GLOBAL CANCER: OCCURRENCE, CAUSES, AND AVENUES TO PREVENTION

IARC 50th Anniversary Conference

A scientific conference to celebrate the 50th anniversary of the International Agency for Research on Cancer.

7-10 JUNE 2016
Centre de Congrès
Lyon, France

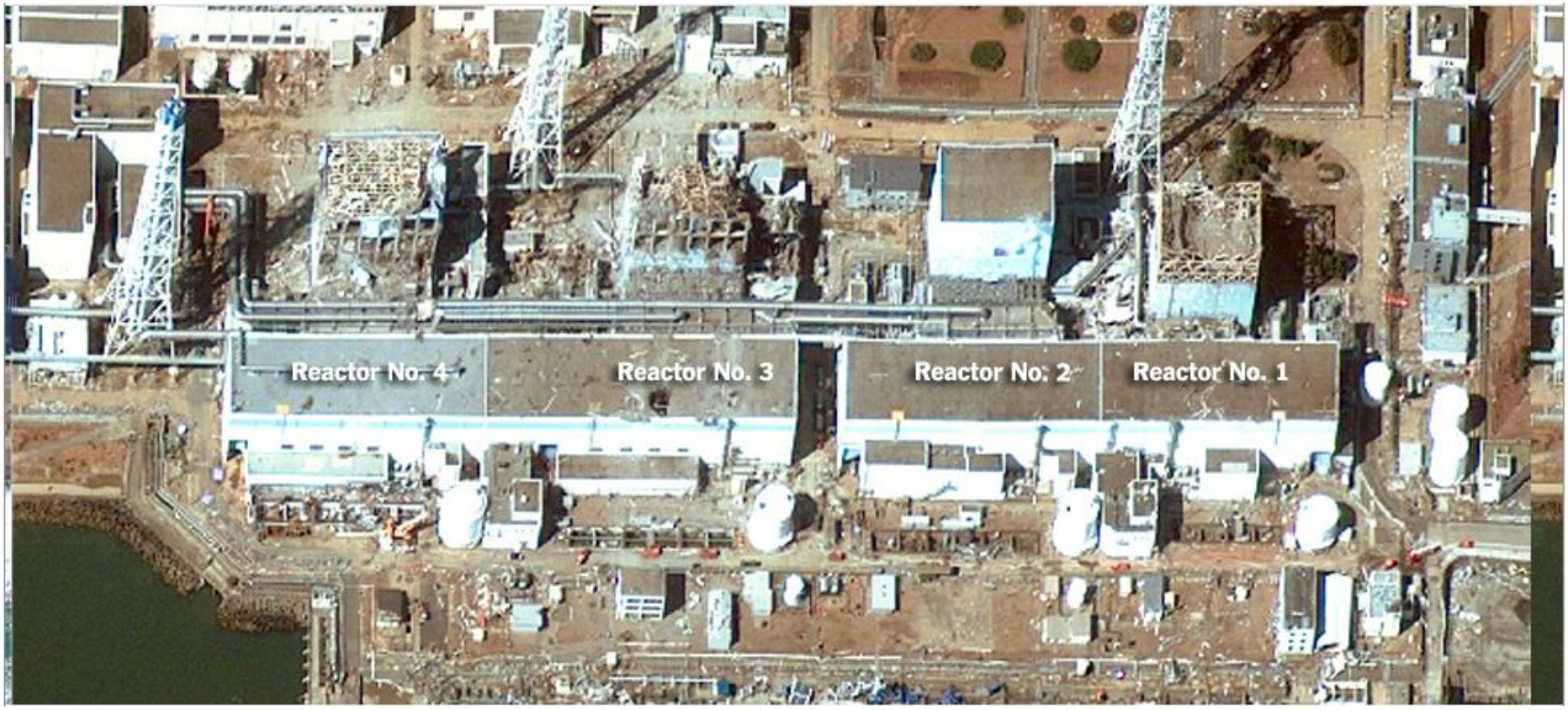
Epidemiology: "Radiation"
Thursday 9 June 16:00-17:00
IARC, Lyon, France

Radiation and Health Effects

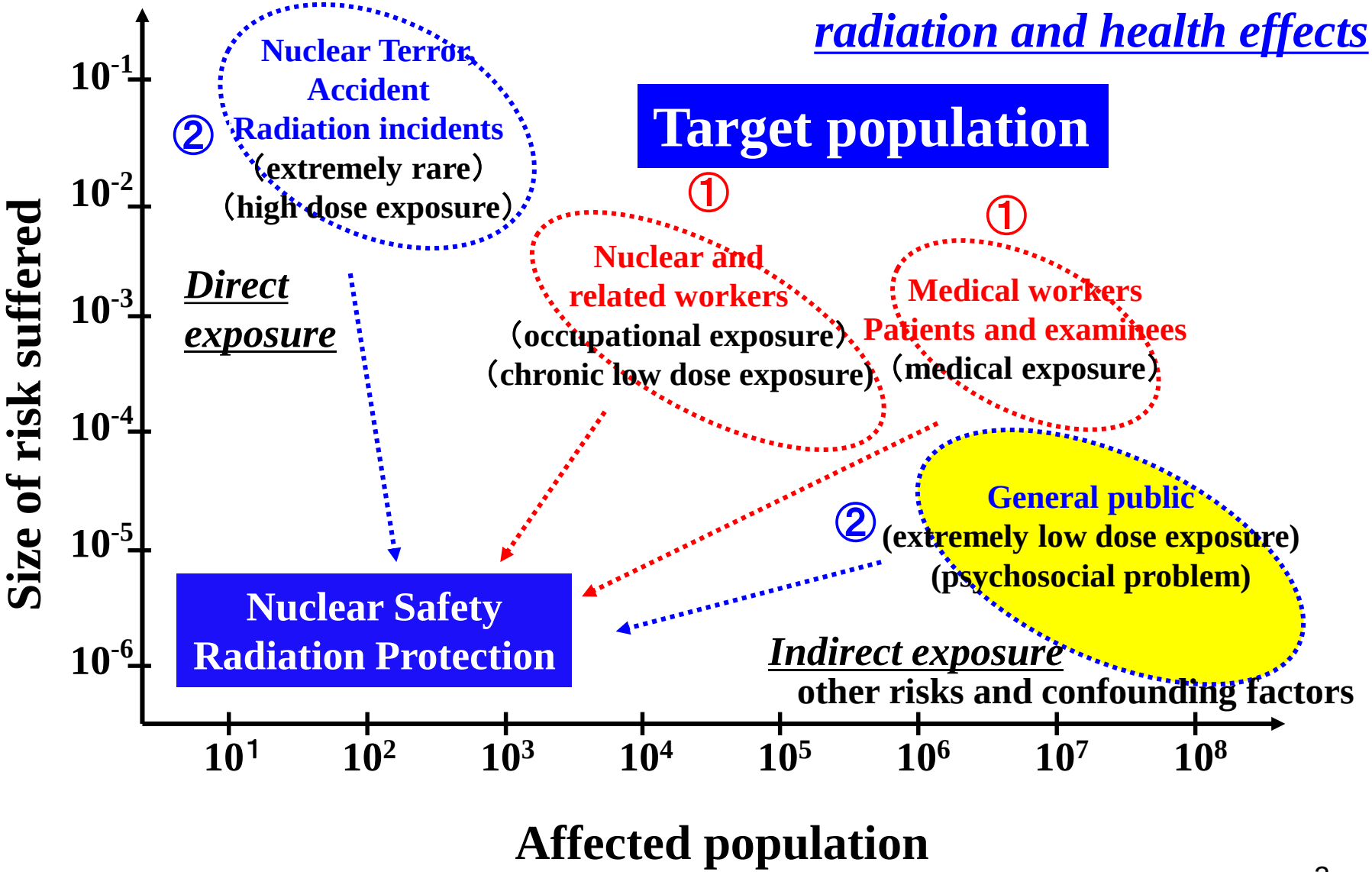
A gap of understanding between real radiation health risk and public risk perception beyond the accumulated scientific knowledge

Shunichi Yamashita, MD, PhD.

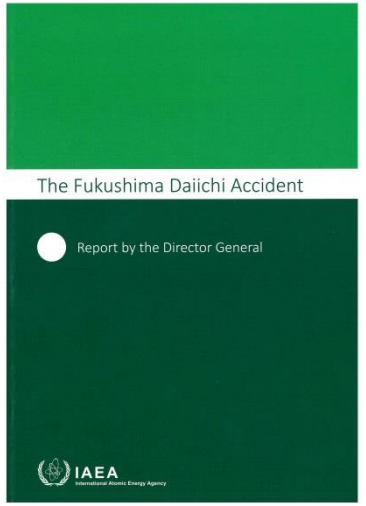
Nagasaki University and Fukushima Medical University, JAPAN



Different approaches needed for the targeted population based on dose and pattern of radiation exposure to evaluate the relationship between *radiation and health effects*

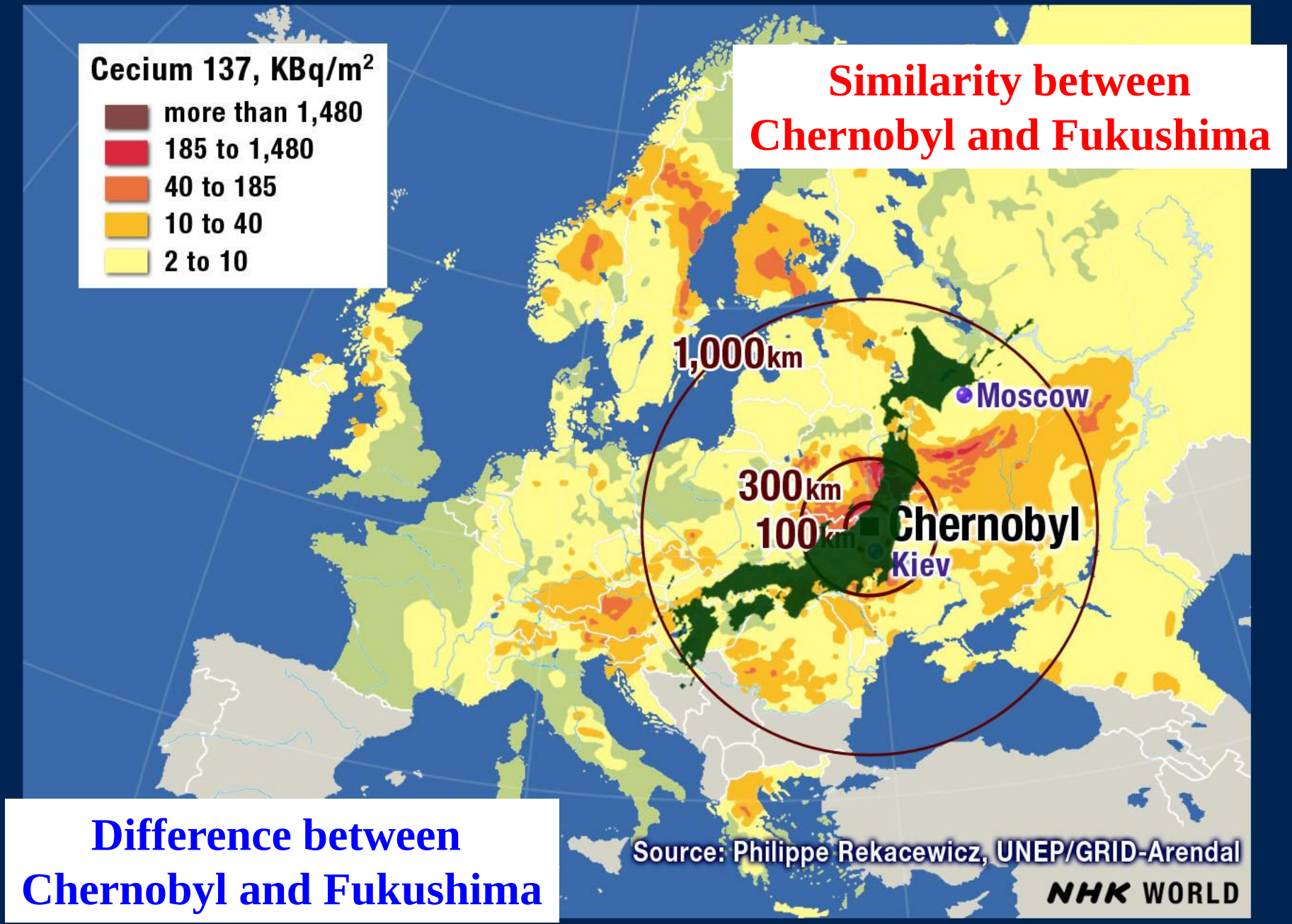


The Fukushima Daiichi Accident reported by the Director General 2015, pp208, IAEA

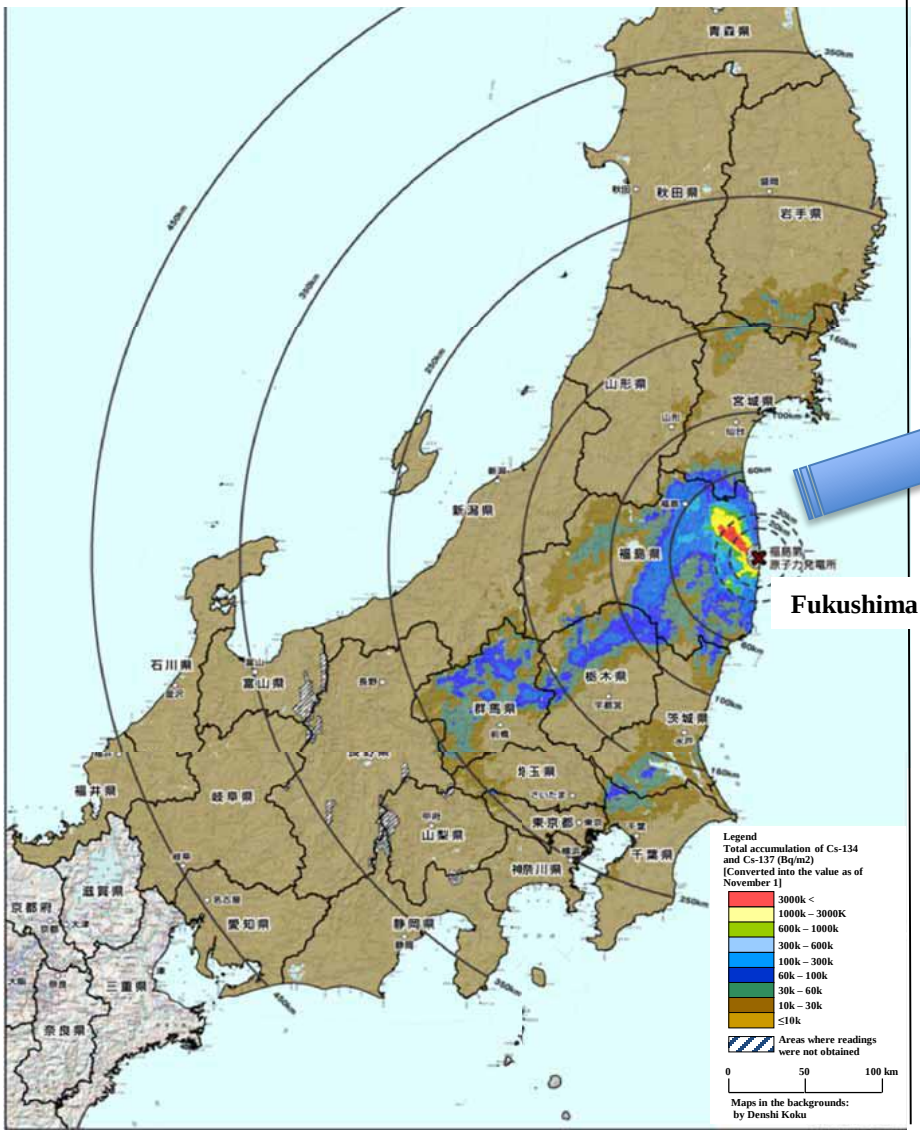


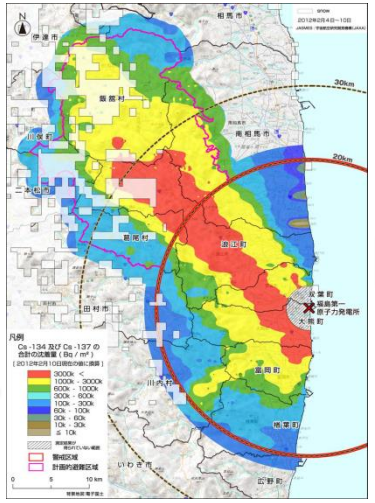
Section 1: Introduction	The Report on the Fukushima Daiichi Accident					
Section 2: The accident and its assessment	Description of the accident	Nuclear safety considerations	Technical Volumes 1&2			
Section 3: Emergency preparedness and response	Initial response in Japan to the accident	Protecting emergency workers	Protecting the public	Transition from the emergency phase to the recovery phase and analyses of the response	Response within the international framework for emergency preparedness and response	Technical Volumes 3
Section 4: Radiological consequences	Radioactivity in the environment	Protecting people against radiation exposure	Radiation exposure	Health effects	Radiological consequences for non-human biota	Technical Volumes 4
Section 5: Post-accident recovery	Off-site remediation of areas affected by the accident	One-site stabilization and preparations for de-commissioning	Management of contaminated material and radioactive waste	Community revitalization and stakeholder engagement	Technical Volumes 5	
Section 6: The IAEA response to the accident	IAEA activities	Meetings of the contracting Parties to the Convention on Nuclear Safety	Technical Volumes 1& 3			

- **WHO Preliminary Report 2012, 2013 -Dose Estimates and Risk Assessments-**
- **UNSCEAR Fukushima Report 2013, 2015**

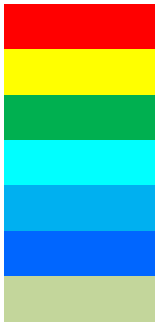

Cecium 137, KBq/m²
more than 1,480
185 to 1,480
40 to 185
10 to 40
2 to 10
Similarity between
Chernobyl and Fukushima
1,000km
Moscow
300km
100km
Chernobyl
Kiev
Difference between
Chernobyl and Fukushima
Source: Philippe Rekacewicz, UNEP/GRID-Arendal
NHK WORLD

Results of the Airborne Monitoring Survey by MEXT as of November 1, 2011 (Total accumulation of Cs-134 and Cs-137 on the ground surface)





Fukushima Dai-ichi NPP

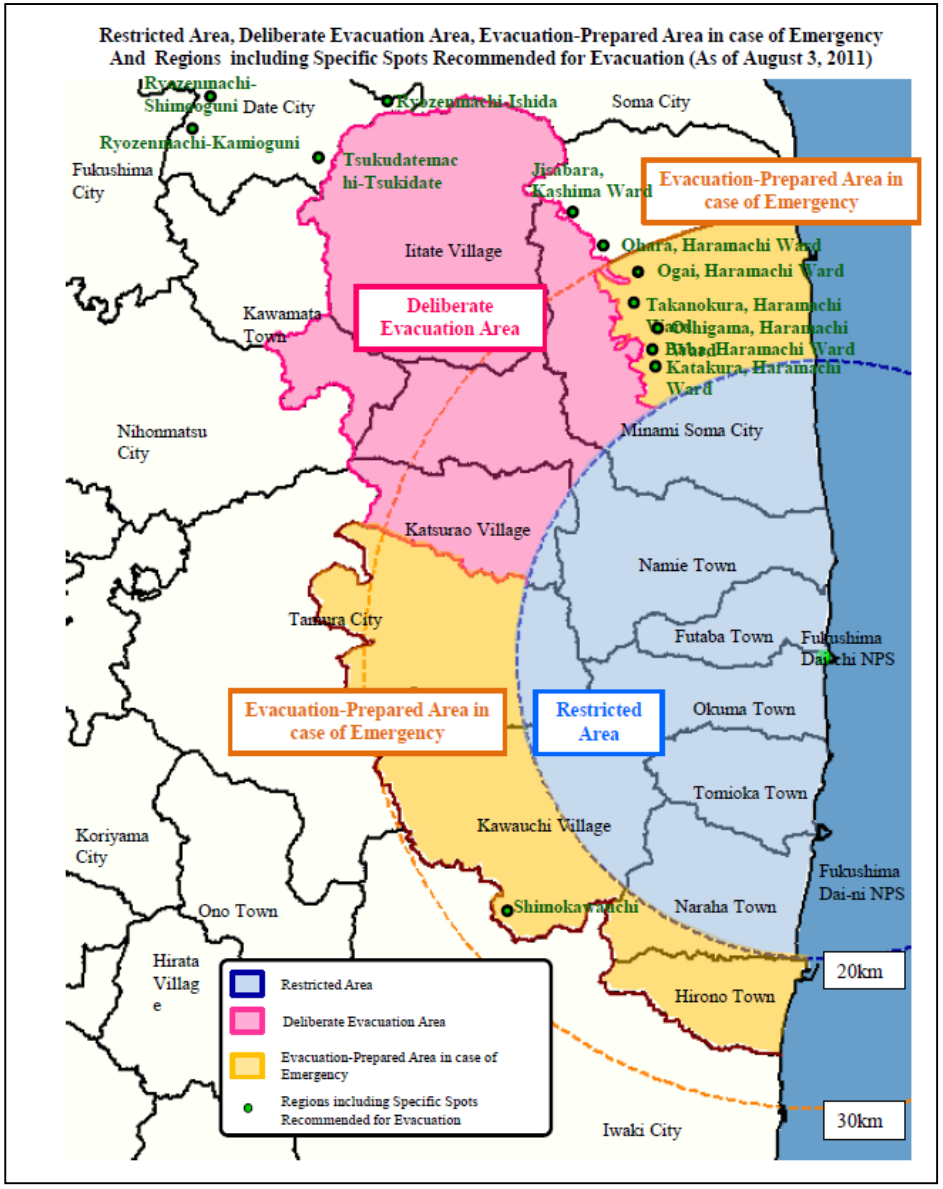


Bq/m²

3,000K<
1,000-3,000K
600-1,000K
300-600K
100-300K
60-100K
30-60K

(Source: MEXT)

Evacuation Status of Residents in Fukushima



Number of evacuees from designated evacuation areas:

- **Restricted Area:**

  about 77,000

- **Deliberate Evacuation Area:**

  about 10,000

- **Evacuation-Prepared Area:**

  about 26,000

Total: about 113,000

(Source: Cabinet Office, Feb 2012)

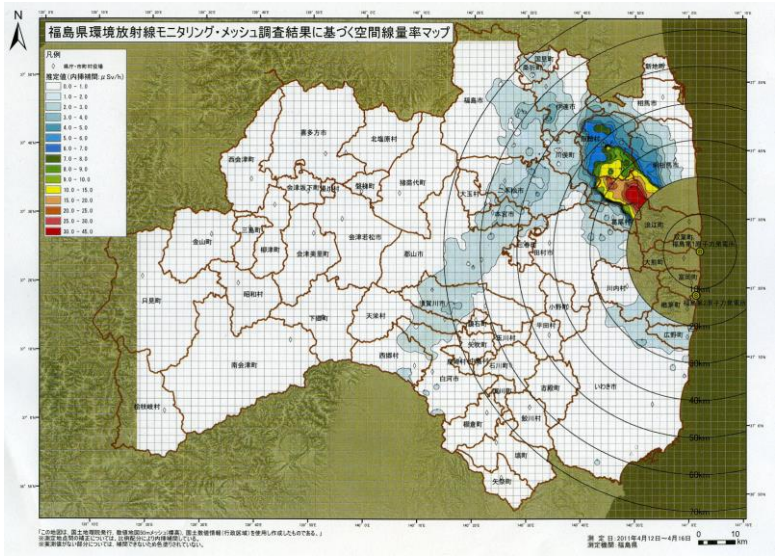
From Chernobyl to Fukushima

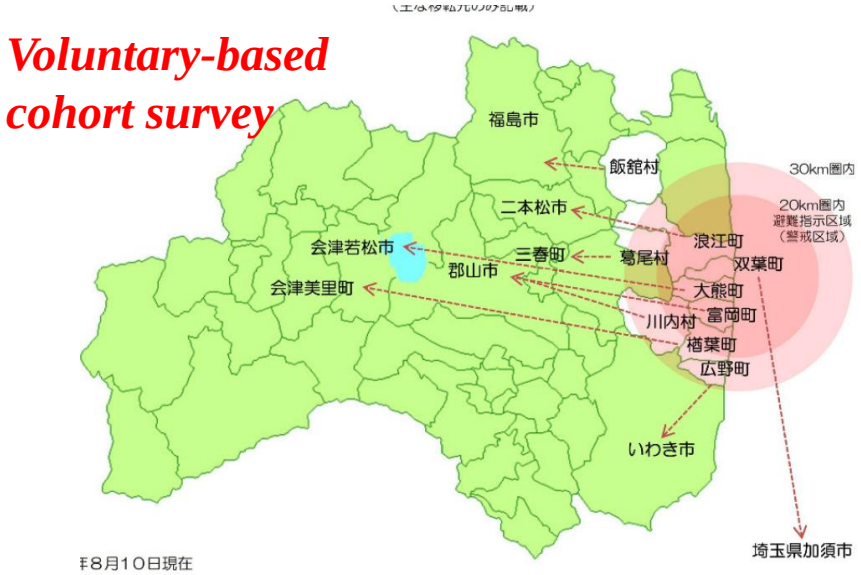
at the standpoint of radiation health risk management

- ***Atomic Bomb survivors' data*** **and radiation risk analysis with other exposure groups have proved the *dose- and age- dependent* cancer risk after *external* irradiation for all their life with unlimited latency *but no PTSD risk approaches before1995*.**
- ***Chernobyl data*** **suggest a dramatic increase of *childhood thyroid cancers* associated by short-lived radioactive iodines by its *internal* exposure just after the accident and also a *psychosocial impact*.**
- ***Fukushima data*** **suggests the necessity of public health response and of improvement of *radiation risk communication beyond the model of LNT*.**

Fukushima Health Management Survey

- **The design of the health management was planned in May, 2011, which was divided into two categories: a basic survey of dose estimates for all the residents and further HEALTH examination of target populations.**
- **The objectives are to watch over a long-term health condition of residents in Fukushima and to promote their health and welfare.**
- **If exists, it is also aimed to investigate whether a long-term low-dose rate radiation exposure has an effect on their health or not.**





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:

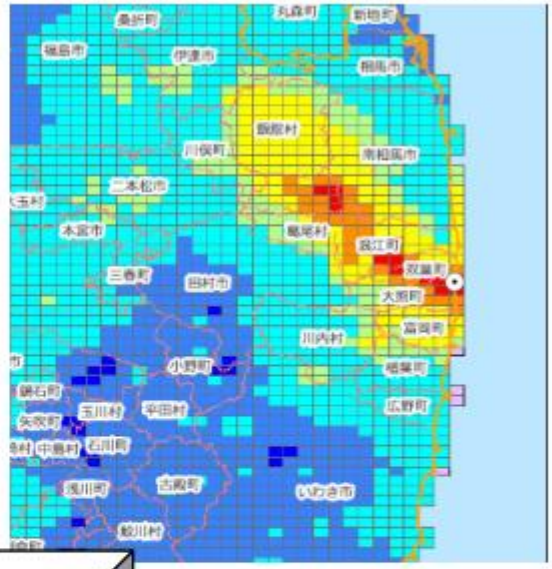
1. **Basic survey (subjects: 2 million all resident in Fukushima)**
2. **Detailed survey**
   - ***Thyroid examination by ultrasonography (370,000; 0-18 y/o)***
   - **Comprehensive medical checkups (210,000 ; Evacuees)**
   - **Mental health and lifestyle survey (210,000 ; Evacuees)**
   - **Survey on pregnant women and nursing mothers (16,000)**

How to analyze radiation dose

Questionnaire

Movement & behavior 調査

Time-course of air dose map



Estimation dose calculating combined above two information by NIRS

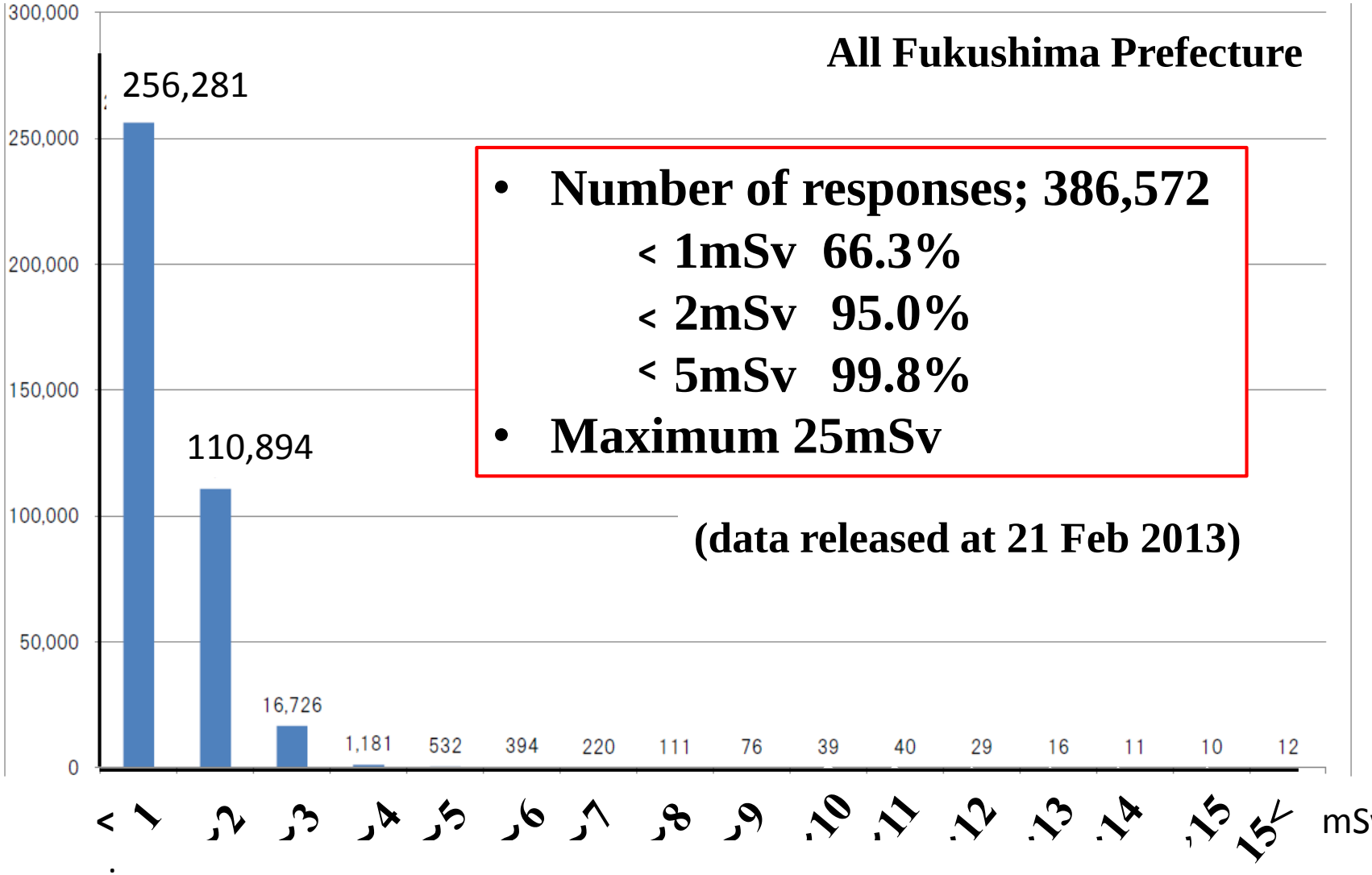
To help understanding of individual first 4M dose

To help understanding of radiation-related health risk

To establish database for long-term health management

Distribution of External Exposure Dose (mSv)

(Estimated Cumulative effective dose from March 11 to July 11)



Estimated from location and time course on questionnaire

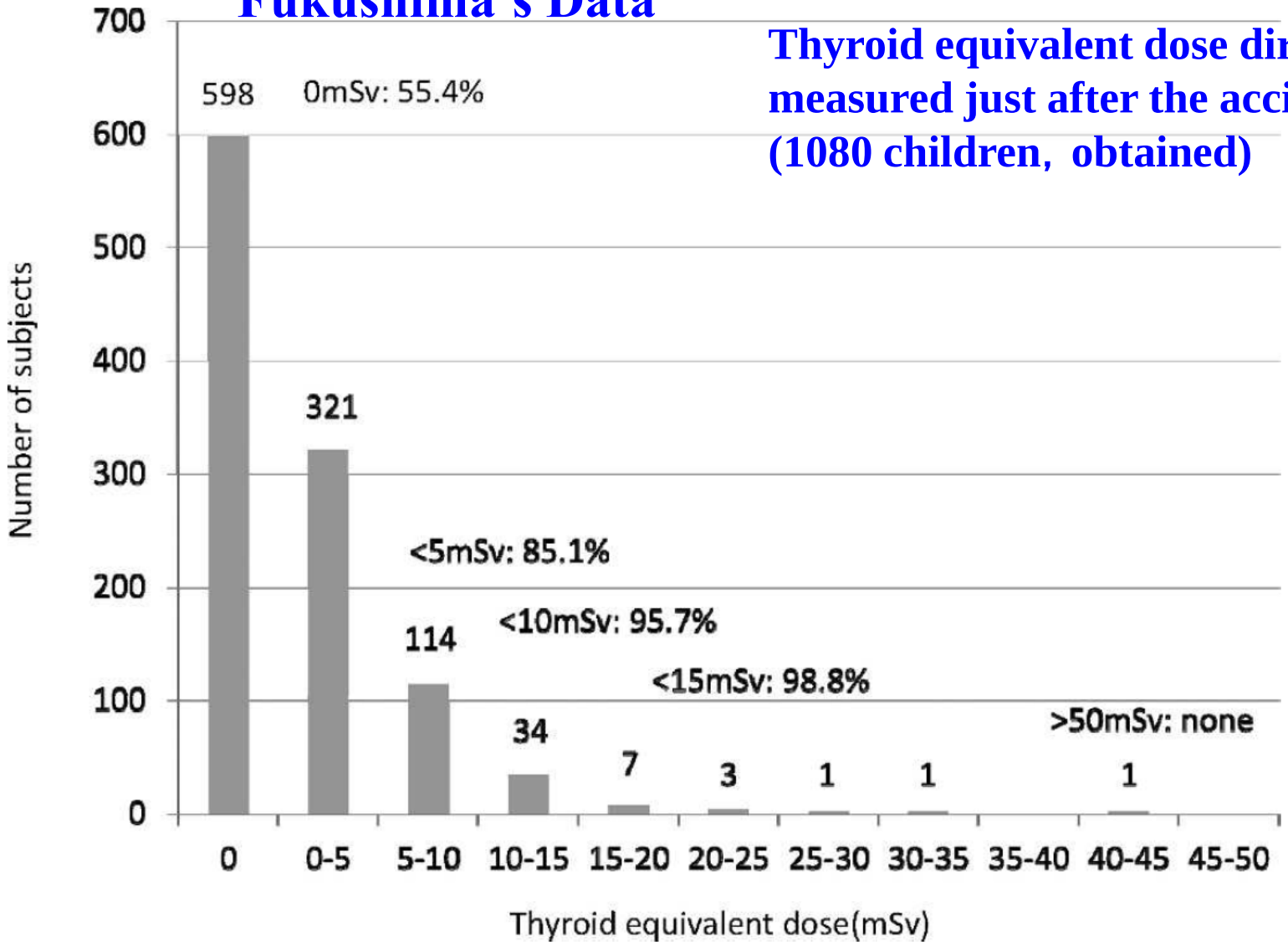


Fig.5 Distribution of thyroid equivalent doses estimated by the results of the screening survey and the intake scenario from March 12, 2011 to the day before measurements.

Radiation Research 180(5):439-447, 2013

Different thyroid dose between Ukraine and Fukushima

Different thyroid dose between Belarus and Fukushima

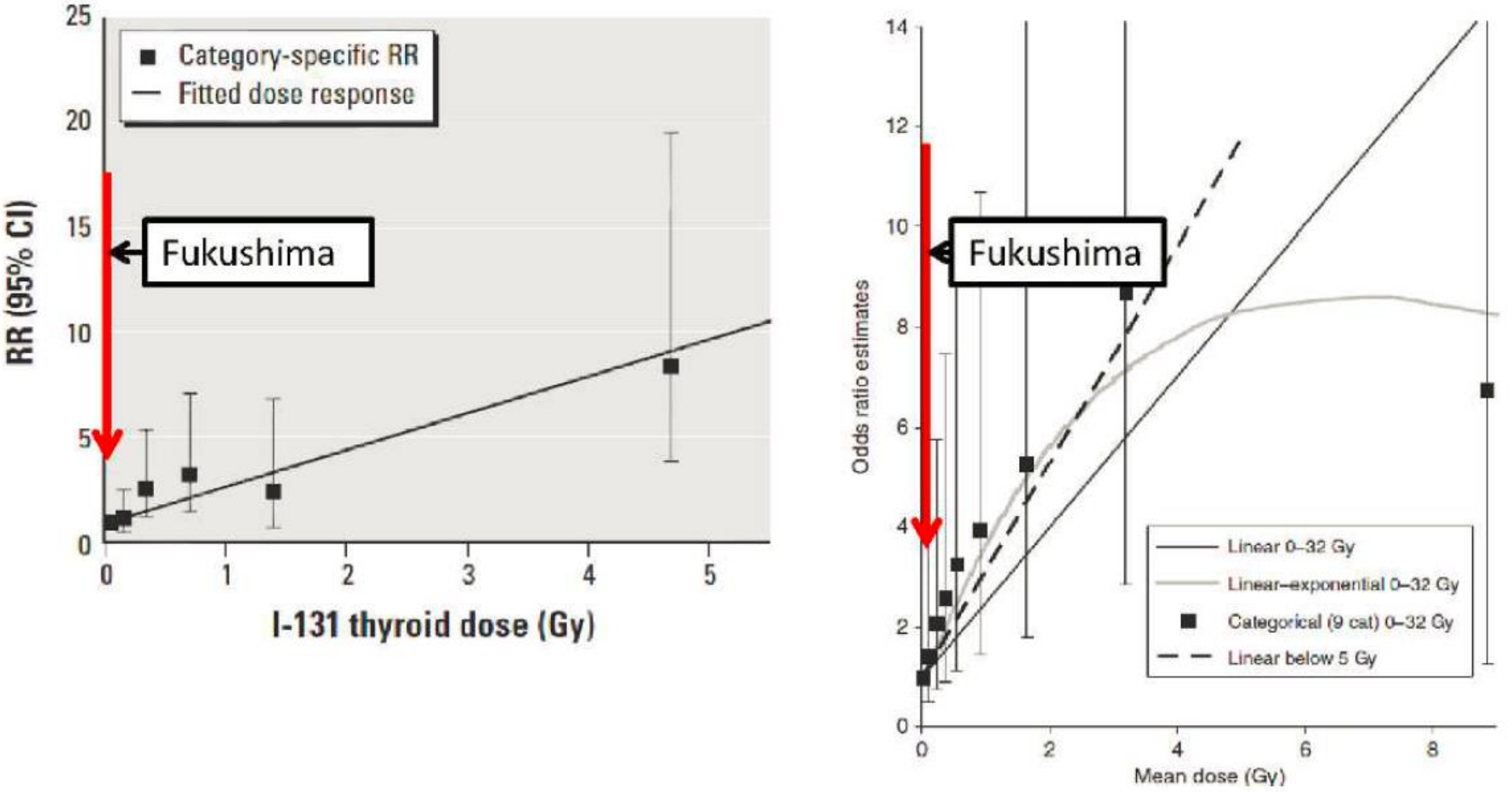
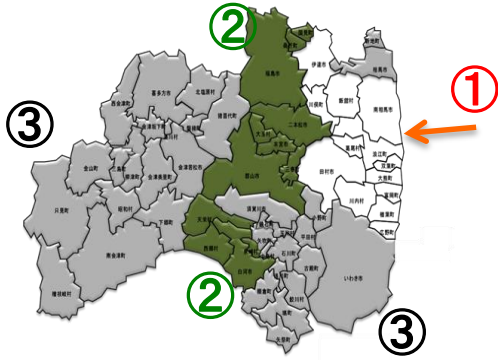


Fig.6. Panel a: Thyroid radiation doses in Fukushima, Ukraine and Belarus in dose-response relationship between thyroid cancer and ^{131}I. Panel b: Dose-response relationship for the incidence of thyroid cancers. Both figures were modified from two articles (republished with permission, Brenner AV, et al. *Environ Health Perspect* 2011; 119: 933-9 and Zablotska LB, et al. *Br J Cancer* 2011; 104: 181-7).

Thyroid Ultrasound Examination Schedule

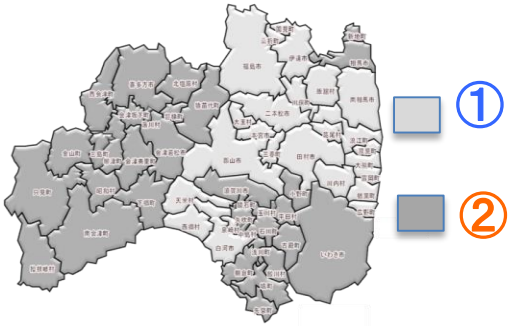
- **Preliminary Baseline Survey (PBS)subjects: 368,000**

  ① *1st survey: FY2011, from October 2011 to March 2012*
  ② *2nd survey: FY2012, from April 2012 to March 2013*
  ③ *3rd Survey: FY2013, from April 2013 to March 2014*

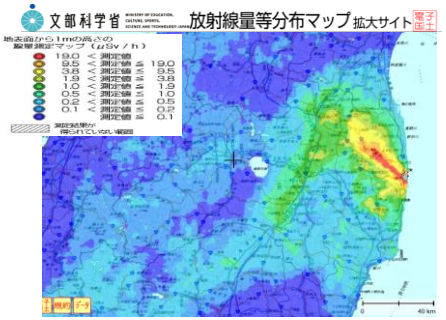


- **Full scale survey（FSS) subjects: 380,000**

  ① *1st survey: FY2014, from April 2014 to March 2015*
  ② *2nd survey: FY2015, from April 2015 to March 2016*



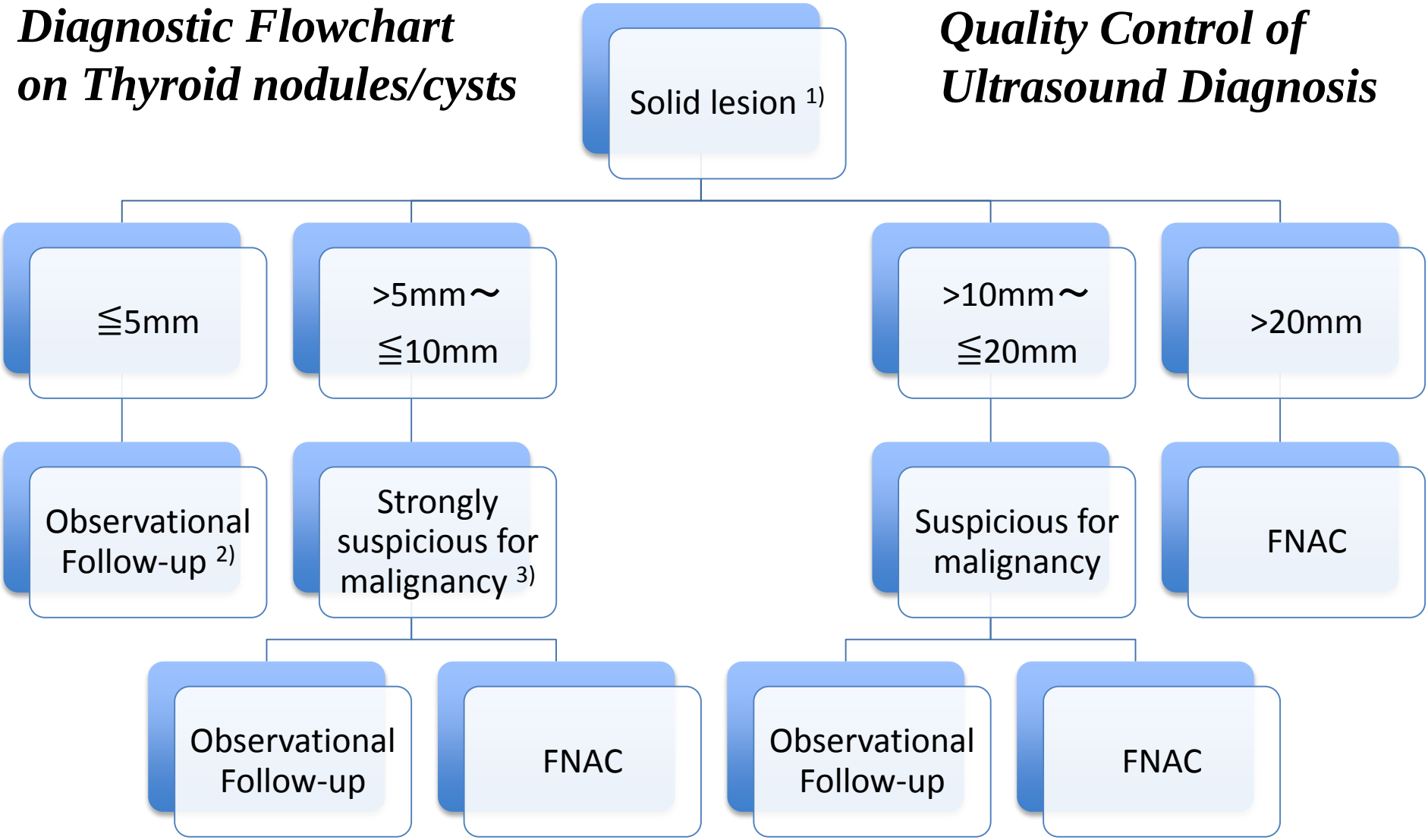
The full-scale survey will then continue every two years for each subject until the age of 20, then every five years thereafter for the remainder of each subject's life.



TUE was performed first on those who were living in high-exposure areas at the time of the accident.

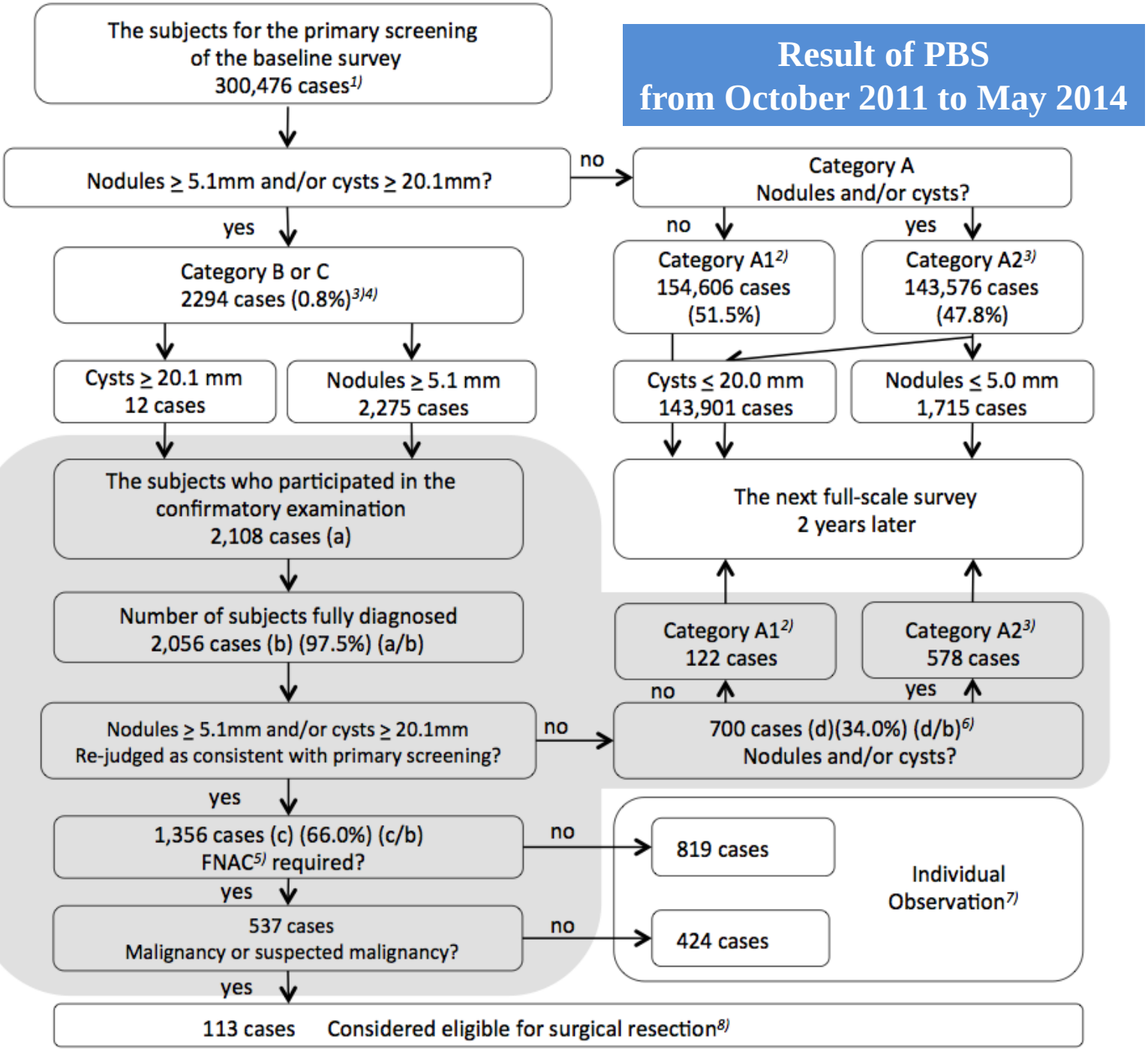
Diagnostic Flowchart on Thyroid nodules/cysts

Quality Control of Ultrasound Diagnosis



Standardized Diagnostic Protocol

Result of PBS from October 2011 to May 2014



Geographical and Yearly Differences of Childhood Thyroid Cancer in Fukushima

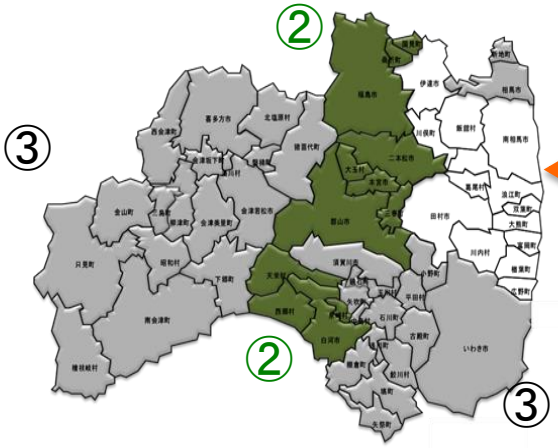
Air-born dose

RH

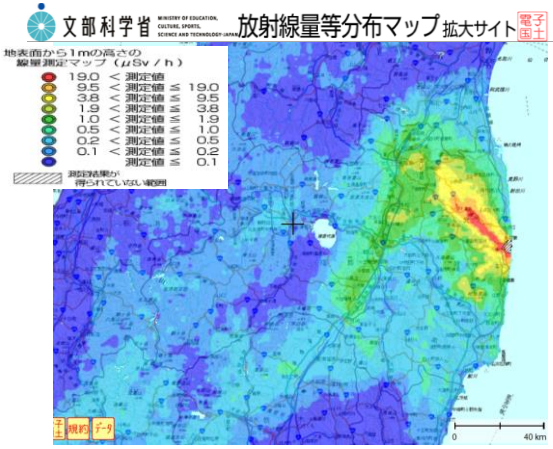
M

L

	Fiscal Year	Number of examinees	Malignancy suspected	Ratio of Malignancy (%)
①	2011FY	41,810	15	0.036
②	2012FY	139,338	56	0.040
③	2013FY	119,328	42	0.035
	合計	300,476	113	0.037

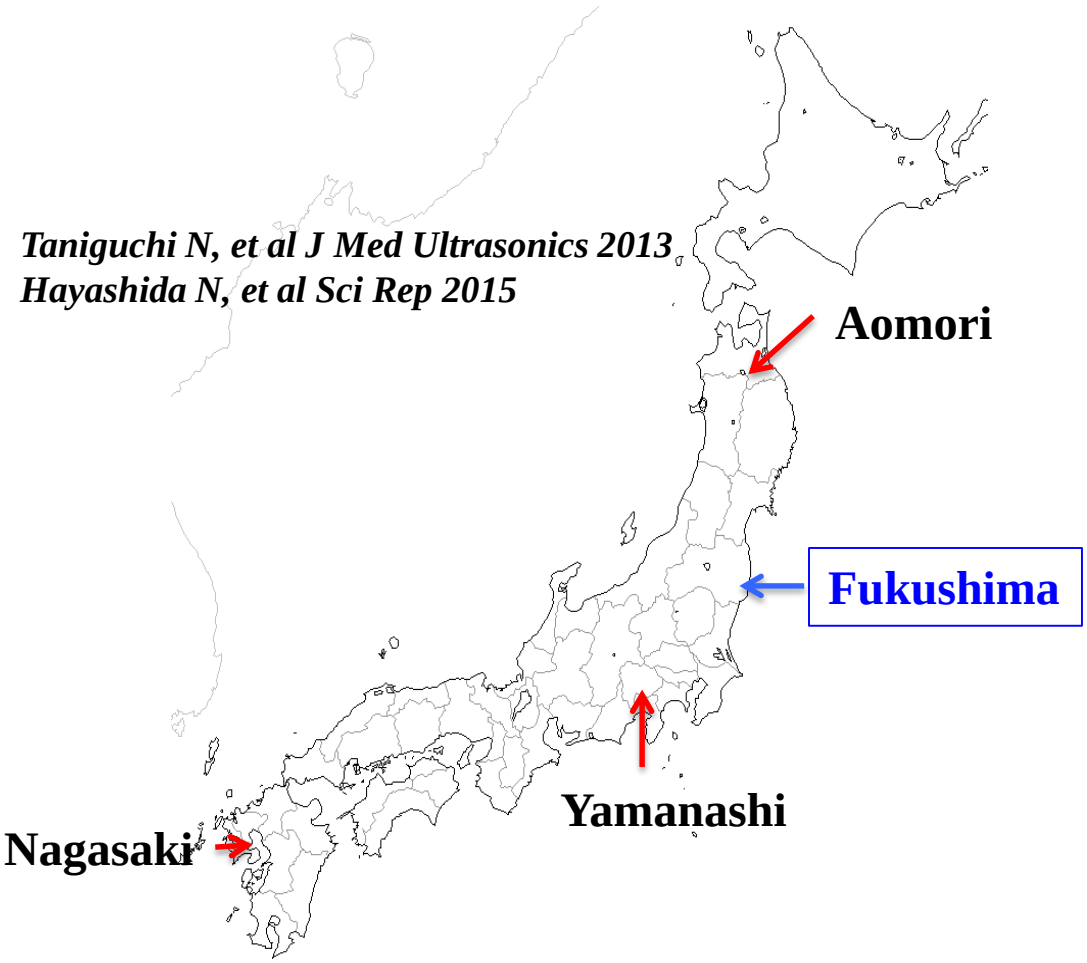


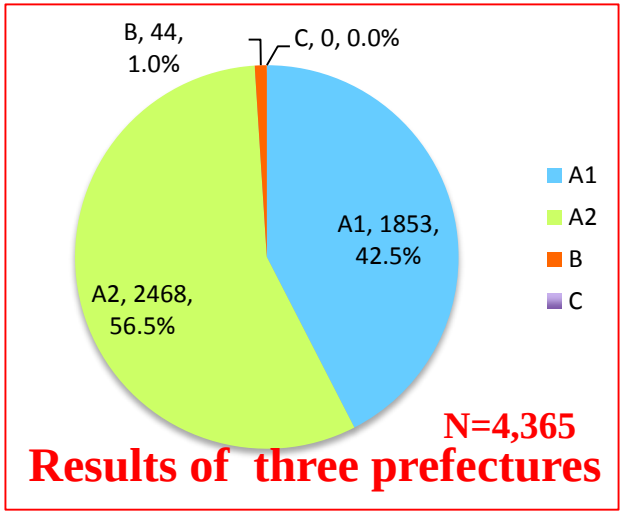
① From October 2011

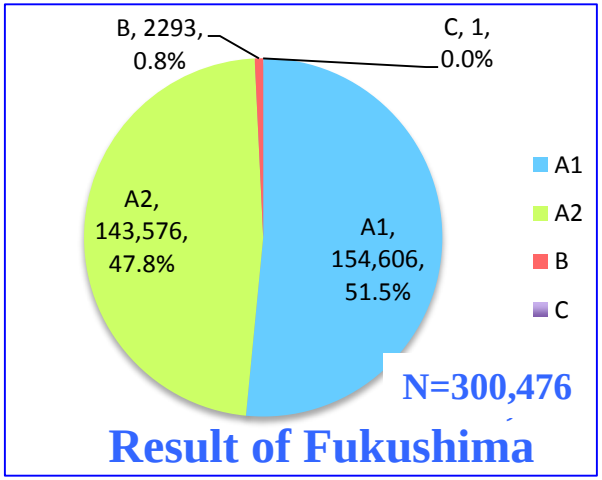


Thyroid ultrasound findings in children from three prefectures: Aomori, Yamanashi, and Nagasaki

To obtain comparative data for increasing A2 in Fukushima, the Ministry of Environment entrusted the Japan Association of Breast and Thyroid Sonology (JABTS) to perform thyroid examinations by the same method used in Fukushima Prefecture.







Malignant or suspicious cases detected by US-FNAB in Fukushima

March 31, 2015

Number of cases (FY 2011-2013)	**Total 112**
Gender	**Male: 38 Female: 74**
Mean age (SD, min-max)	**17.2 years (±2.7, 8-22)**
	at the time of diagnosis
	14.8 years (±2.6, 6-18)
	at the time of the disaster
Mean tumor size (SD, min-max)	**14.2 mm (±7.8, 5.1-45.0)**

Pathological diagnosis of 99 surgical cases

1 benign nodule
95 papillary thyroid carcinomas
3 poorly differentiated carcinoma

68 Operated Thyroid Cancer Cases
-clinico-pathological and genetic findings-

- **Age and sex at operation; 17.3±2.8 (M22, F 46)**
- **Tumor size; 14.7±9.2mm**
- **Histology; CP61, FV2, CMV4, PD1**
- **TNM classification; pT1/2 37, pT3 31; pN0 15, pN1a or 1b 52; M0 65, M1 2; pEx0 36, pEx1 32**

- **<u>Genetic mutation</u>;**

  ***Braf^{V600E}* 43 (63.2%), *H-Ras* 0, *K-Ras* 0, *N-Ras* 0, *Ret/PTC1* 6 (8.8%), *Ret/PTC3* 1 (1.5%), *ETV6(ex4)/NTRK* 4 (5.9%), *ETV6(ex5)/NTRK* 0, *AKAP9/Braf* 0, *TERT C250T* 0, *TERT C228T* 0**

Summary

How to interpret the 137 cases of childhood/adolescent thyroid cancer detected in Fukushima in the past four years (2011-2014)

due to sophisticated US Mass Screening from neonates to young adolescence

Screening Bias/Harvest Effect

Latency and Dose; Fukushima ＜Chernobyl

Unlikely due to radiation exposure

Basal prevalence of thyroid cancer?

Overdiagnosis?
Overtreatment?

unnecessary examination?
indolent tumor?
life-time asymptomatic microcarcinoma PTC?

- merits and demerits of early diagnosis by US screening-

5~10mm in tumor size;
***indication of FNA cytology**
***watch and wait strategy**

Thyroid Highlights in Fukushima

- **Out of the 2 million residents in Fukushima, there were about 367,000 children and adolescents aged less than 18 years at the time of the FNPP accident. *Because of the urgent requests from the public, and the central and local governments, thyroid ultrasound examination was implemented for neonates, infants, children, and adolescents to address fear and anxiety about thyroid cancer risk.***
- **Although the risk of radiation-associated health consequences in Fukushima is considerably low based on the estimated radiation doses individuals received during the accident, *a high prevalence of childhood and adolescent thyroid cancers detected by a mass screening aggravates negatively radiation fear and anxiety*.**
- **It is, therefore, critically important to explain the current prevalence of thyroid cancers in Fukushima to the public correctly *as a mass screening effect but not as epidemic due to direct linkage of radiation-induced*.**

(ASCO Daily News Article June 2016*;* *http://bit.ly/1UhYswE*)

Fukushima Radiation and Health

http://fmu-global.jp

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News

All

2016-06-07	NEW! Proceedings of the 23rd Prefectural Oversight Committee Meeting for Fukushima Health Management Survey
2016-05-26	NEW! 5th International Expert Symposium in Fukushima will be held on September 26, 27
2016-03-11	8 March 2016 Five Years After the Triple Disaster of March 11, 2011, FMU Held an International Symposium
2016-02-16	Proceedings of the 22nd Prefectural Oversight Committee Meeting for Fukushima Health Management Survey
2016-01-22	12-13 Dec 2015 International Workshop on the Fukushima Dialogue Initiative
2015-12-14	10-11 Nov 2015 STS Technical Meeting in Nagasaki
2015-12-03	Proceedings of the 21st Prefectural Oversight Committee Meeting for Fukushima Health Management Survey
2015-11-27	27 Nov 2015 IAEA releases a free online learning platform based on a Train-the-Trainers Workshop held at FMU
2015-11-04	22 Oct 2015 UNSCEAR Published Fukushima 2015 White Paper
2015-10-16	17 Sep 2015 Report on the KHNP-RHI International Seminar 2015
2015-09-14	14 Sep 2015 International Commission on Radiological Protection leaders visited FMU
2015-09-12	12-13 Sep 2015 The 12th Dialogue Seminar
2015-09-03	3 Sep 2015 Specialists from Korea Hydro and Nuclear Power visited FMU
2015-09-01	Proceedings of the 20th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey released
2015-08-29	29 Aug 2015 The Japanese Association for Radiation Accident/Disaster Medicine (JARADM) convened its 3rd national meeting at FMU
2015-08-27	29 Jul 2015 and 27 Aug 2015 World Bank officials visit FMU

Message from Visitors

Contacts

Contacts

For questions or concerns, please send email to kenkani@fmu.ac.jp.

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The Radiation Medical Science Center accepts individual and institutional donations to carry out its public outreach, research projects in the field of low dose radiation effects on human