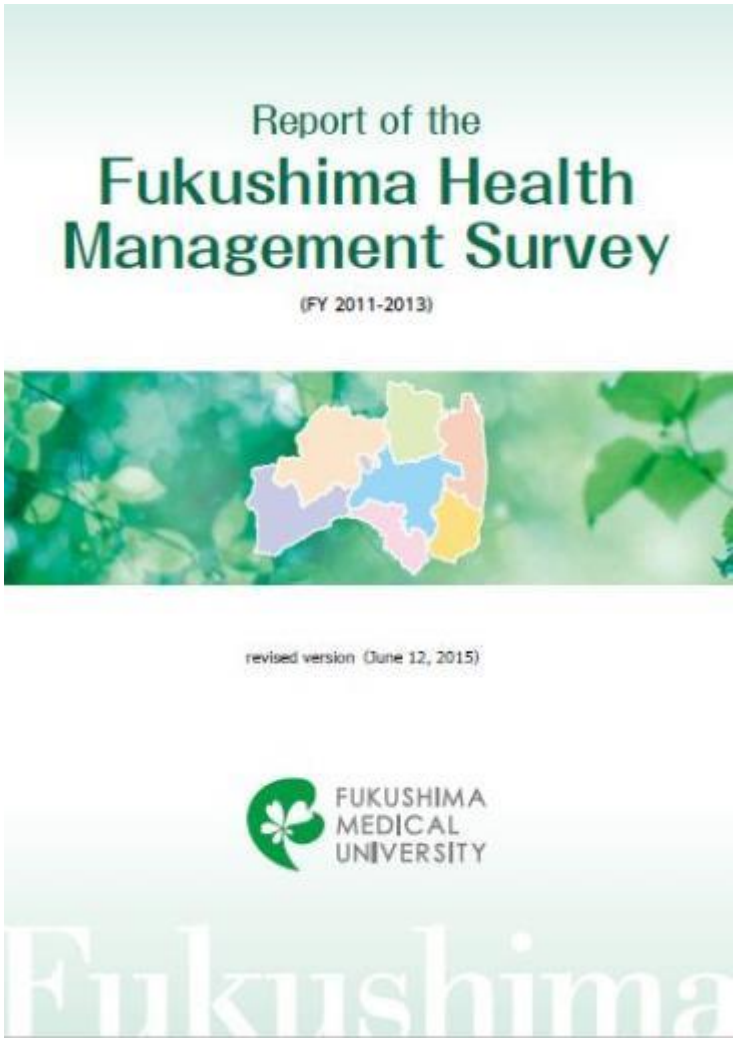
**p=0.0002

Satoh H, at al. Evacuation after the Fukushima Daiichi Nuclear Power Plant Accident Is a Cause of Diabetes: Results from the Fukushima Health Management Survey. J Diabetes Res.2015;2015:627390. doi: 10.1155/2015/627390.

Summary of Comprehensive Health Check

- After the disaster, the prevalence of diabetes increased significantly, and we observed that the incidence of diabetes was significantly greater among evacuees than among nonevacuees.
- Multivariate logistic regression analysis revealed that evacuation was significantly associated with the incidence of diabetes.
- Evacuation (relocation) is associated with the incidence of diabetes and other health risks.

Mental Health and Lifestyle Survey

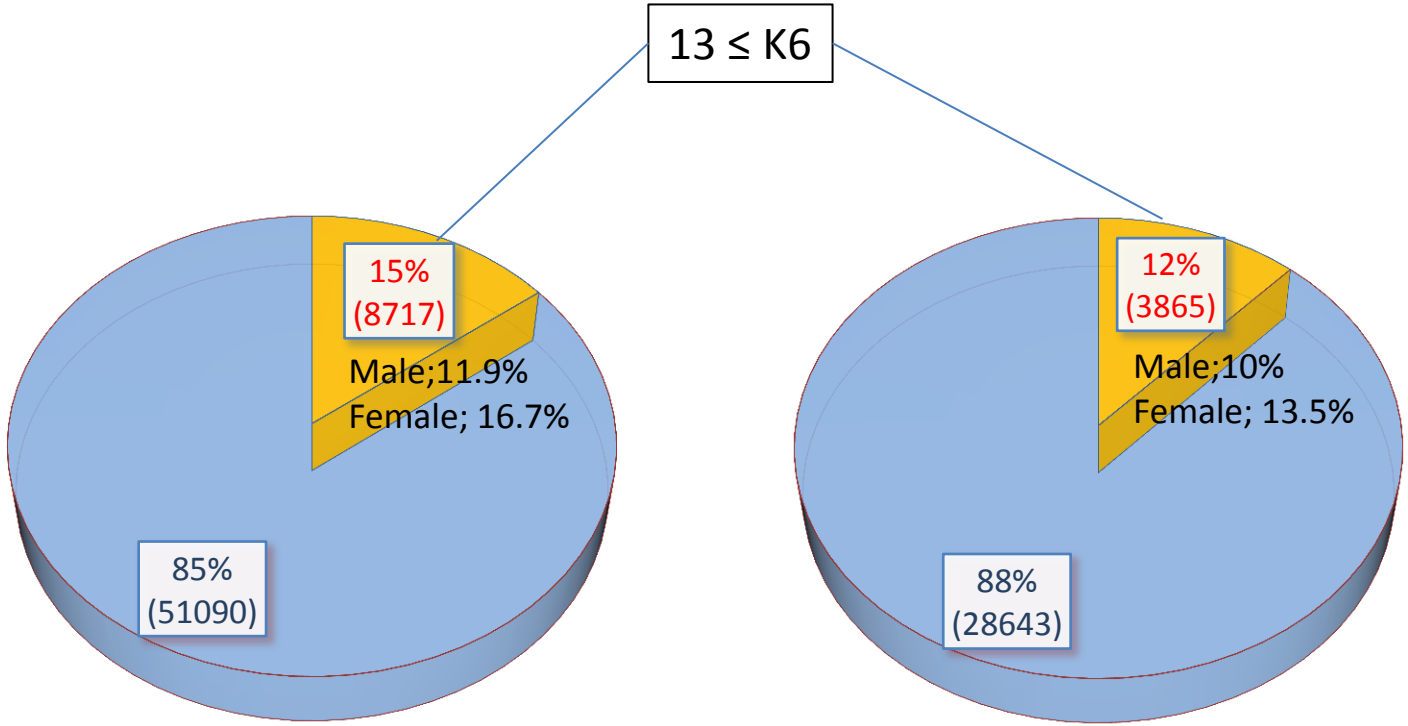


http://fmu-global.jp/?wpdmdl=1032

Features of psychological impact on the Fukushima people after the accident

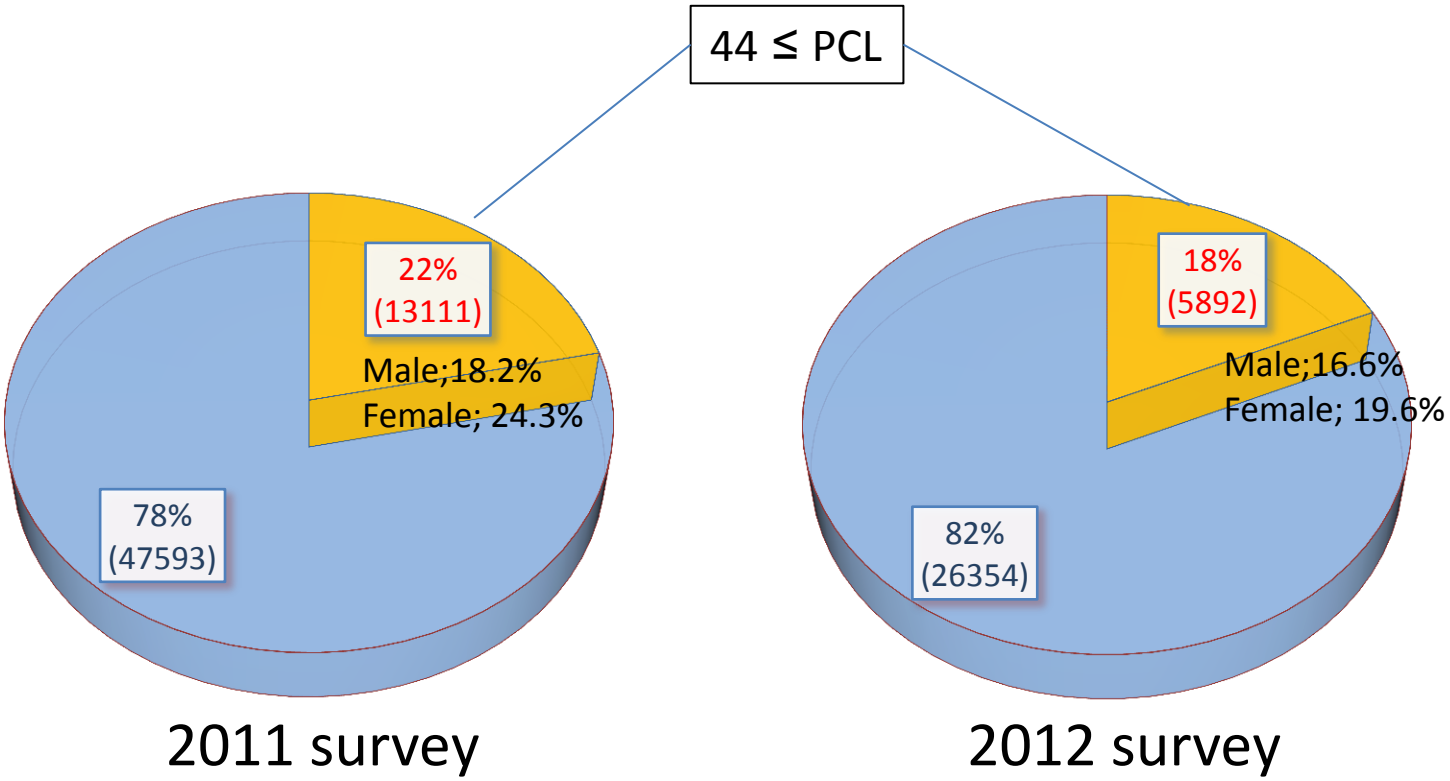
Psychological impact	Features
Post-traumatic stress responses	Traumatic memories of plant explosion and evacuation Hyper arousal Re-experiencing symptoms
Chronic anxiety and guilt	Fear of radioactive exposure, especially in the case of parents with young children Negative influence on children's development Guilt about abandoning friends and neighbours
Ambiguous loss experience	Loss of home through evacuation rather than damage Uncertainty of nuclear accident evacuees about returning home Depressive symptoms
Separated families/communities	Weakened resilience within community Increased conflicts within and between families Frustration of neighbouring cities that take in evacuees
Self-stigma	Discrimination against workers and young women Concealment of history in Fukushima Righteous anger Loss of self-esteem

Maeda M, Oe M. Traumatic Stress and Long-Term Recovery: Coping with Disasters and Other Negative Life Events. New York: Springer; 2015.



Kessler six-item psychological distress scale (K6) after the accident

- Scores >20 denote substantial problems, and scores of 13–19 denote mild to- moderate problems)
- 3% for K6>13 in the usual state



Posttraumatic Stress Disorder Checklist (PCL) after the accident

- The proportion of adults with a PCL score of 44 or more; ie, probable PTSD

Suicide rates in the aftermath of the 2011 earthquake in Japan

	2010	2011	2012	2013	2014
Fukushima prefecture					
N	540	525	458	466	476*
Deaths per 100 000 people	26·6	26·4	22·8	23·9	24·5*
Standardised suicide mortality ratio	108	107	94	96	126
Iwate prefecture					
N	467	401	373	373	374*
Deaths per 100 000 people	35·1	30·1	28·6	28·8	28·9*
Standardised suicide mortality ratio	141	122	115	115	138
Miyagi prefecture					
N	620	483	508	485	519*
Deaths per 100 000 people	26·4	20·8	21·9	20·8	22·3*
Standardised suicide mortality ratio	108	84	88	88	110
Japan total					
N	31 690	30 651	27 858	27 283	25 374*
Deaths per 100 000 people	24·9	24·0	21·8	21·4	19·9*

Information of suicide deaths were from the Cabinet Office, Japan and the Reconstruction Agency, Japan. We calculated standardised suicide mortality ratios to compare mortality in each prefecture based on the age-specific rates per year. *Provisional data.

Table: **Suicide deaths in prefectures affected by the earthquake and tsunami of March, 2011**

Ohto H, et al. Suicide rates in the aftermath of the 2011 earthquake in Japan. Lancet 2015; 385; 1727

Psychological distress and the perception of radiation risks: the Fukushima health management survey

Yuriko Suzuki,[a] Hirooki Yabe,[b] Seiji Yasumura,[b] Tetsuya Ohira,[b] Shin-Ichi Niwa,[b] Akira Ohtsuru,[b] Hirobumi Mashiko,[c] Masaharu Maeda[b] & Masafumi Abe[b] on behalf of the Mental Health Group of the Fukushima health management survey

Objective To assess relationships between the perception of radiation risks and psychological distress among evacuees from the Fukushima nuclear power plant disaster.

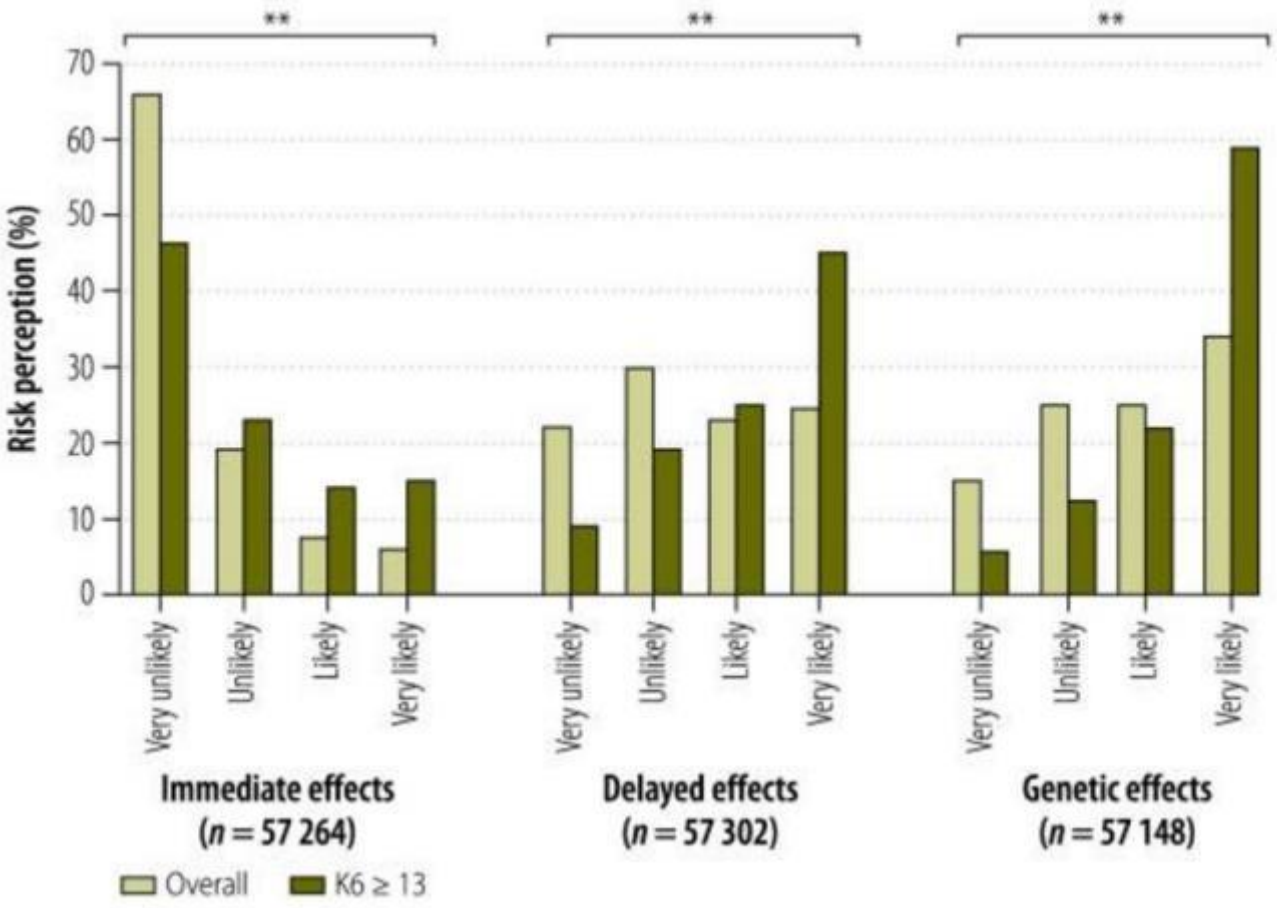
Methods We analysed cross-sectional data from a survey of evacuees conducted in 2012. Psychological distress was classified as present or absent based on the K6 scale. Respondents recorded their views about the health risks of exposure to ionizing radiation, including immediate, delayed and genetic (inherited) health effects, on a four-point Likert scale. We examined associations between psychological distress and risk perception in logistic regression models. Age, gender, educational attainment, history of mental illness and the consequences of the disaster for employment and living conditions were potential confounders.

Findings Out of the 180 604 people who received the questionnaire, we included 59 807 responses in our sample. There were 8717 respondents reporting psychological distress. Respondents who believed that radiation exposure was very likely to cause health effects were significantly more likely to be psychologically distressed than other respondents: odds ratio (OR) 1.64 (99.9% confidence interval, CI: 1.42–1.89) for immediate effects; OR: 1.48 (99.9% CI: 1.32–1.67) for delayed effects and OR: 2.17 (99.9% CI: 1.94–2.42) for genetic (inherited) effects. Similar results were obtained after controlling for individual characteristics and disaster-related stressors.

Conclusion Among evacuees of the Fukushima nuclear disaster, concern about radiation risks was associated with psychological distress.

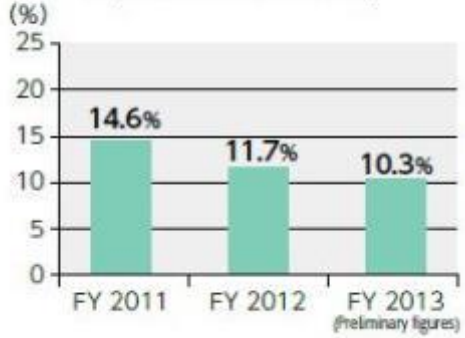
Suzuki Y, et al. Psychological distress and the perception of radiation risks: the Fukushima health management survey. Bull World Health Organ. 2015 Sep 1;93(9):598-605. doi: 10.2471/BLT.14.146498. Epub 2015 Jun 15.

Perception of radiation risks and psychological distress in Fukushima evacuees, Japan, 2012

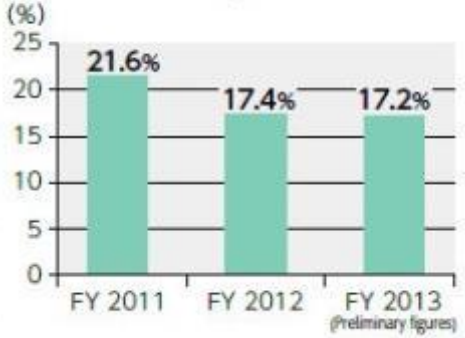


Suzuki Y, et al. Psychological distress and the perception of radiation risks: the Fukushima health management survey. Bull World Health Organ. 2015 Sep 1;93(9):598-605. doi: 10.2471/BLT.14.146498. Epub 2015 Jun 15.

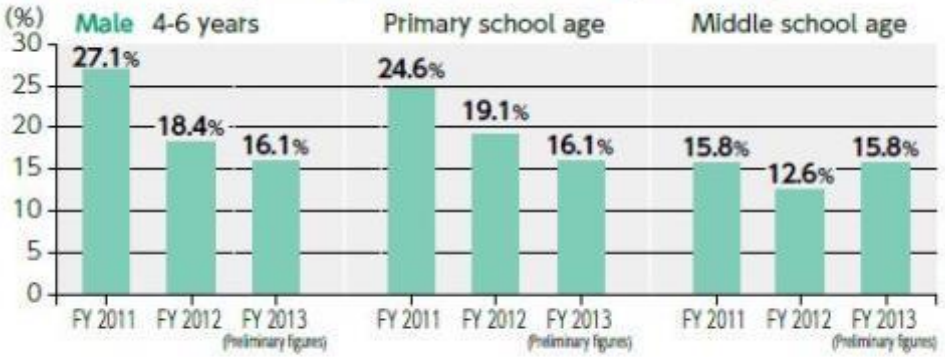
Proportion of participants who required support in regard to depression or anxiety

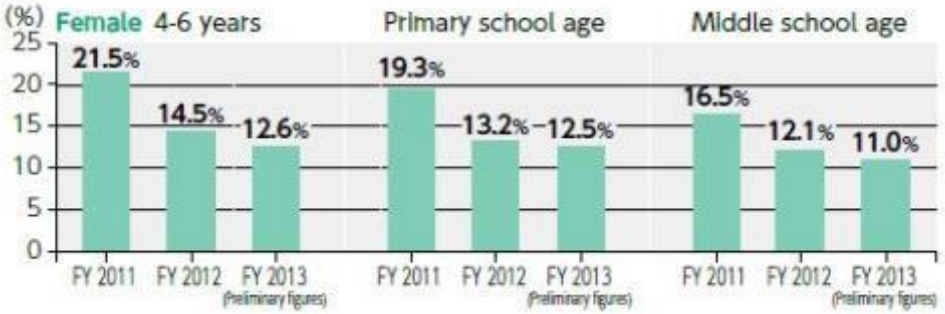


Proportion of participants who required support in regard to post-traumatic reaction caused by the disaster



Proportion of participants by sex who required support



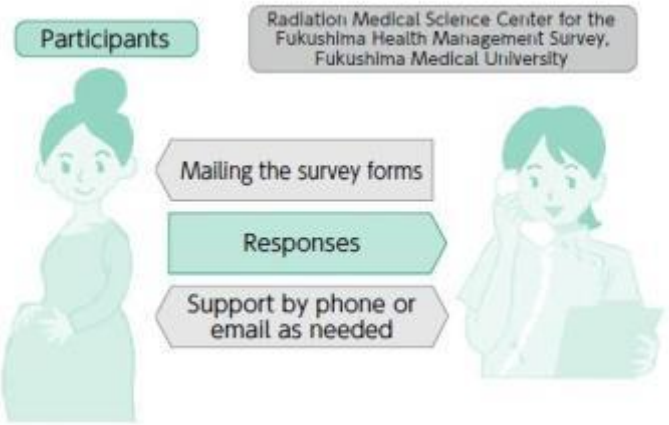


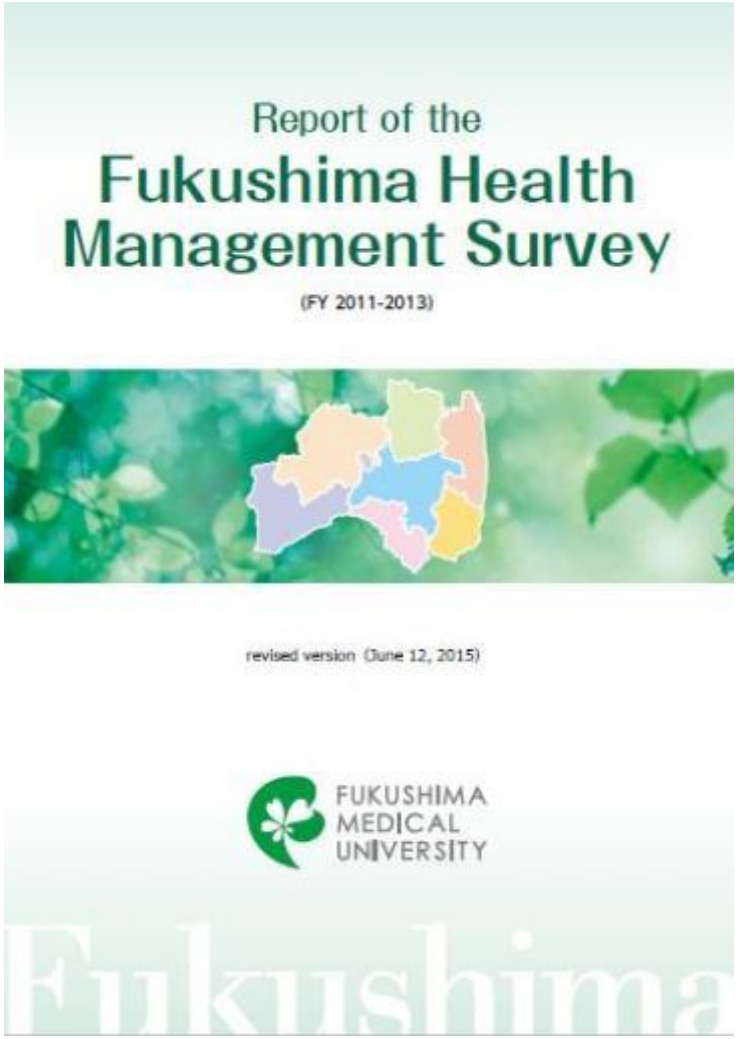
http://fmu-global.jp/?wpdmdl=1032

Summary of Mental Health and Lifestyle Survey

- The proportion of those with psychological distress including children was far greater in our study (14.6%) than in other areas affected by the Tohoku earthquake and subsequent tsunami (6.2%) or the Japanese population under normal circumstances (4.2–4.4%). Not surprisingly, emergency workers were more susceptible to psychological trauma than the general affected population.
- It was indicated that greater perceived radiation risks were associated with poor mental health.
- In addition to the mental problems, complicated psycho-social issues arose in or out of Fukushima, i.e., discordance in families and society, and stigma.
- The proportion of residents who require support for depressive symptoms and anxieties has been decreasing gradually, but remained at much higher levels in comparison with general population. Continued monitoring of the mental status of the residents are still required, and we need work closely with service providers and local mental health organizations to mitigate mental impacts of the disaster.

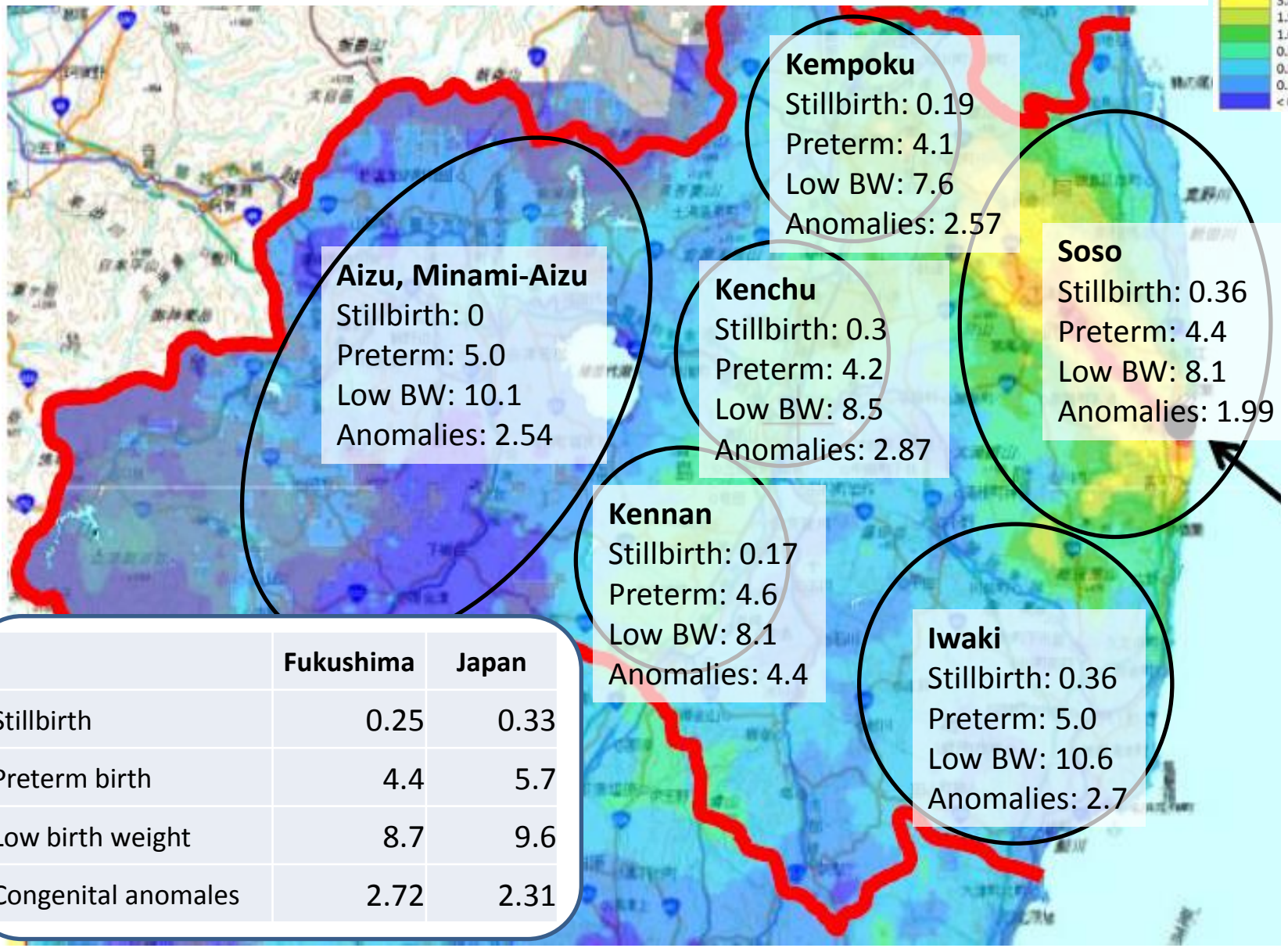
Pregnancy and Birth Survey





http://fmu-global.jp/?wpdmdl=1032

Obstetrical outcomes (%) of pregnancy (March 31, 2013)



	Fukushima	Japan
Stillbirth	0.25	0.33
Preterm birth	4.4	5.7
Low birth weight	8.7	9.6
Congenital anomales	2.72	2.31

Fujimori K, et al. Pregnancy and birth survey after the Great East Japan Earthquake and Fukushima Daiichi Nuclear Power Plant accident in Fukushima prefecture. Fukushima J Med Sci. 2014;60(1):75-81. Epub 2014 Jul 15.

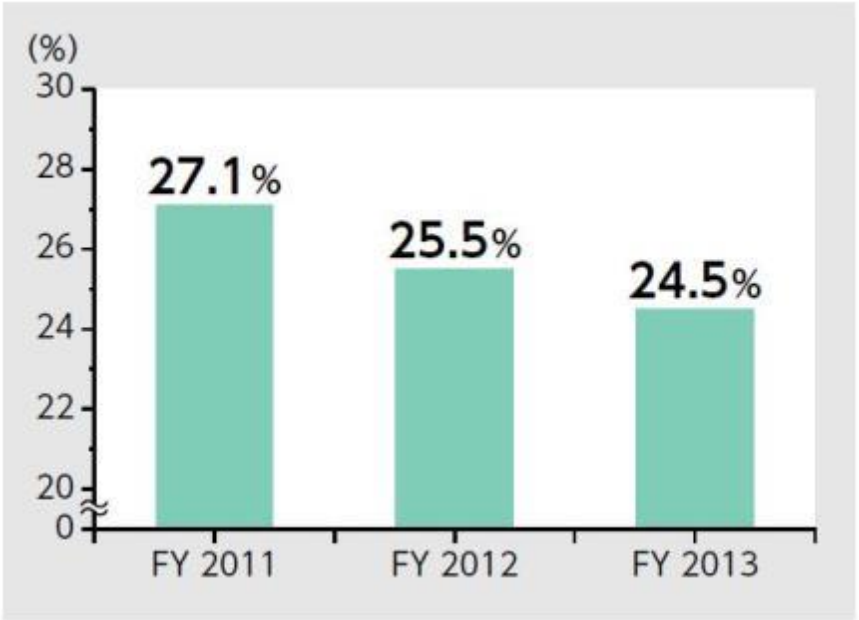
(%)

	Preterm deliveries	Low birth weight infants	Congenital anomalies	
FY 2011	4.75(5.7)	8.9(9.6)	2.85	(3～5)*
FY 2012	5.74(5.7)	9.6(9.6)	2.39	
FY 2013	5.40(5.8)	9.9(9.6)	2.35	

Figures in the brackets are the proportion of preterm deliveries and incidence of low birth weight infants reported in the Vital Statistics conducted by Ministry of Health, Labour and Welfare for the same fiscal year.

*Figures in the brackets are the generally reported incidence of congenital anomalies.

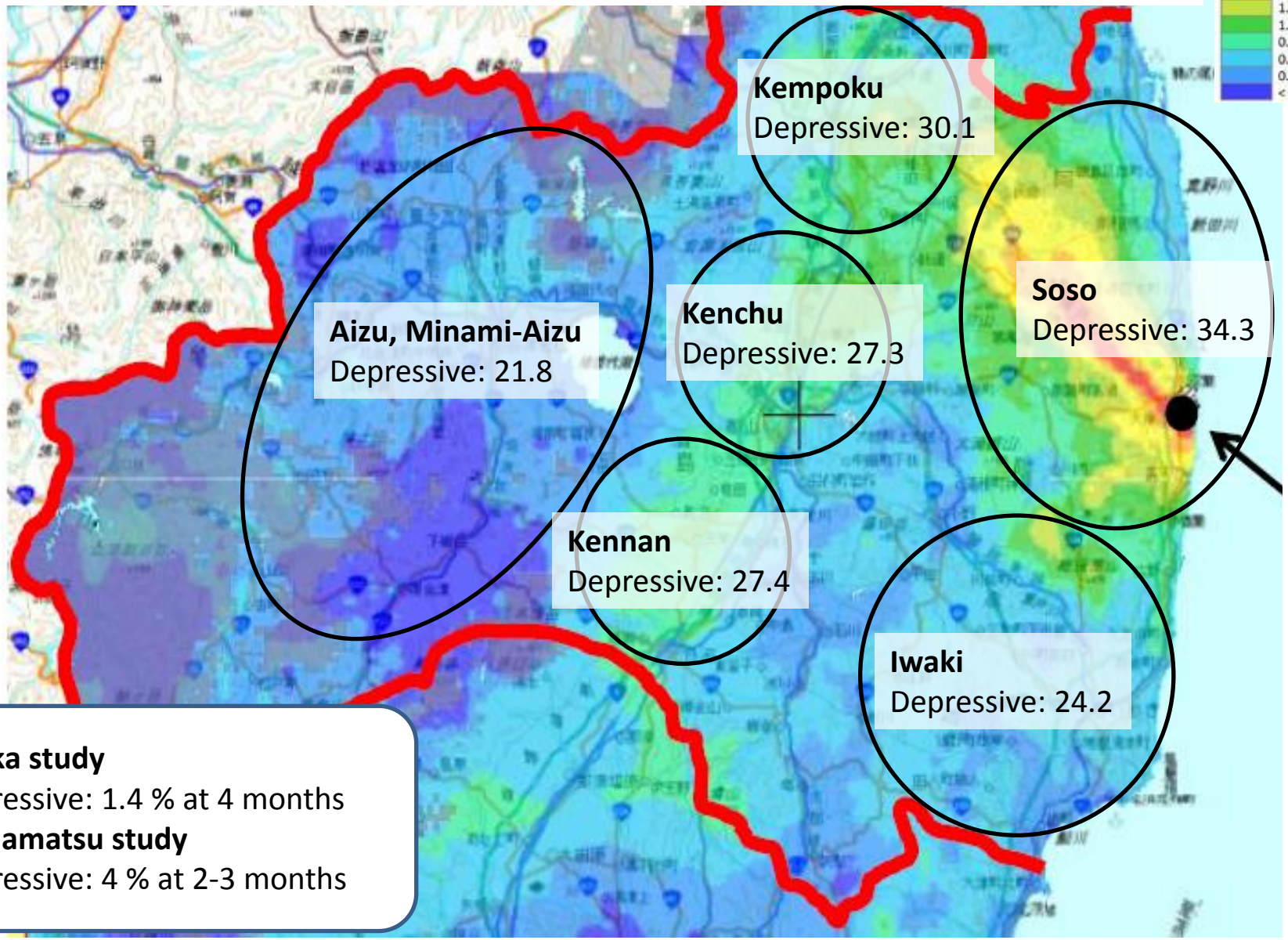
Changes in the numbers of mothers with depressive Symptoms



Changes of content of concerns in telephone counseling

FY 2011	FY 2012	FY 2013
Anxiety over radiation or effects of radiation 29.2%	Mental or physical health of mothers 33.4%	Mental or physical health of mothers 42.5%
Mental or physical health of mothers 20.2%	Child rearing (baby food, nighttime crying, constipation, vaccination) 26.7%	Child rearing (baby food, nighttime crying, constipation, vaccination) 38.7%
Child rearing (baby food, nighttime crying, constipation, vaccination) 14.0%	Anxiety over radiation or effects of radiation 23.7%	Mental or physical health of children 20.3%

Regional variation in frequency (%) of mothers positive for depressive symptoms



Osaka study
Depressive: 1.4 % at 4 months
Hamamatsu study
Depressive: 4 % at 2-3 months

Goto A, et al. Immediate effects of the Fukushima nuclear power plant disaster on depressive symptoms among mothers with infants: a prefectural-wide cross-sectional study from the Fukushima Health Management Survey. BMC Psychiatry. 2015 Mar 26;15:59. doi: 10.1186/s12888-015-0443-8.

Summary of Pregnancy and Birth Survey

- No significant adverse outcomes in the pregnancy and birth survey was observed after the disaster.
- However, 27.6% of all mothers surveyed at around 6 months postpartum showed depressive symptoms, which is remarkably high. The prevalence was found to be higher among mothers in the region in which the damaged nuclear power plant is located and lower in regions that were less affected by the nuclear accident.
- In addition, a greater prevalence was reported among mothers that experienced an interruption in their obstetrical care following the disaster.
- Our findings suggest that improving mental health support for mothers with infants should be a high priority in the acute phase of nuclear disaster response.
- We further recommend that in the strategic provisioning of parental support, close attention should be paid to regional variations in negative mental health consequences, particularly to those who experienced an interruption in their obstetrical care.

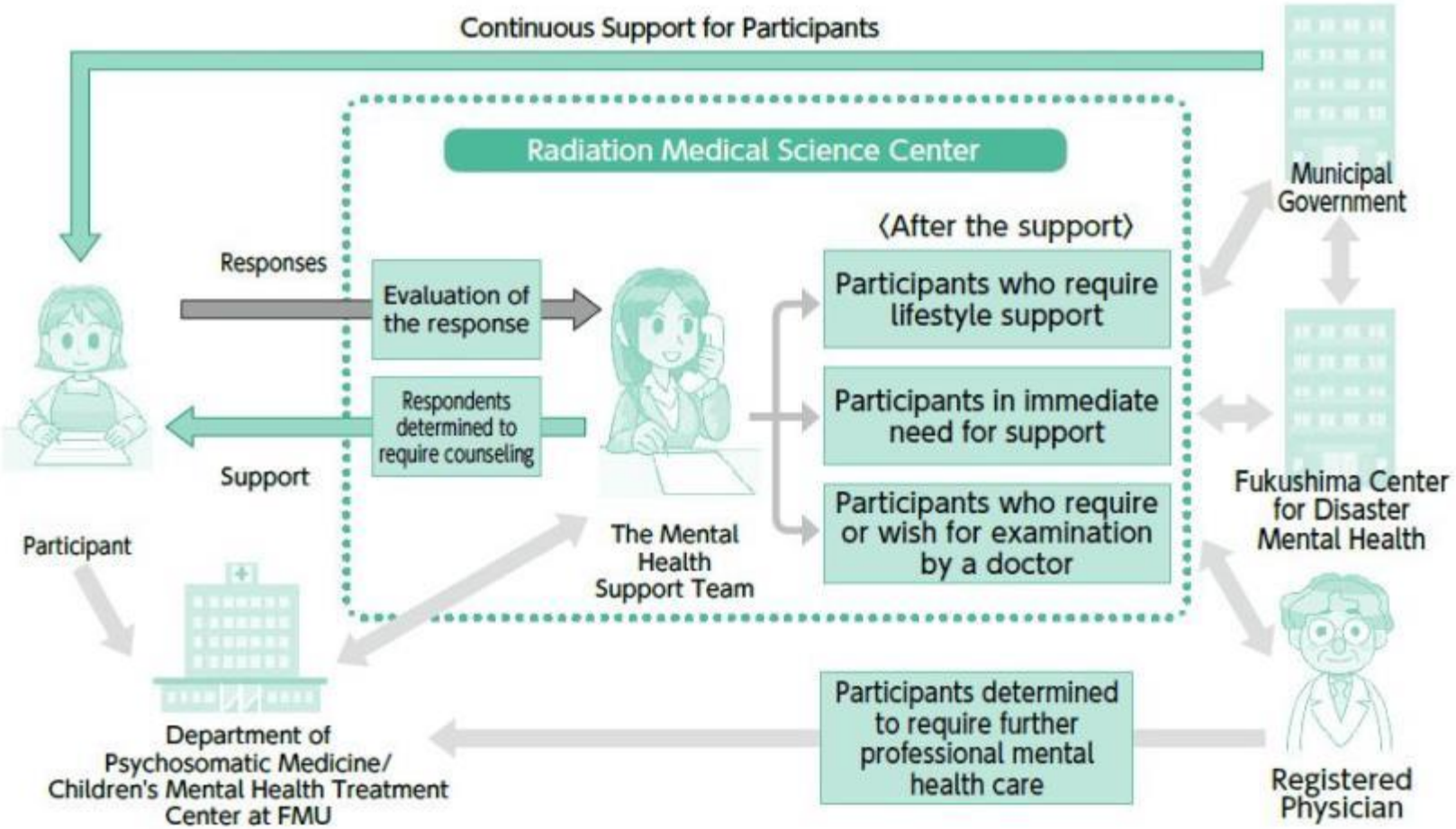
Goto A, et al. Immediate effects of the Fukushima nuclear power plant disaster on depressive symptoms among mothers with infants: a prefectural-wide cross-sectional study from the Fukushima Health Management Survey. BMC Psychiatry. 2015 Mar 26;15:59. doi: 10.1186/s12888-015-0443-8.

3. Lessons learned in the Fukushima accident and the future roles of Fukushima Medical University

Health consequences of the Fukushima NPP accident

Health effects of radiation	Health effects not attributable to radiation
• No deterministic effect cases including Acute Radiation Syndrome case to date • Stochastic effect would not be expected over the baseline level • Although 2-3 excess cancers could be inferred over the lifetime among workers with doses greater than 100mSv, it is unlikely that such increased incidence of cancer due to radiation would be discernible • No discernible radiation-related increases in rates of leukemia or breast cancer, nor in other types of solid cancer besides possible thyroid cancer among public	• Deaths in rapid evacuation among inpatients and elderly people at nursing care facilities • Increased mortality of displaced elderly people requiring nursing care • Adverse health effects such as mental health and lifestyle-related issues

Hasegawa A, et al. Emergency Responses and Health Consequences after the Fukushima Accident; Evacuation and Relocation. Clin Oncol. 2016 in press.


Continuous Support for Participants
Radiation Medical Science Center
Municipal Government
〈After the support〉
Responses
Evaluation of the response
Participants who require lifestyle support
Respondents determined to require counseling
Participants in immediate need for support
Support
Fukushima Center for Disaster Mental Health
Participant
The Mental Health Support Team
Participants who require or wish for examination by a doctor
Department of Psychosomatic Medicine/ Children's Mental Health Treatment Center at FMU
Participants determined to require further professional mental health care
Registered Physician

Addressing concerns in thyroid ultrasound examination

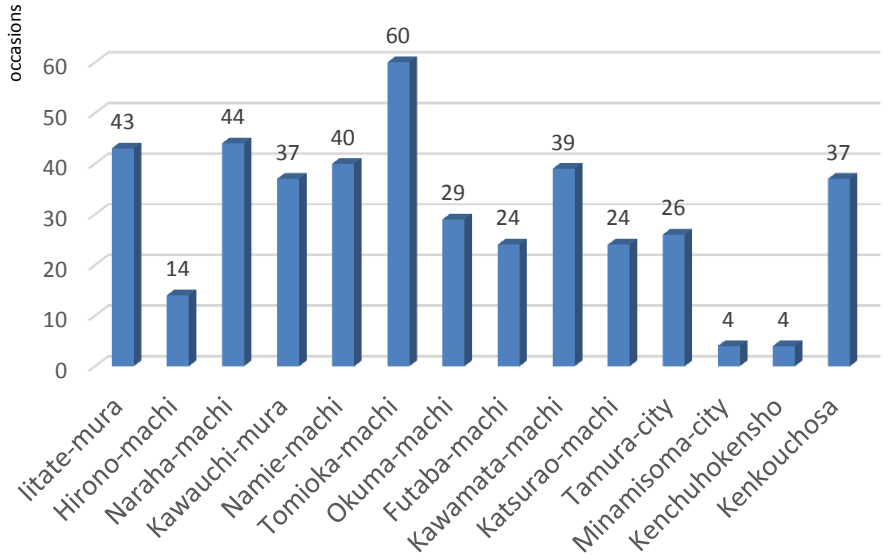
Although thyroid examination showed some benefits of early diagnosis with sophisticated ultrasound, the resulting increase in prevalence of thyroid cancer can cause anxiety among residents.

- We explain the results individually at the spot immediately after the examinations in order to relieve the anxieties of the examinees and their families about the results, and provide supports on health risks of radiation and self-coping methods.
- We provide classes on thyroid examinations to the students of elementary schools and junior high schools who are the subjects of the examinations.

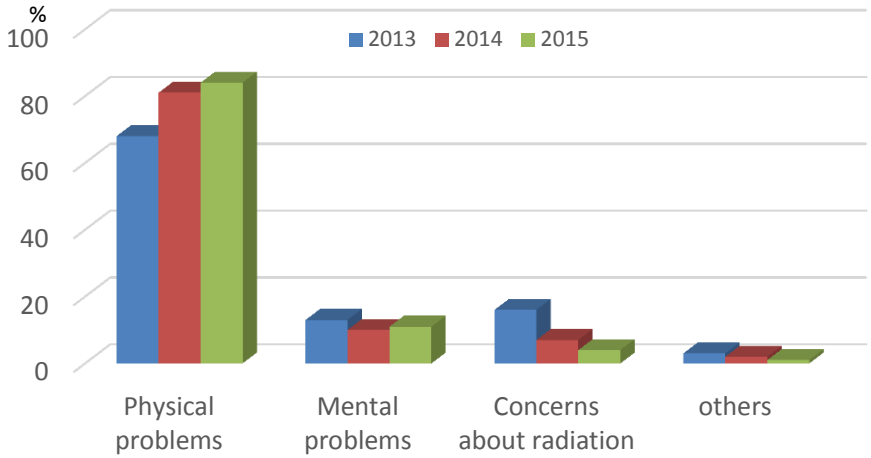
General health consultations

- Fukushima residents were apprehensive about the consequences of the accident, but their concerns were not always related to radiation.
- Efforts have been made to address these issues, such as in “general health consultations,” to widely target the apprehensions of the evacuees and residents without specifying the effects of radiation.

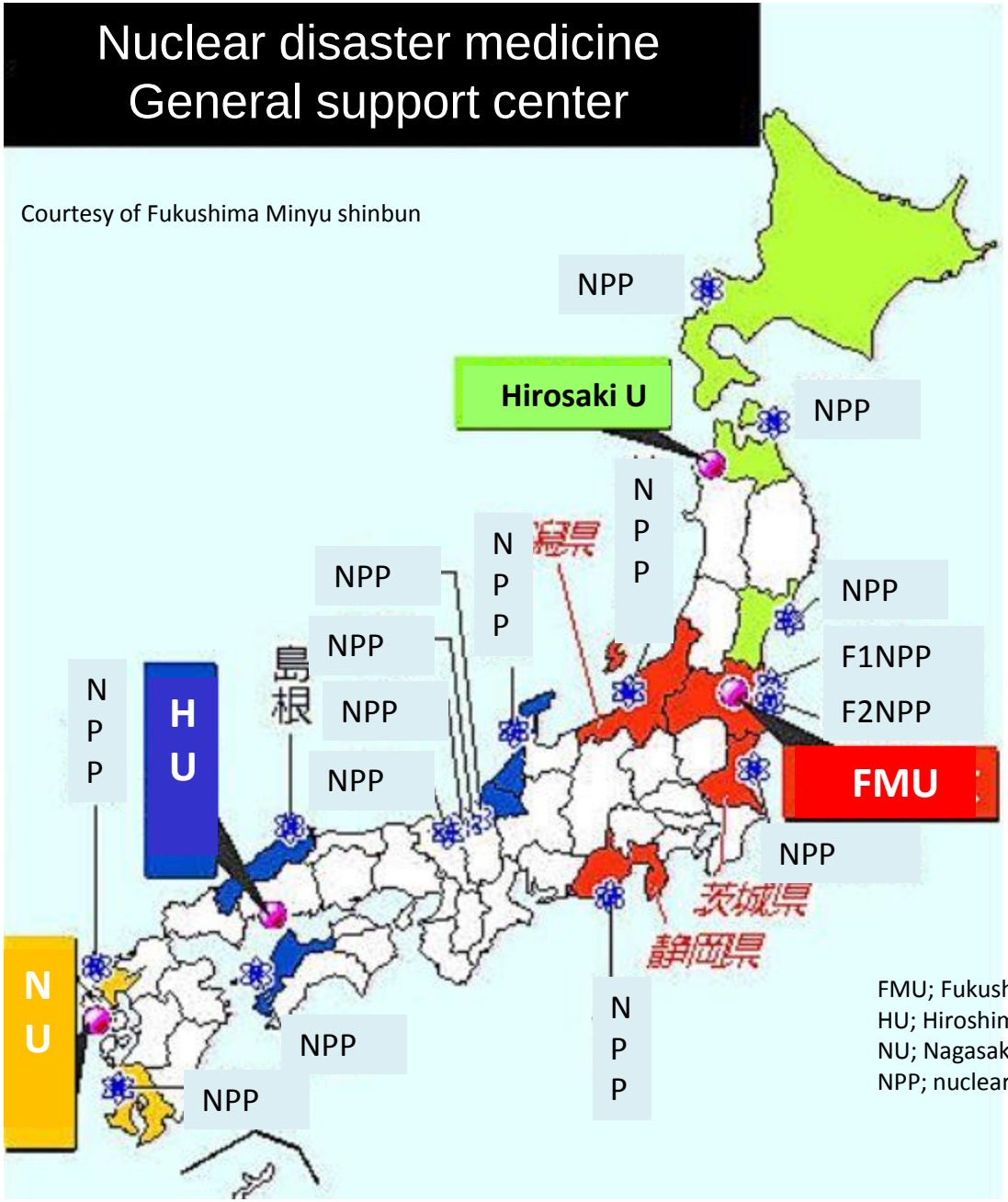
Miyazaki M. Yorozu health consultation project. 4th International Expert Symposium in Fukushima. 15 Mar 2015. http://fmu-global.jp/?wpdmdl=605.



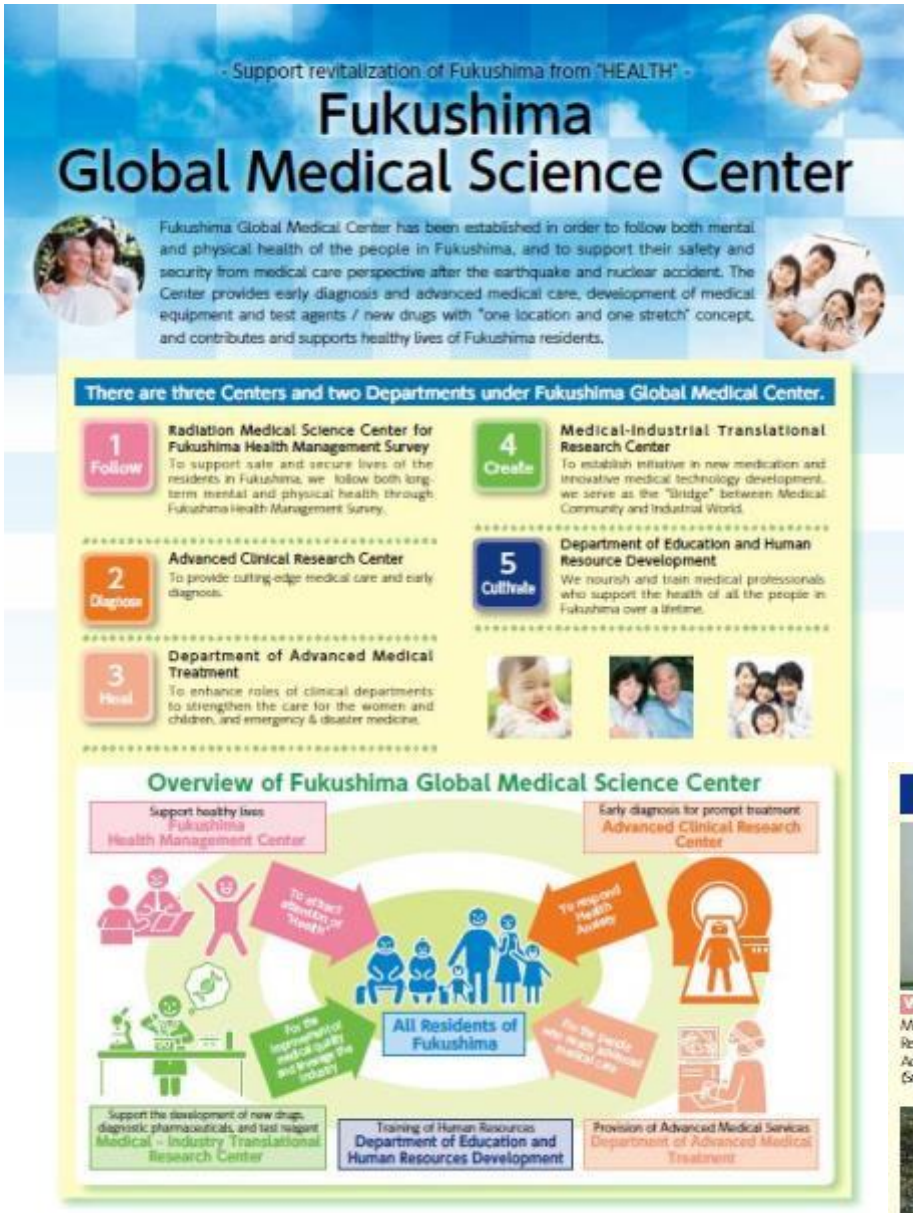
General health consultations were held in Fukushima on 546 occasions by October 2015



Consulted problems



New nuclear disaster medical system in Japan (2015 -)



公立大学法人
福島県立医科大学
FUKUSHIMA MEDICAL UNIVERSITY

The Principles of Fukushima Medical University

Fukushima Medical University promotes education, research, and medicine based on the following principles:

- We respect human life and nurture medical professionals with high ethical standards.
- We pursue advanced medicine and nursing.
- We provide holistic and integrated medical care as the core medical institution in the prefecture.

Conclusion

- Evacuation, which intends to minimize the health risks of radiation exposure, produced other serious health risks, particularly for vulnerable populations. Establishing the evacuation zone around the nuclear power plant resulted in the collapse of the local emergency medical system; this led to difficulties in responding to mass casualty events, such as explosions at the plant, and common medical emergencies.
- In the mid-long term, dislocating hundreds of thousands of citizens created a wide range of health consequences including increase of disaster related death, socio-psychological and public care issues.
- Re-organization of the disaster medical system and planning to respond a compound disaster is a must. Strengthening of public health services is another key issue in addition to mental and psychological care, behavioral and societal support, and efforts to improve perceptions about radiation.