2022年 福島県立医科大学『県民健康調査』国際シンポジウム
公立大学法人福島県立医科大学放射線医学県民健康管理センター
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2022 Fukushima Medical University International Symposium on the Fukushima Health Management Survey
Secretariat of International Symposium
Office of Public Communications and International Cooperation, Radiation Medical Science Center for the Fukushima Health Management Survey, Fukushima Medical University
✉ kenkani@fmu.ac.jp, TEL: +81-24-581-5454 (Weekday, 9a.m. - 5 p.m. JST)

Lessons Learned from the Fukushima Health Management Survey

– Effects of radiation exposure on physical and mental health–

March 5, 2022

Radiation Medical Science Center for the Fukushima Health Management Survey, Fukushima Medical University

Tetsuya Ohira

FUKUSHIMA MEDICAL UNIVERSITY

“Great East Japan Earthquake”
Triple Disasters in Fukushima

2,329 deaths were indirect disaster-related deaths (Miyagi 929, Iwate 470).

1,613 died and 197 are still lost due to Earthquake and/or Tsunami.

Earthquake

Fukushima City

Tsunami

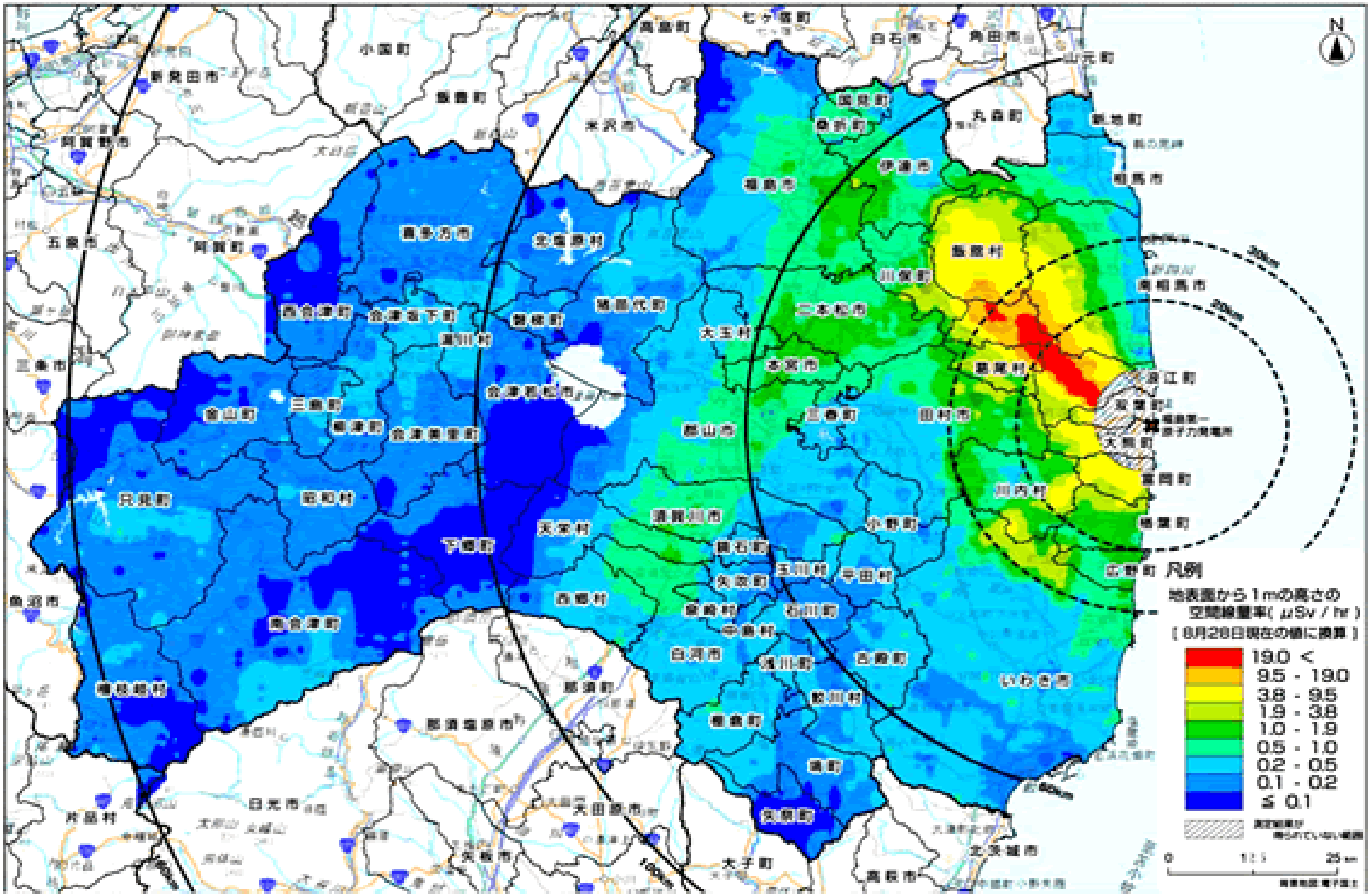
Minami-soma City

Nuclear Power Plant Accident

Fukushima Dai-ichi Nuclear Power Plant

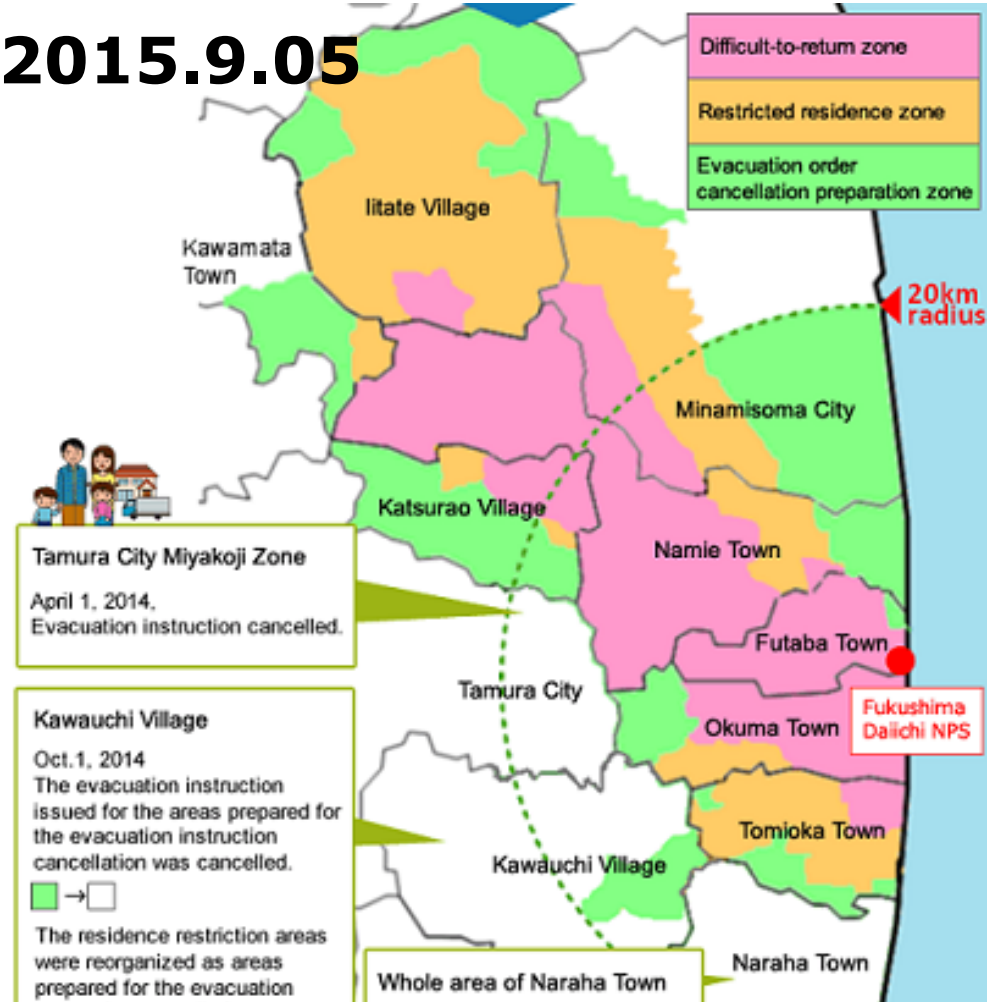
文部科学省による福島県内等の航空機モニタリングの測定結果について

（福島県内の地表面から1m高さの空間線量率）

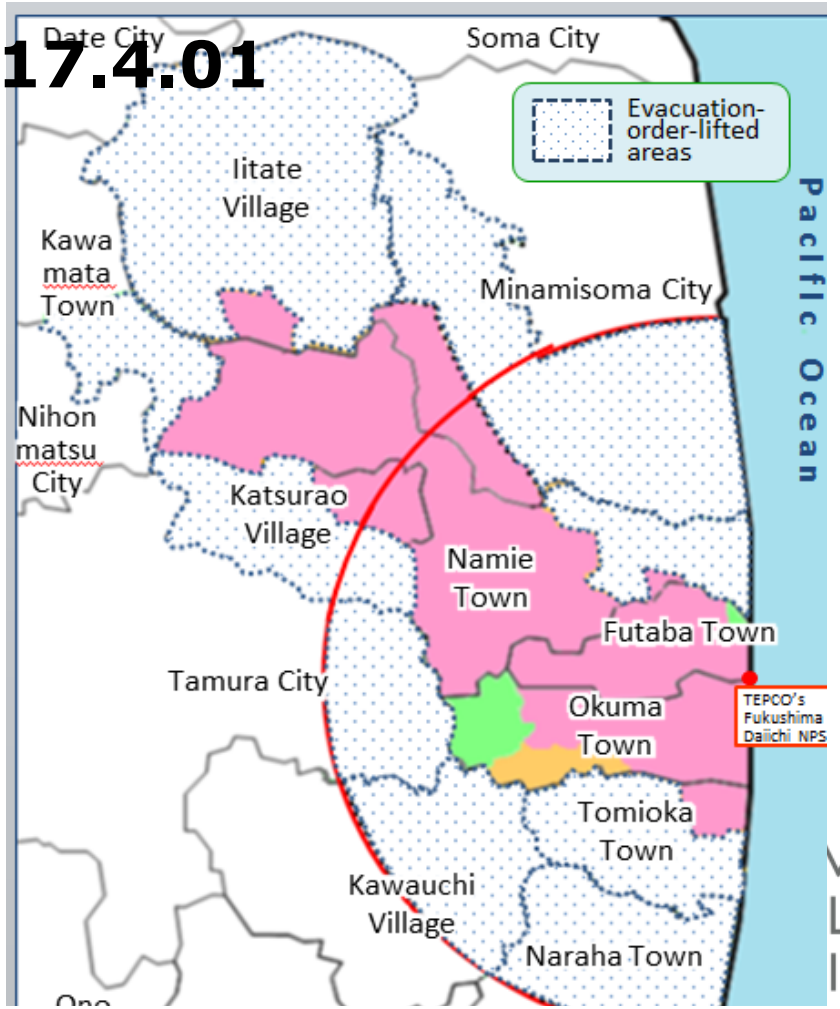


Transition of Evacuation Designated Zones

2015.9.05

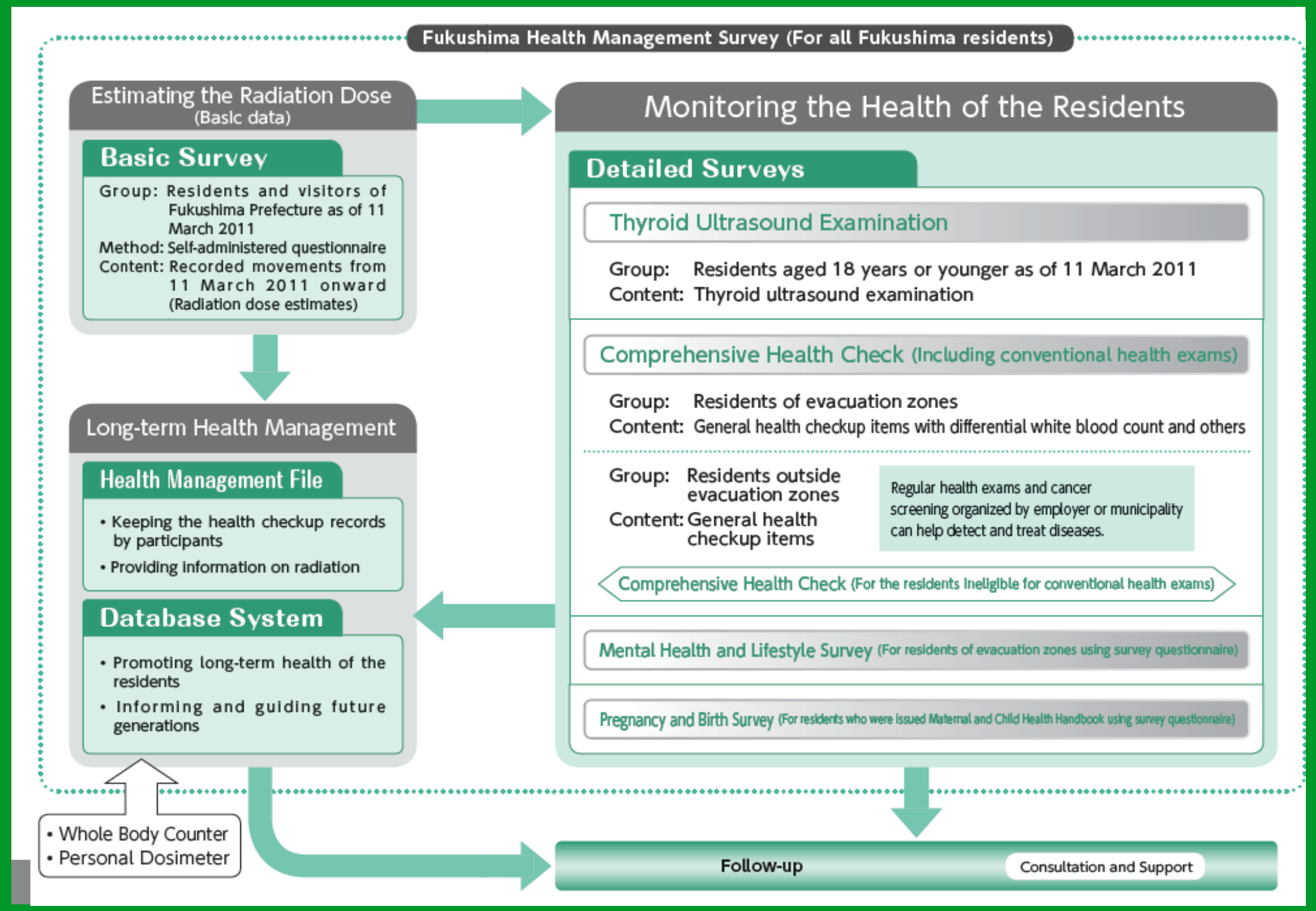


2017.4.01



http://www.pref.fukushima.lg.jp/site/portal-english/en03-08.html

Fukushima Health Management Survey


Fukushima Health Management Survey (For all Fukushima residents)
Estimating the Radiation Dose
(Basic data)
Basic Survey
Group: Residents and visitors of Fukushima Prefecture as of 11 March 2011
Method: Self-administered questionnaire
Content: Recorded movements from 11 March 2011 onward (Radiation dose estimates)
Long-term Health Management
Health Management File
• Keeping the health checkup records by participants
• Providing information on radiation
Database System
• Promoting long-term health of the residents
• Informing and guiding future generations
• Whole Body Counter
• Personal Dosimeter
Monitoring the Health of the Residents
Detailed Surveys
Thyroid Ultrasound Examination
Group: Residents aged 18 years or younger as of 11 March 2011
Content: Thyroid ultrasound examination
Comprehensive Health Check (Including conventional health exams)
Group: Residents of evacuation zones
Content: General health checkup items with differential white blood count and others
Group: Residents outside evacuation zones
Content: General health checkup items
Regular health exams and cancer screening organized by employer or municipality can help detect and treat diseases.
Comprehensive Health Check (For the residents ineligible for conventional health exams)
Mental Health and Lifestyle Survey (For residents of evacuation zones using survey questionnaire)
Pregnancy and Birth Survey (For residents who were issued Maternal and Child Health Handbook using survey questionnaire)
Follow-up
Consultation and Support

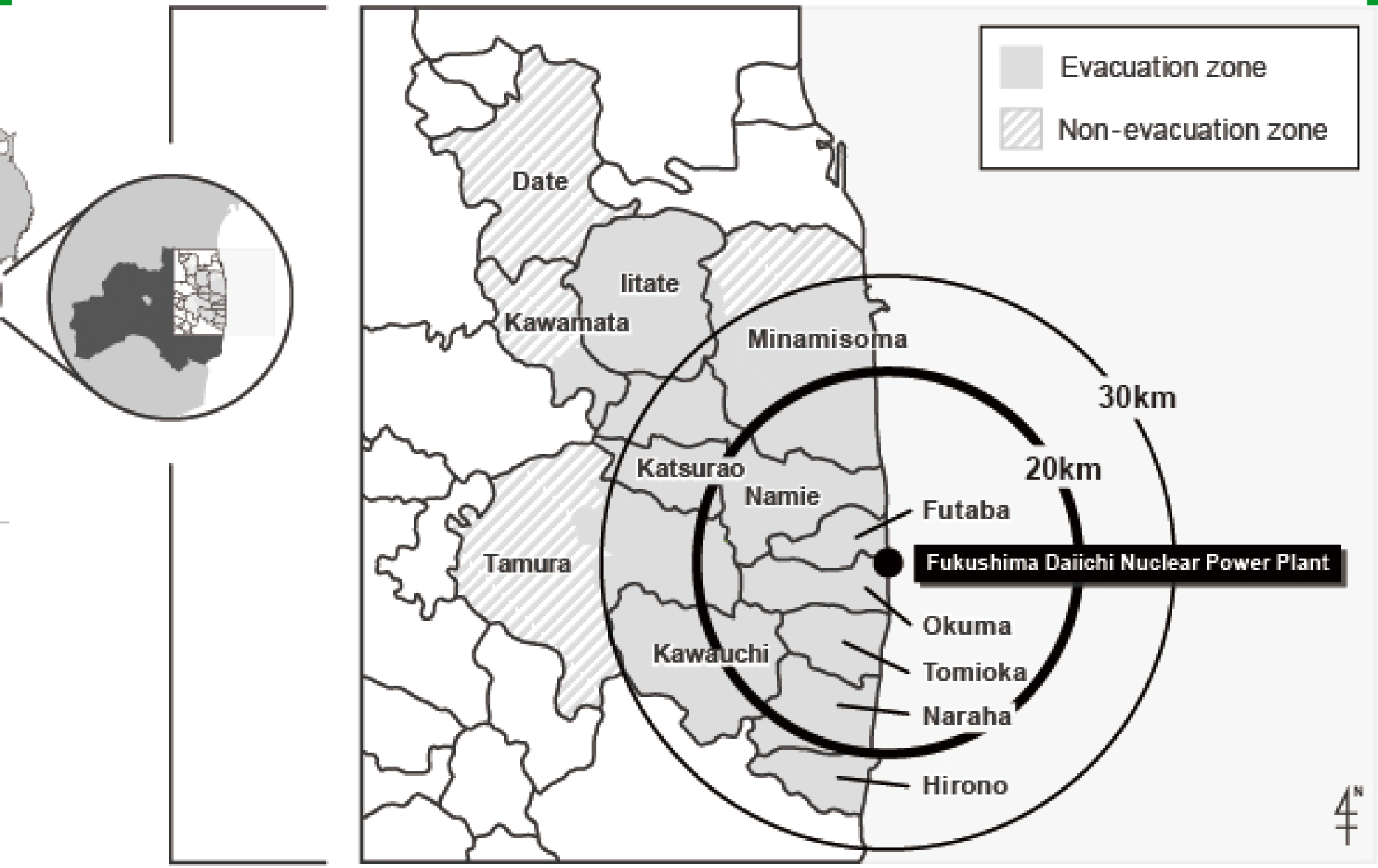
■Basic Surveys (Estimation of the external exposure doses)

■Thyroid Ultrasound Examination Survey

■Comprehensive Health Check:

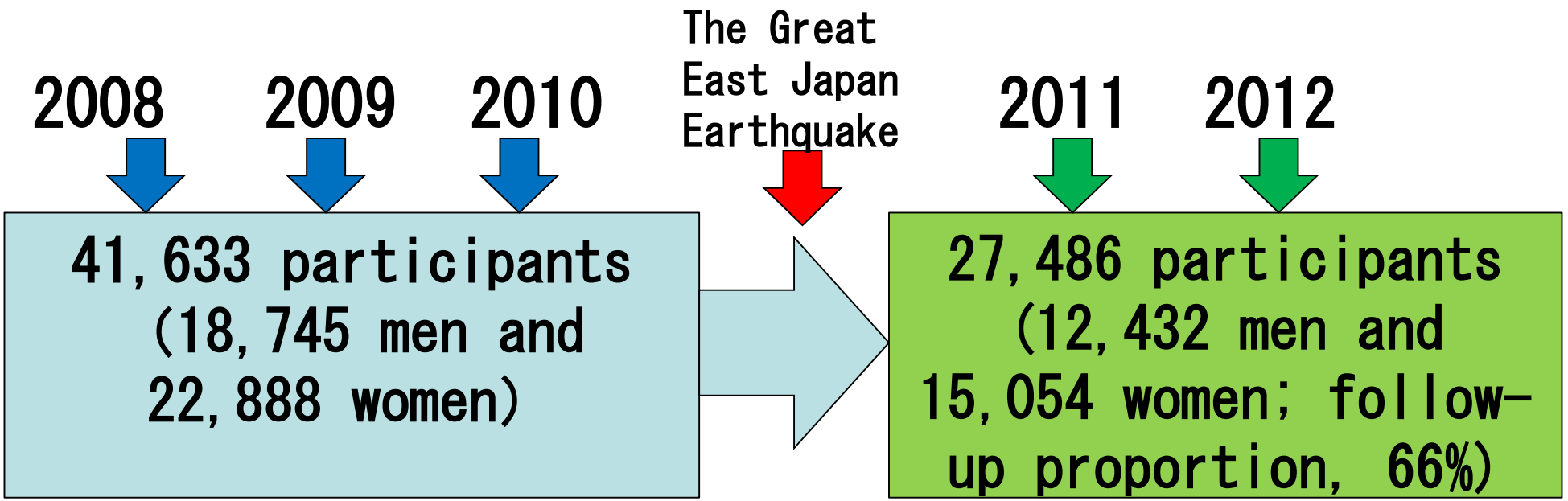
■Mental Health and Lifestyle Survey

■Pregnancy and Birth Survey


Evacuation zone
Non-evacuation zone
Date
Iitate
Kawamata
Minamisoma
30km
20km
Katsurao
Namie
Futaba
Tamura
Fukushima Daiichi Nuclear Power Plant
Okuma
Kawauchi
Tomioka
Naraha
Hirono
N

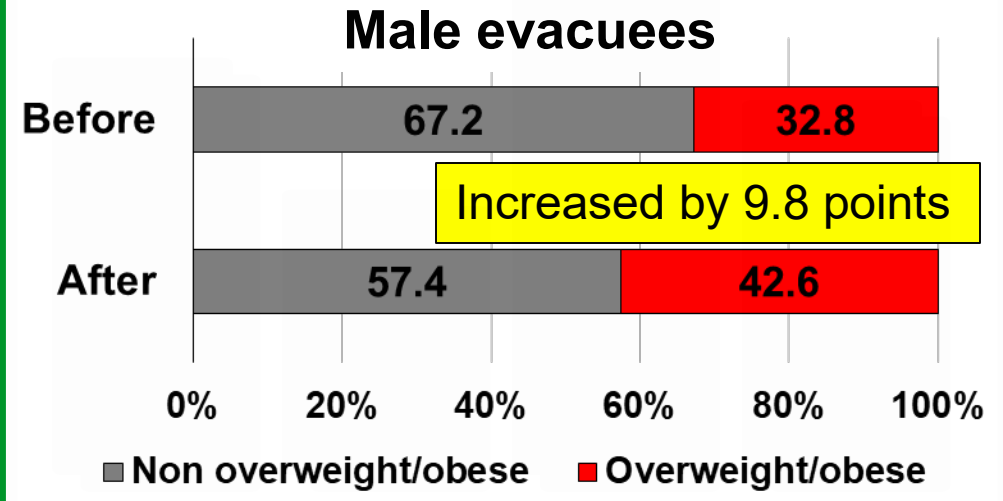
Methods

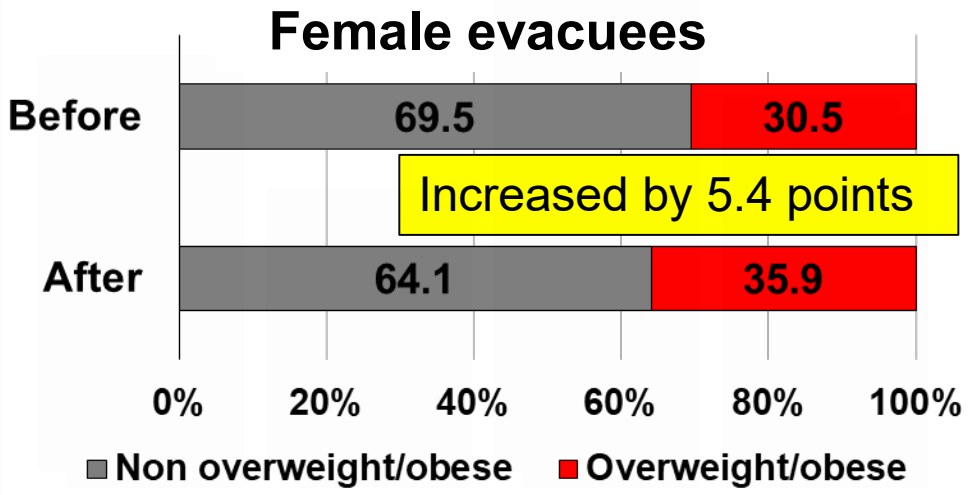
General health checkups

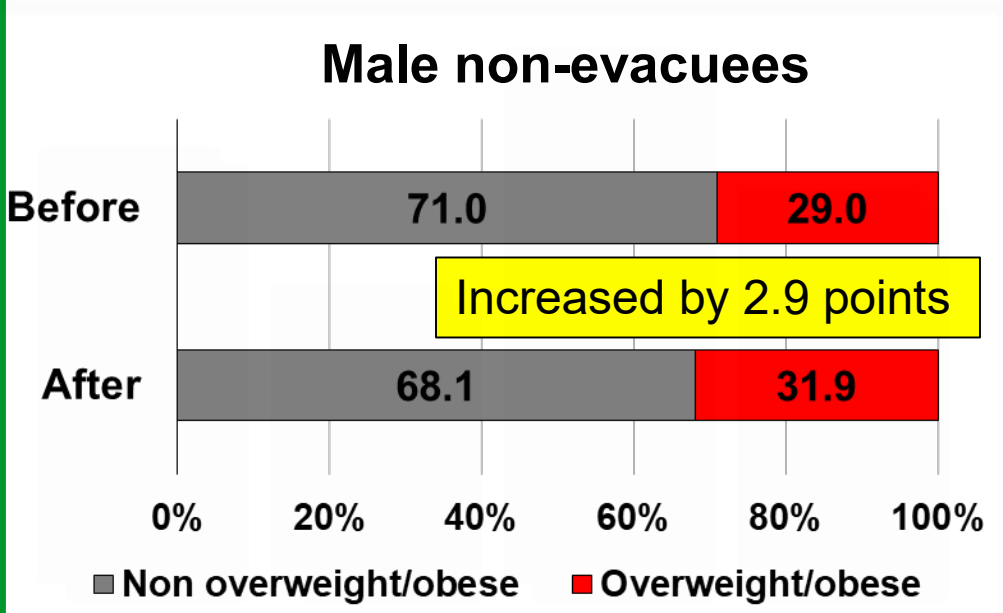


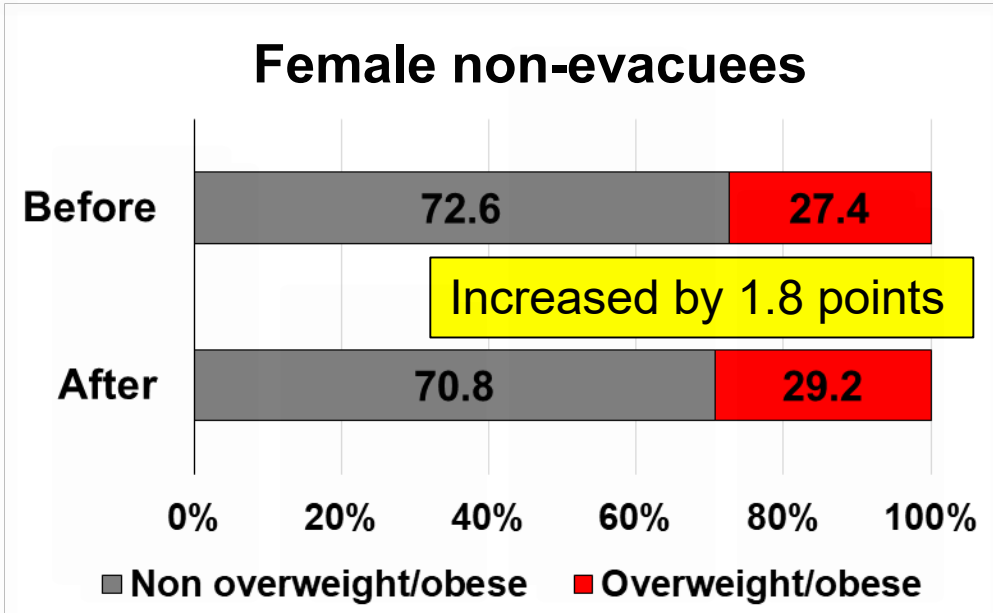
The nearest data from the Earthquake were used for analysis if the participants received the checkups more than two times, and an average follow-up duration was 1.6 years.

Change in Proportion of Overweight/Obese People Before and After the Disaster



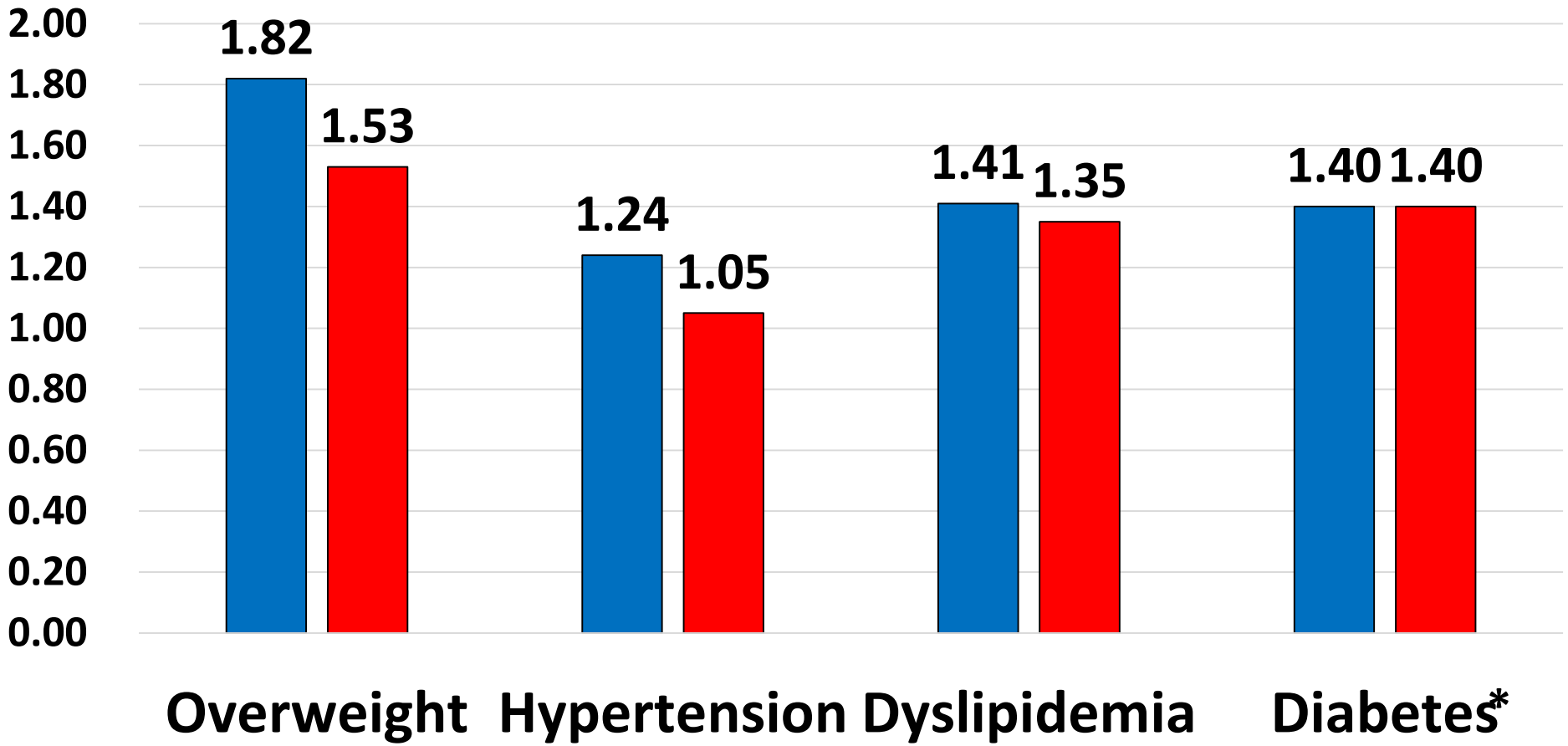






Ohira T, et al. Am J Prev Med, 2016.

Multivariable-adjusted Hazard Ratios of Overweight, Hypertension, Dyslipidemia, and Diabetes Mellitus for Evacuation



*HR was calculated by using combined data of men and women for diabetes.

Am J Prev Med, 2016. Hypertension, 2016. J Diabetes Res, 2015, Intern Med, 2016

Current Issue

- It has been reported that lifestyle-related diseases increased and the proportion of those complaining of mental distress increased among residents living in evacuation area following the Great East Japan Earthquake and the subsequent accident at the Fukushima Daiichi Nuclear Power Plant.
- It is not clear whether there are direct effects of low-dose exposure or effects via social factors and lifestyle changes due to evacuation, etc.

Purpose

- One of the main objectives of the Fukushima Health Management Survey (FHMS) is to clarify the health effects of long-term low-dose radiation exposure in residents.
- To summarize the results of the FHMS to date and discuss the current status and issues regarding the association between individual external radiation doses measured in the basic survey and their physical and mental health status (excluding thyroid gland).

Today's Contents

- Associations between external radiation dose and health check-ups results
- Associations of external radiation dose with psychological distress and trauma reactions
- Associations between external radiation dose and perinatal outcomes

Sakai A, et al. J Epidemiol, in press. Miura I, et al. J Epidemiol, in press. Yasuda S, et al. J Epidemiol, in press.

Today's Contents

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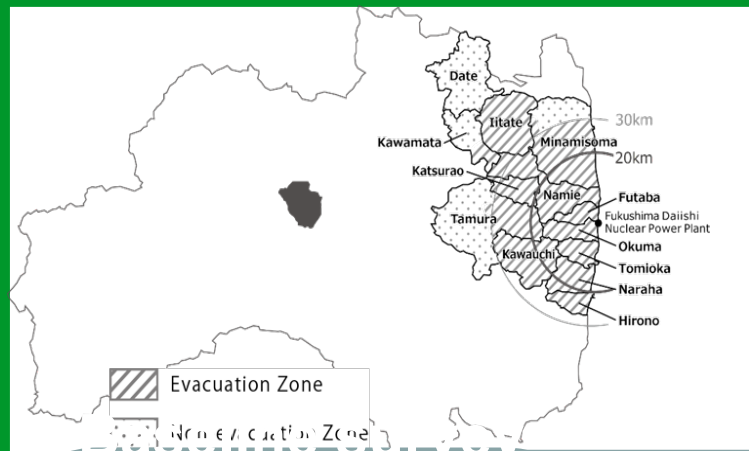


Comprehensive Health Check

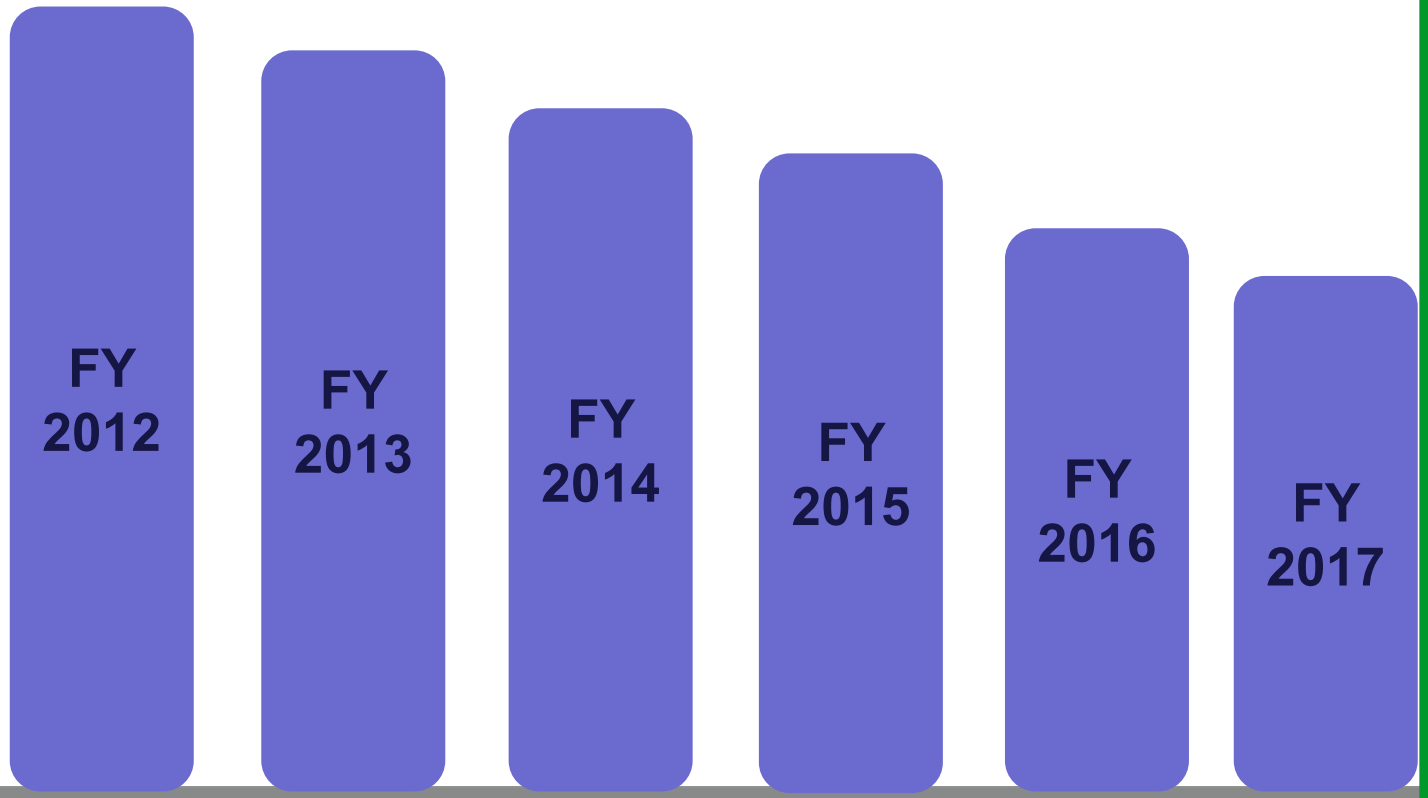
Follow-up surveys

FY 2011

72,869 participants of the health check-ups in the evacuation area

↓

54,087 participants aged 16-84 years were analyzed

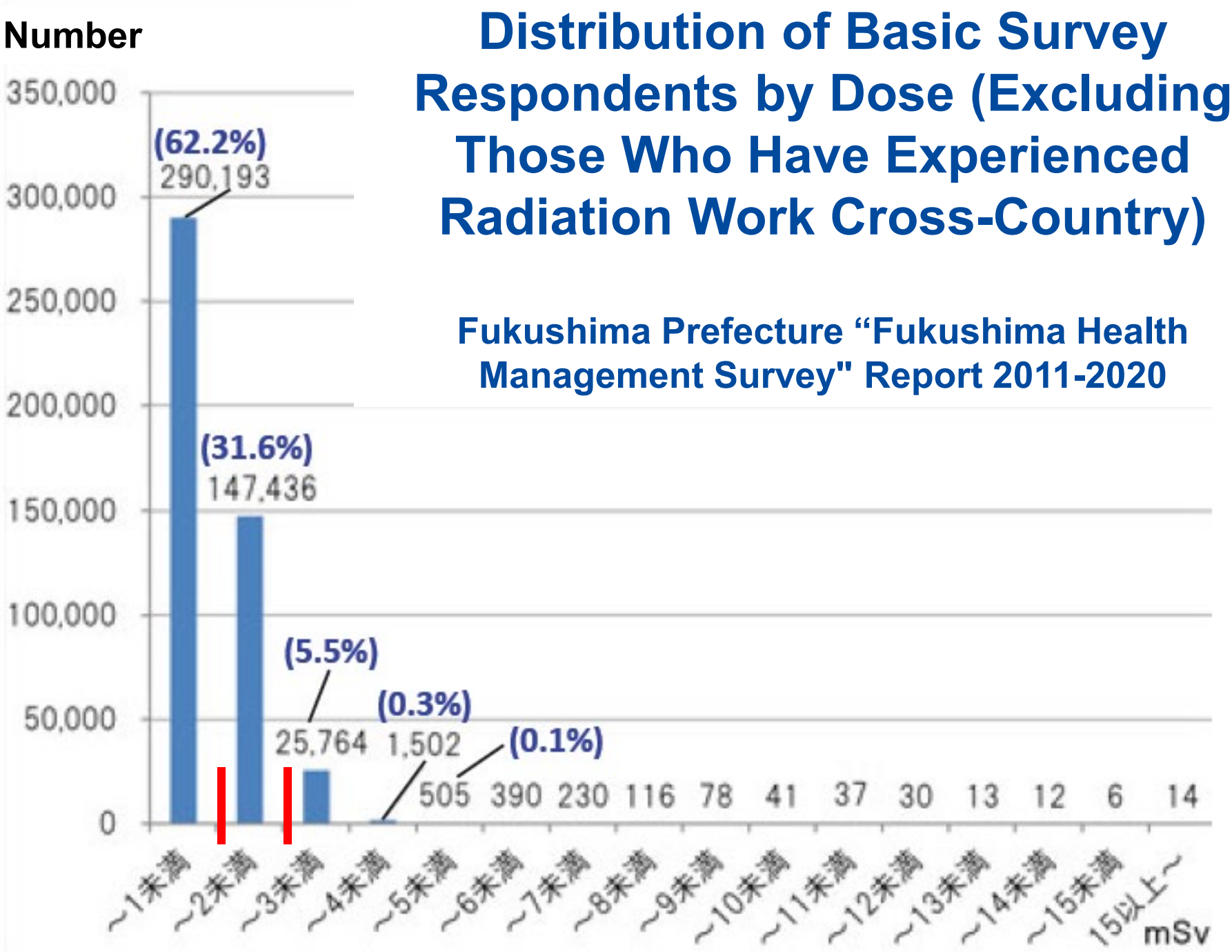


Statistical Analysis

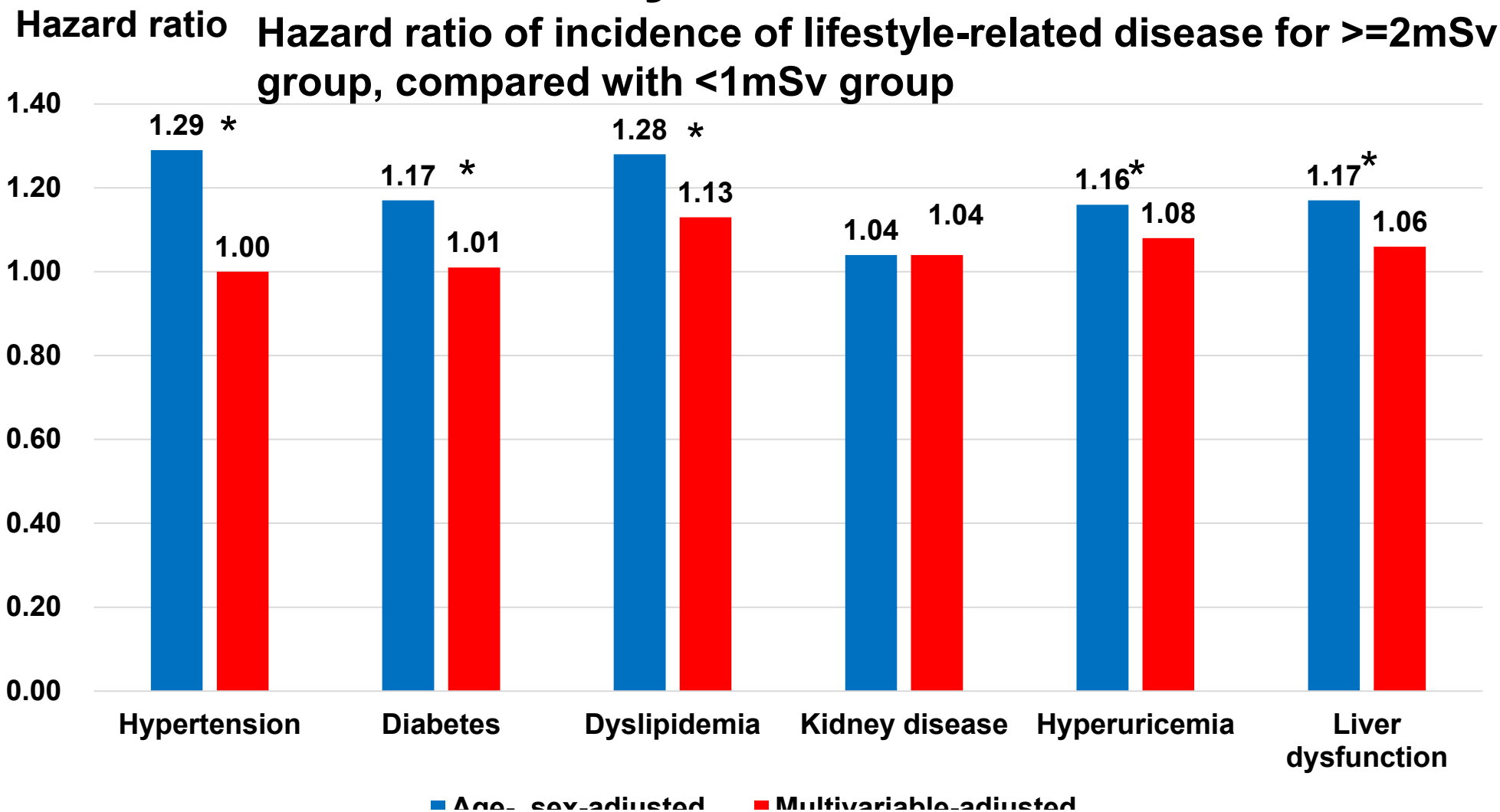
- We divided individual external radiation doses measured in the Basic Survey into three groups: <1mSv, 1-2mSv, and ≥2mSv, and prospectively examined associations of radiation doses with incidence of hypertension, diabetes, dyslipidemia, chronic kidney disease, liver dysfunction, hyperuricemia, and anemia between FY2012 and FY2017.
- For the 25,685 (47.5%) participants who did not participate in the Basic Survey, external radiation doses were supplemented by multiple imputation method.

Distribution of Basic Survey Respondents by Dose (Excluding Those Who Have Experienced Radiation Work Cross-Country)

Fukushima Prefecture “Fukushima Health Management Survey" Report 2011-2020



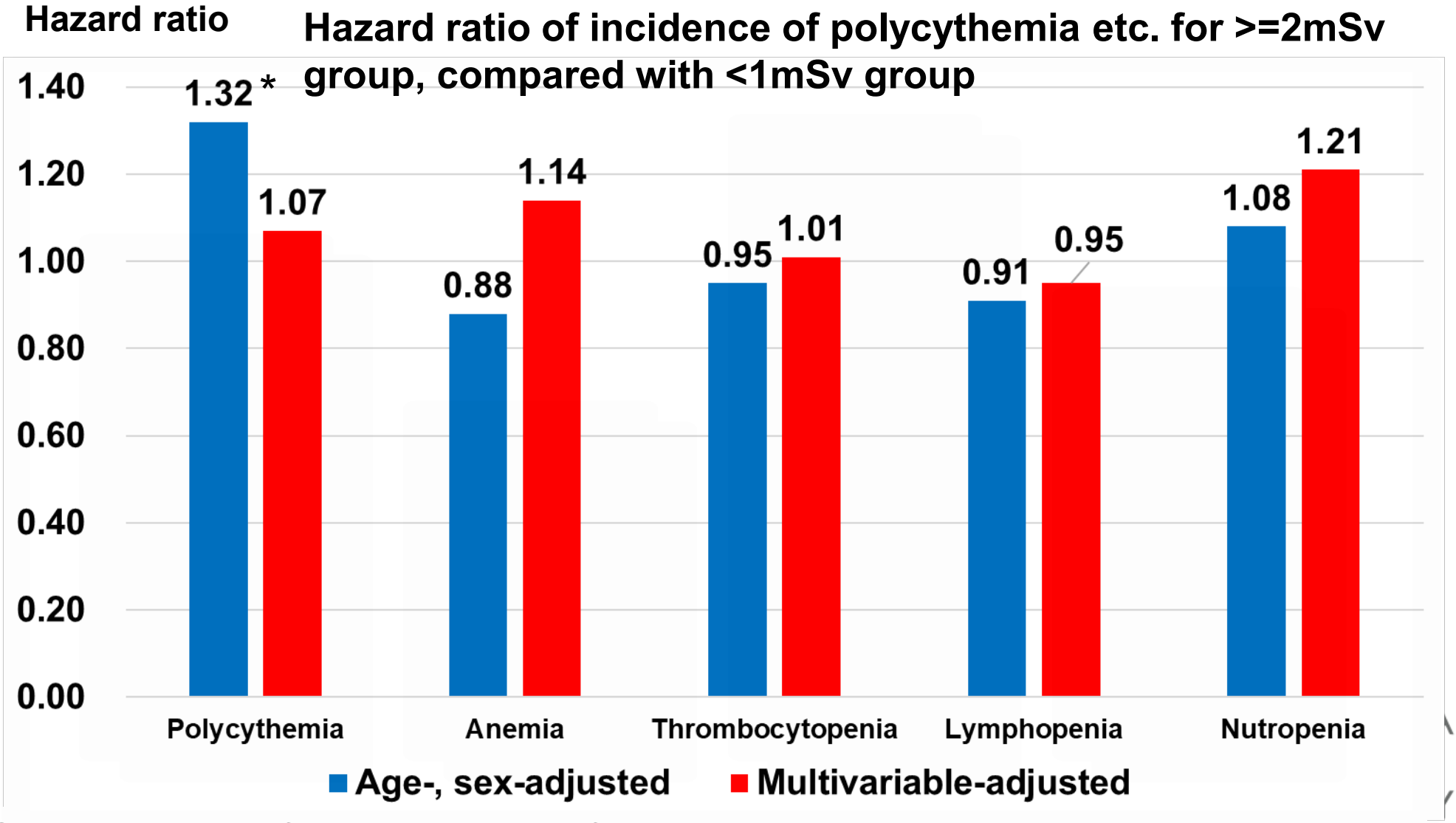
Associations between External Radiation Dose and Lifestyle-Related Diseases



*Statistically significant. **Adjusted for sex, age, BMI, smoking status, excess drinking, evacuation, each values at baseline, and medication use

Sakai A, et al. J Epidemiol. in press.

Associations between External Radiation Dose and Blood Counts



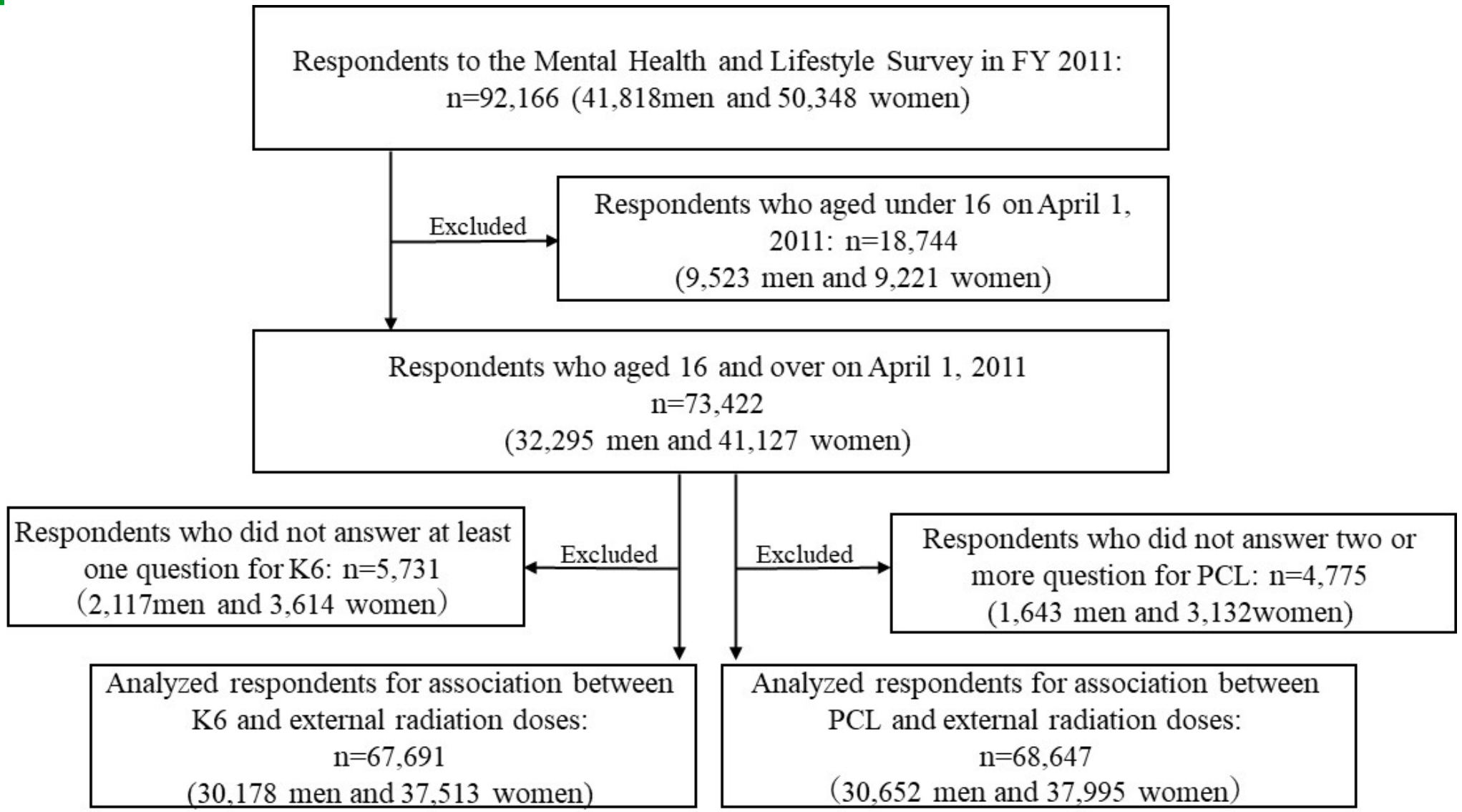
*Statistically significant. **Adjusted for sex, age, BMI, smoking status, excess drinking, and evacuation

Sakai A, et al. J Epidemiol, in press.

Today's Contents

- Associations between external radiation dose and health check-ups results
- **Associations of external radiation dose with psychological distress and trauma reactions**
- Associations between external radiation dose and perinatal outcomes

Mental Health and Lifestyle Survey



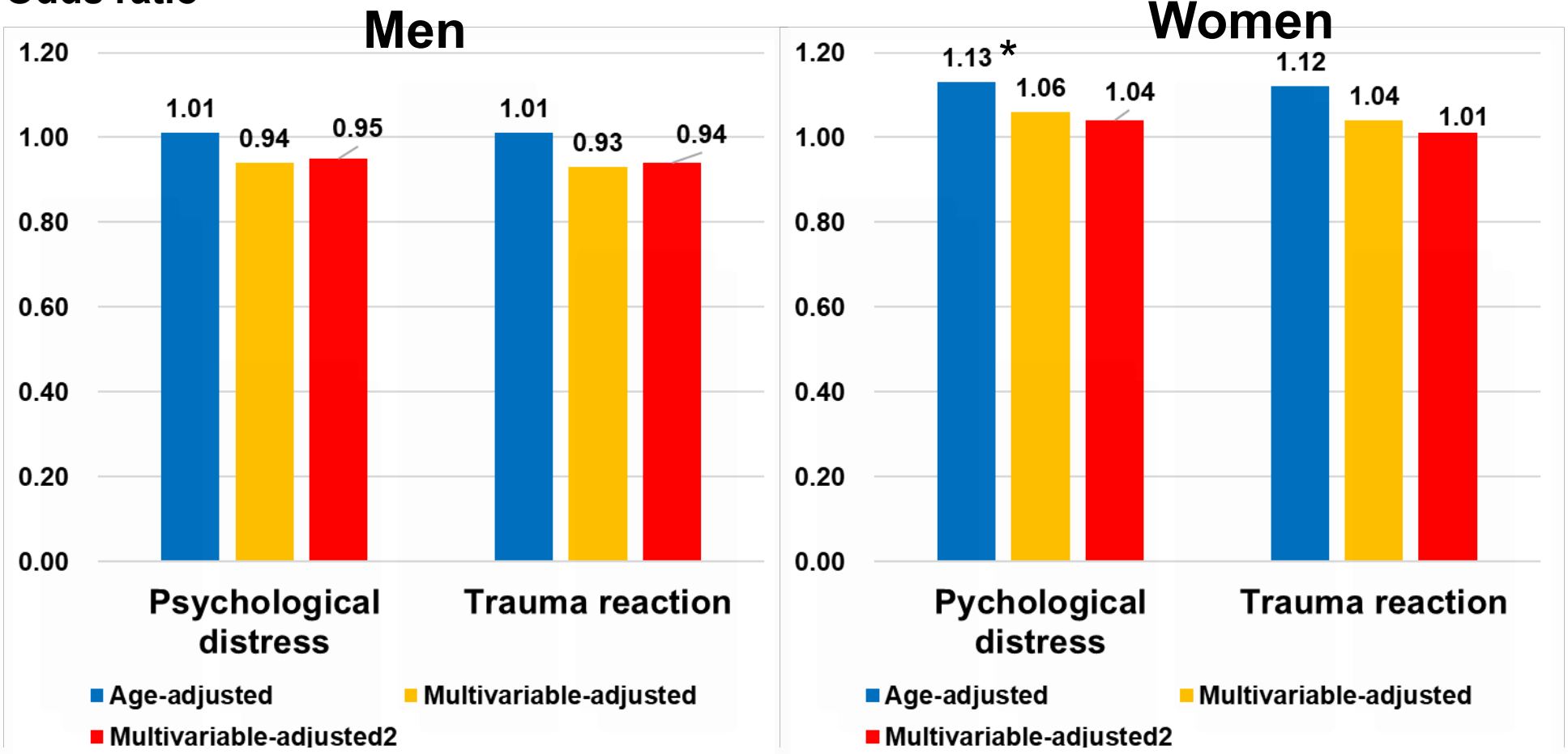
Miura I, et al. J Epidemiol, in press.

Statistical Analysis

- We divided individual external radiation doses measured in the Basic Survey into three groups: <1mSv, 1-2mSv, and ≥2mSv, and examined cross-sectional associations of radiation doses with psychological distress (Kessler 6-item >=13 points) and trauma reaction (PTSD Checklist Stressor-Specific Version >=44 points) at FY2011.
- For the 27,783 (43.3%) participants who did not participate in the Basic Survey, external radiation doses were supplemented by multiple imputation method.

Associations of External Radiation Dose with Psychological Distress and Trauma Reaction

Odds ratios of psychological distress and trauma reaction for >=2mSv group, compared with <1mSv group



*Statistically significant. **Multivariable-adjusted: adjusted for age and evacuation. Multivariable-adjusted2: adjusted for age, evacuation, and radiation risk perception.

Miura I, et al. J Epidemiol, in press.

Today's Contents

- Associations between external radiation dose and health check-ups results
- Associations of external radiation dose with psychological distress and trauma reactions
- **Associations between external radiation dose and perinatal outcomes**

Background

- Based on the results obtained from the Pregnancy and Birth Survey in the Fukushima Health Management Survey, preterm birth rate (<37 weeks), low birth weight rate and congenital anomaly rate did not differ from the national average or from the general data. (*Fujimori K et al., 2014, Ishii K et al.,2017*)
- Regarding the effects of radiation on the fetus, there has been no change in the incidence of congenital anomaly before and after the Chernobyl accident*1, and reports from A-bomb survivors in Hiroshima and Nagasaki*2 have shown no association between exposure and effects on the fetus or the occurrence of congenital anomaly. *1 (*Kolominsky y etal.,1999*) *2 (*Green DM et al, 2009, M. Ohtake et al., 1990*)
- No reports have shown an association between individual radiation dose and perinatal outcome after the Fukushima nuclear accident

Subjects

Subjects

Pregnancies since the earthquake in the Pregnancy and Birth Survey conducted in FY 2011-2018.

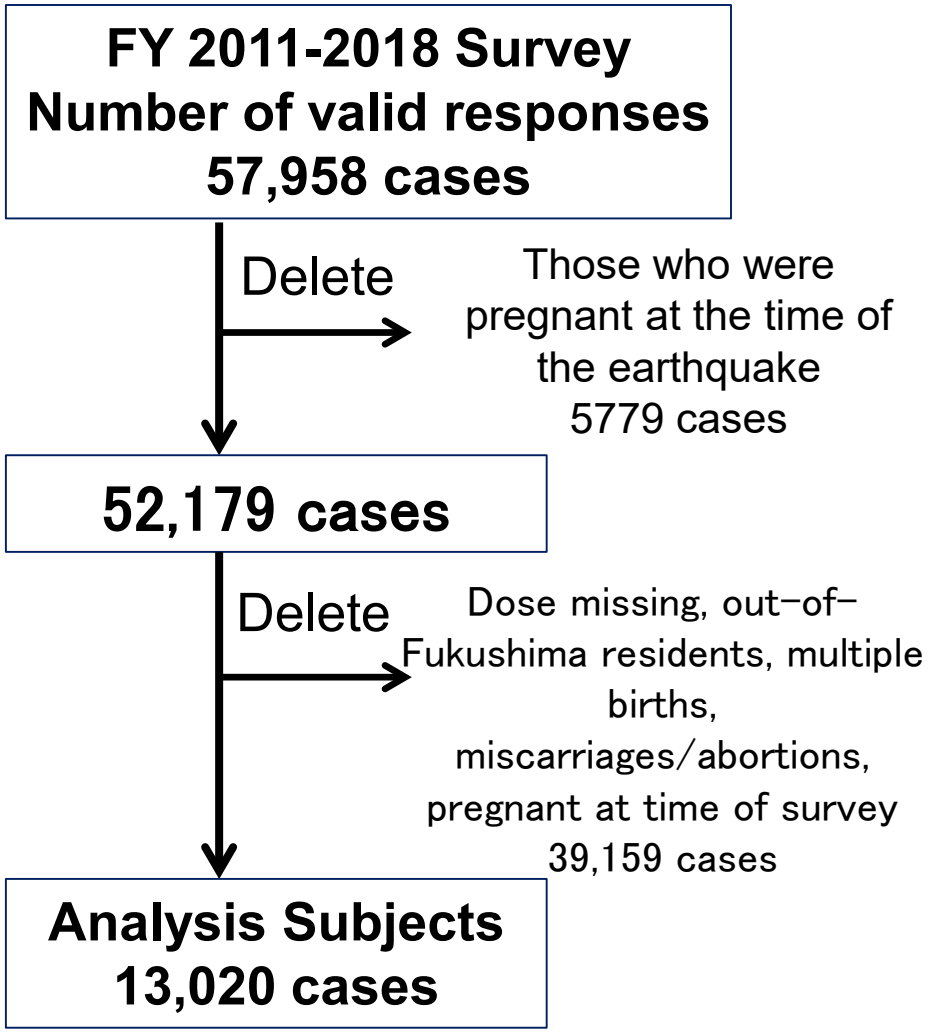
Exclusion

Dose deficit, out-of-prefecture residents, pregnant at the time of the survey, multiple births, and miscarriages/abortions

Primary outcome: the number of

Congenital anomaly rate,

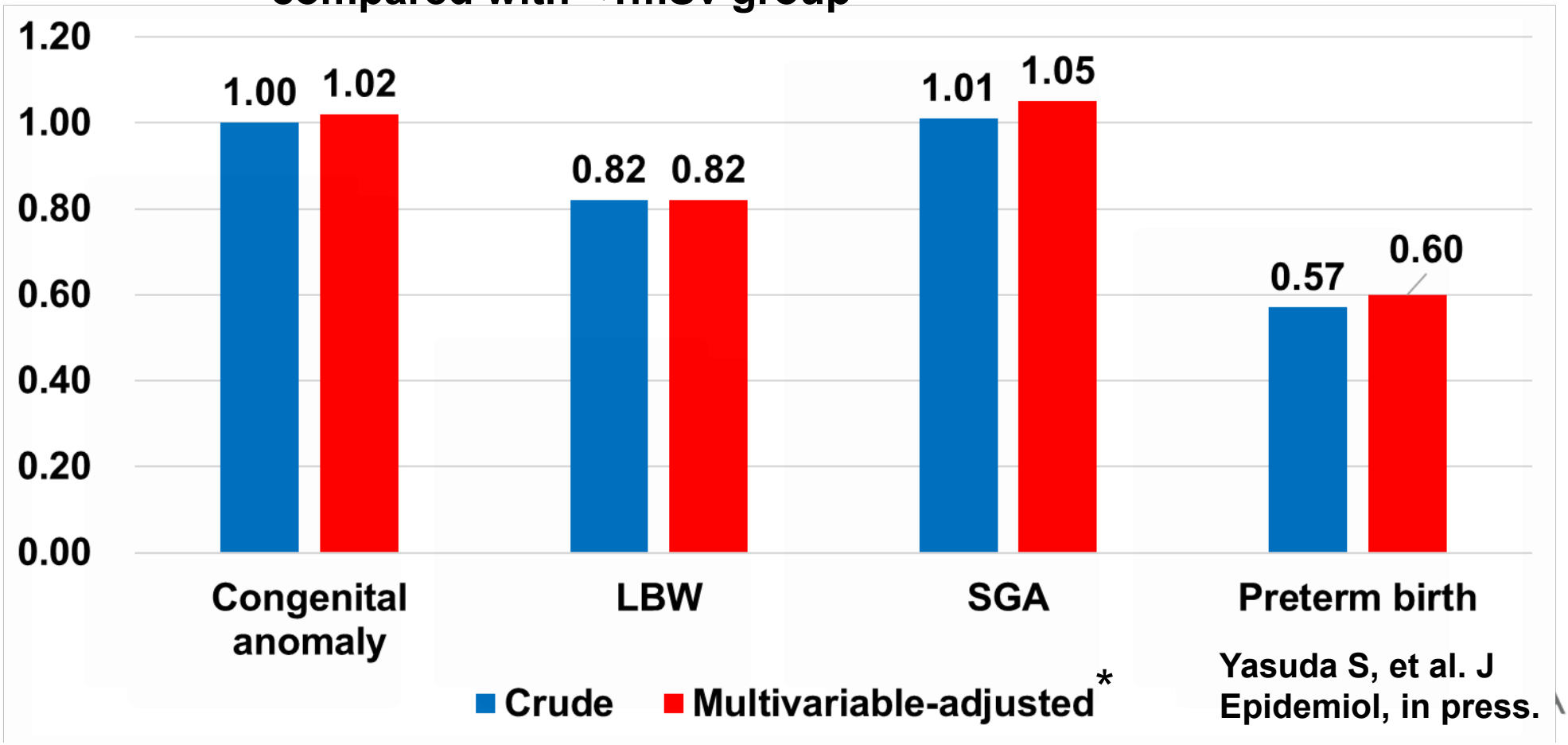
Low birth weight (LBW; <2500g), Small for gestational age (SGA; <10th percentile) rate, and Preterm birth rate (< 37



Statistical Analysis

- We divided individual external radiation doses measured in the Basic Survey into three groups: <1mSv, 1-2mSv, and ≥2mSv, and examined cross-sectional associations of radiation doses with congenital anomaly, LBW, SGA, and Preterm birth.
- Analyses were conducted separately for FY 2011 and FY 2011-2018. For those who did not participate in the Basic Survey, external radiation doses were supplemented by multiple imputation method.

Associations between External Radiation Dose and Perinatal Outcomes



*Adjustment factors: Maternal age, infant sex, number of days since the disaster, first birth or not, placenta previa, gestational hypertension, infertility treatment, mental illness, and evacuation, adjusted for those factors that were significant in univariate analysis.

Limitations

- The response rate of the Basic Survey on external exposure dose is not high → Based on a previous study (Ishikawa et al., J Radiol Prot. 2017), the survey is considered to be representative of external exposure dose in the prefecture → Analyses using the multiple imputation method with missing data yield similar results
- Participation rates for the Comprehensive Health Check, Mental Health and Lifestyle Survey, and Pregnant and Birth Survey were not high and representativeness may be an issue.
- The study was not able to examine the association with internal radiation dose.
- The maximum follow-up period of this study is only 6 years. Longer follow-up is needed to assess radiation effects on disease incidence.

Conclusion

- Among residents in the evacuation are in Fukushima Prefecture, the risk of developing lifestyle-related diseases is higher among those with higher external radiation doses, but this must be due to the evacuation and subsequent lifestyle changes rather than the direct effects of radiation exposure.
- Among residents of the evacuation area, an increased risk of psychological distress was observed among women with higher external radiation doses, possibly due to the evacuation experience and perceived radiation risk.
- No apparent association between post-disaster external radiation dose and perinatal outcomes among pregnant women in Fukushima Prefecture
- Further long-term follow-up is needed to clarify the health effects of low-dose radiation exposure.

The content of this presentation will be published in Journal of Epidemiology, vol:32, Suppl. “Sakai A, et al. J Epidemiol, in press; Miura I, et al. J Epidemiol, in press; Yasuda S, et al. J Epidemiol, in press”


Thank you

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