2023年 福島県立医科大学『県民健康調査』国際シンポジウム
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2023 Fukushima Medical University International Symposium on the Fukushima Health Management Survey
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Factors associated with the development of thyroid cancer identified in the Thyroid Ultrasound Examination

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Radiation Medical Science Center for the Fukushima Health Management Survey

Fukushima Medical University, Fukushima, Japan

COI Disclosures

Nothing to disclose

This presentation

- Current progress and future plans for the Thyroid Ultrasound Examination (TUE) in the Fukushima Health Management Survey.
- Confounding factors other than radiation associated with the detection rate of thyroid cancer (thyroid nodule).
  - Age
  - Sex
  - Participation rate of the confirmatory examination
  - Survey interval
  - Implementation rate of FNAC
  - Obesity
- Association between radiation exposure and detection rate of thyroid cancer (thyroid nodules)
  - Association with municipal average estimated thyroid absorbed doses (UNSCEAR estimate)
  - Association with individually estimated equivalent thyroid doses (estimated in Fukushima Medical University)

Flow chart of Thyroid Ultrasound Examination program

for residents in Fukushima aged 18 years or younger at the accident

Primary examination（with portable US machines）

By visiting all towns and schools in Fukushima

and examination at medical facility in all prefectures in Japan

Interpretation of US images

Others

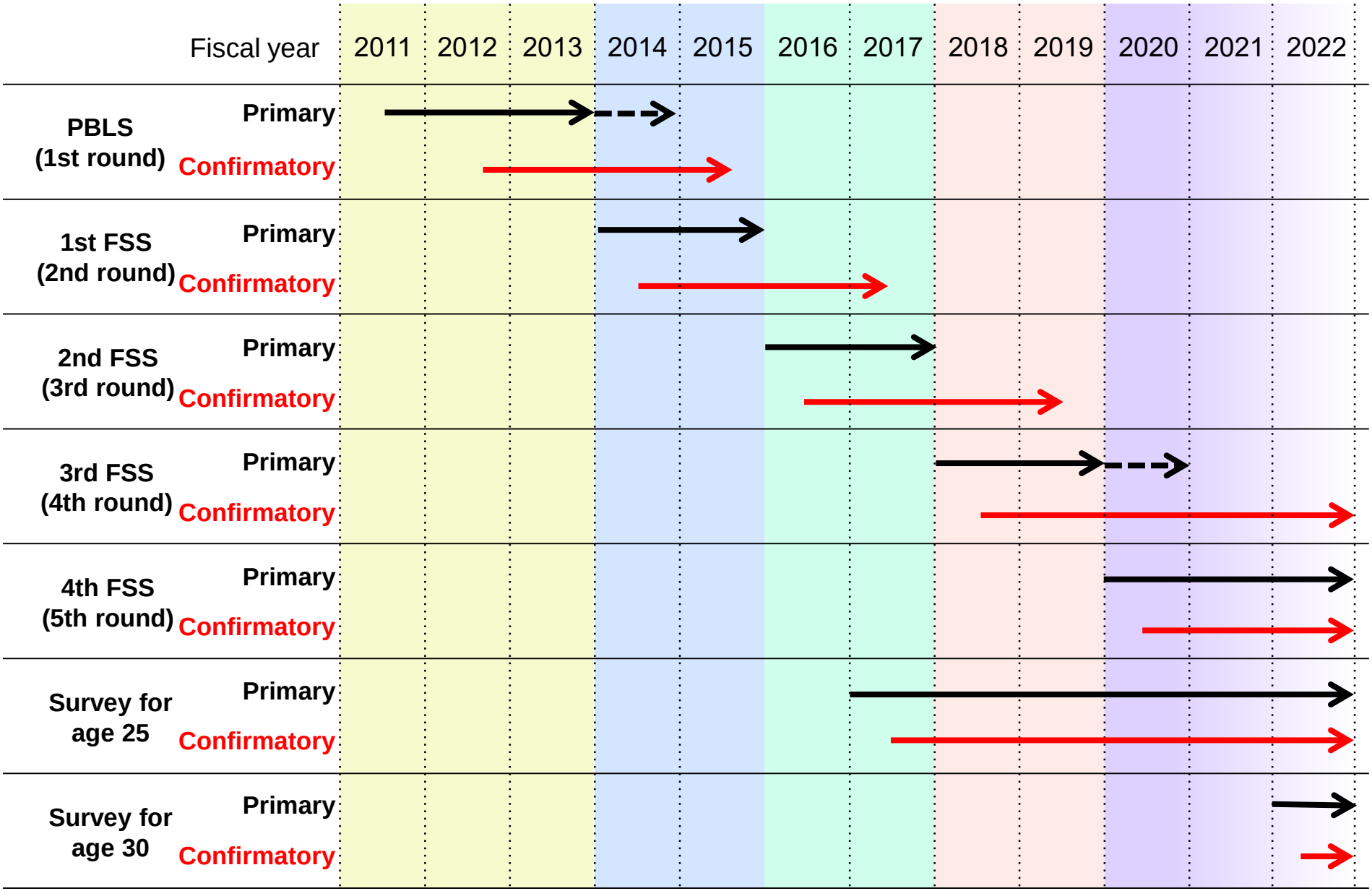
Nodule ≥ 5.1mm or cyst ≥20.1mm

Confirmatory examination
（US, blood and urine exam., FNAC when needed）

Next examination
(2 years-interval in childhood,
5 years-interval in > 20 y/o)

Surgical treatment or medical follow-up

Progress of Thyroid Ultrasound Examination



PBLS: Preliminary Baseline Survey, FSS: Full-Scale Survey

Progress of fifth-round and plans in sixth-round survey

	Fifth round			Sixth round	
	FY2020	FY2021	FY2022	FY2023	FY2024
Born in FY1992	28	29	30	31	32
Born in FY1993	27	28	29	30	31
Born in FY1994	26	27	28	29	30
Born in FY1995	25	26	27	28	29
Born in FY1996	24	25	26	27	28
Born in FY1997	23	24	25	26	27
Born in FY1998	22	23	24	25	26
Born in FY1999	21	22	23	24	25
Born in FY2000	20	21	22	23	24
Born in FY2001	19	20	21	22	23
Born in FY2002	18	19	20	21	22
Born in FY2003	17	18	19	20	21
Born in FY2004	16	17	18	19	20
Born in FY2005	15	16	17	18	19

Numbers in the table are ages at the end of each fiscal year.

Examination mainly at medical facilities

Examination mainly at schools

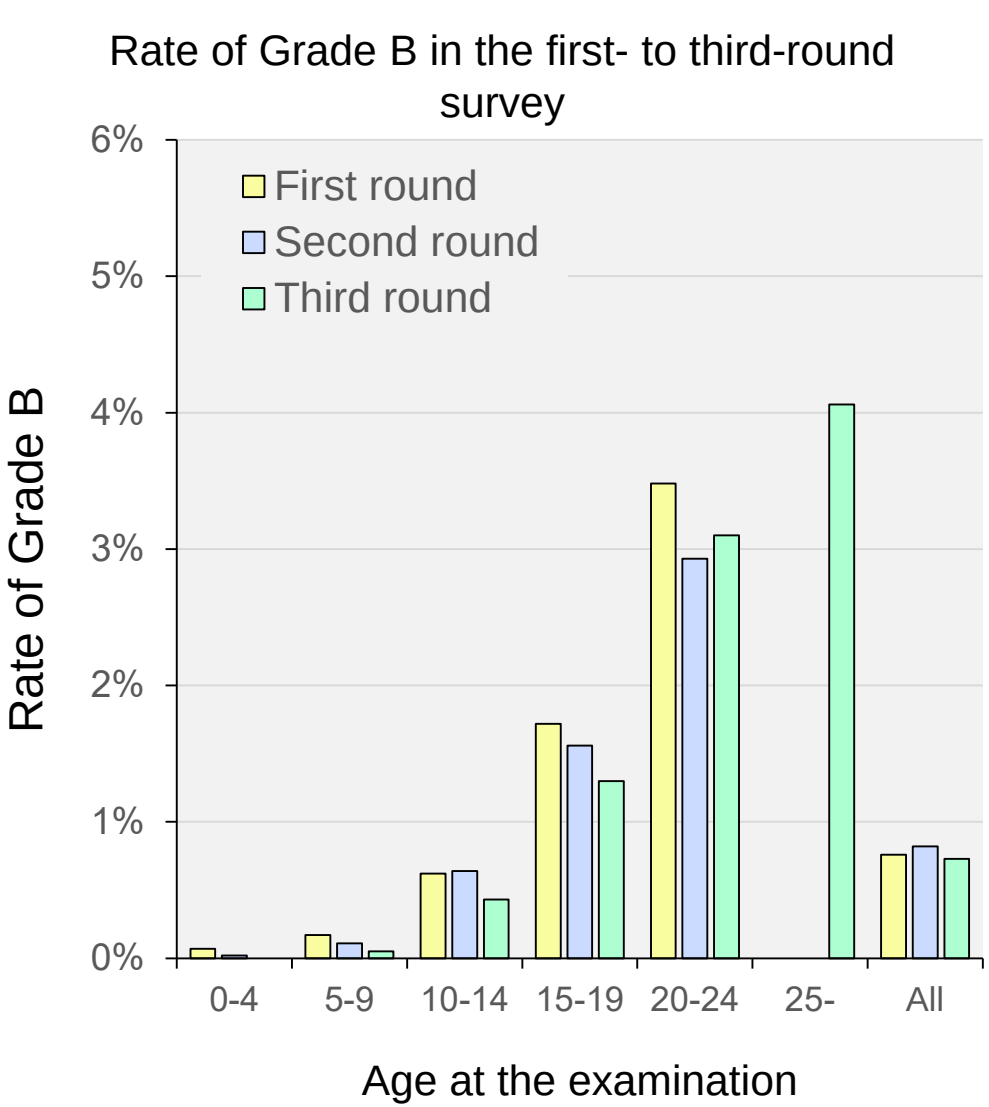
Summary of results

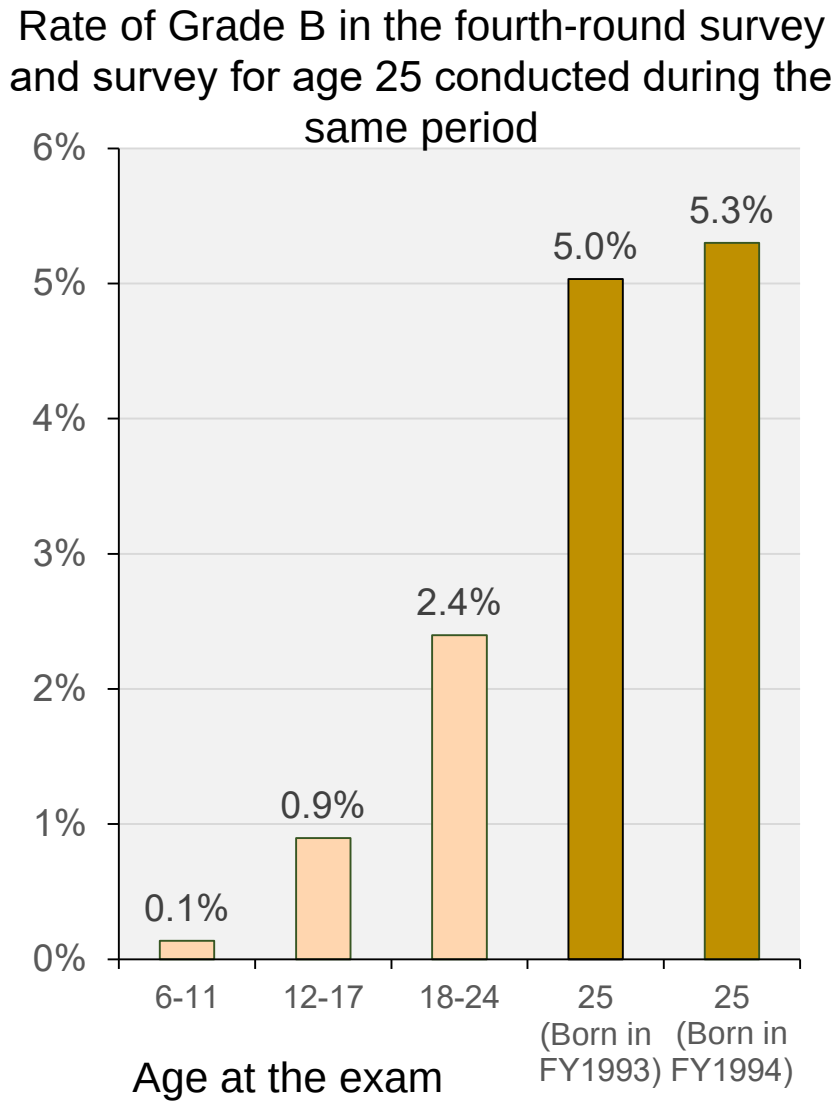
		PBLS (1st round)*	1st FSS (2nd round)**	2nd FSS (3rd round)***	3rd FSS (4th round)****	Survey for age 25**
Fiscal year		***2011-2013***	***2014-2015***	***2016-2017***	***2018-2019***	***2017-***
Eligible persons		***367,637***	***381,237***	***336,667***	***294,228***	***108,713***
Participation rate		***81.7%***	***71.0%***	***64.7%***	***62.3%***	***9.1%***
Judgement in the primary examination	A1	***51.5%***	***40.2%***	***35.1%***	***33.6%***	***42.5%***
	A2	***47.8%***	***59.0%***	***64.2%***	***65.6%***	***52.2%***
	B	***0.8%***	***0.8%***	***0.7%***	***0.8%***	***5.3%***
	C	***0.0%***	***0.0%***	***0.0%***	***0.0%***	***0.0%***
Eligible persons for the conf exam		***2,293***	***2,230***	***1,502***	***1,394***	***430***
Participation rate of conf exam		***92.9%***	***84.2%***	***73.5%***	***74.3%***	***82.1%***
M or SM (FNAC)		***116***	***71***	***31***	***39***	***16***
Surgically treated		***102***	***56***	***29***	***34***	***10***
Pathological diagnosis	PTC	***100***	***55***	***29***	***34***	***9***
	PDTC	***1***				
	Others	***1 (Benign)***	***1 (Others)***			***1 (FTC)***

PBLS: Preliminary Baseline Survey, FSS: Full-Scale Survey, M or MS: malignancy or suspicious for malignancy

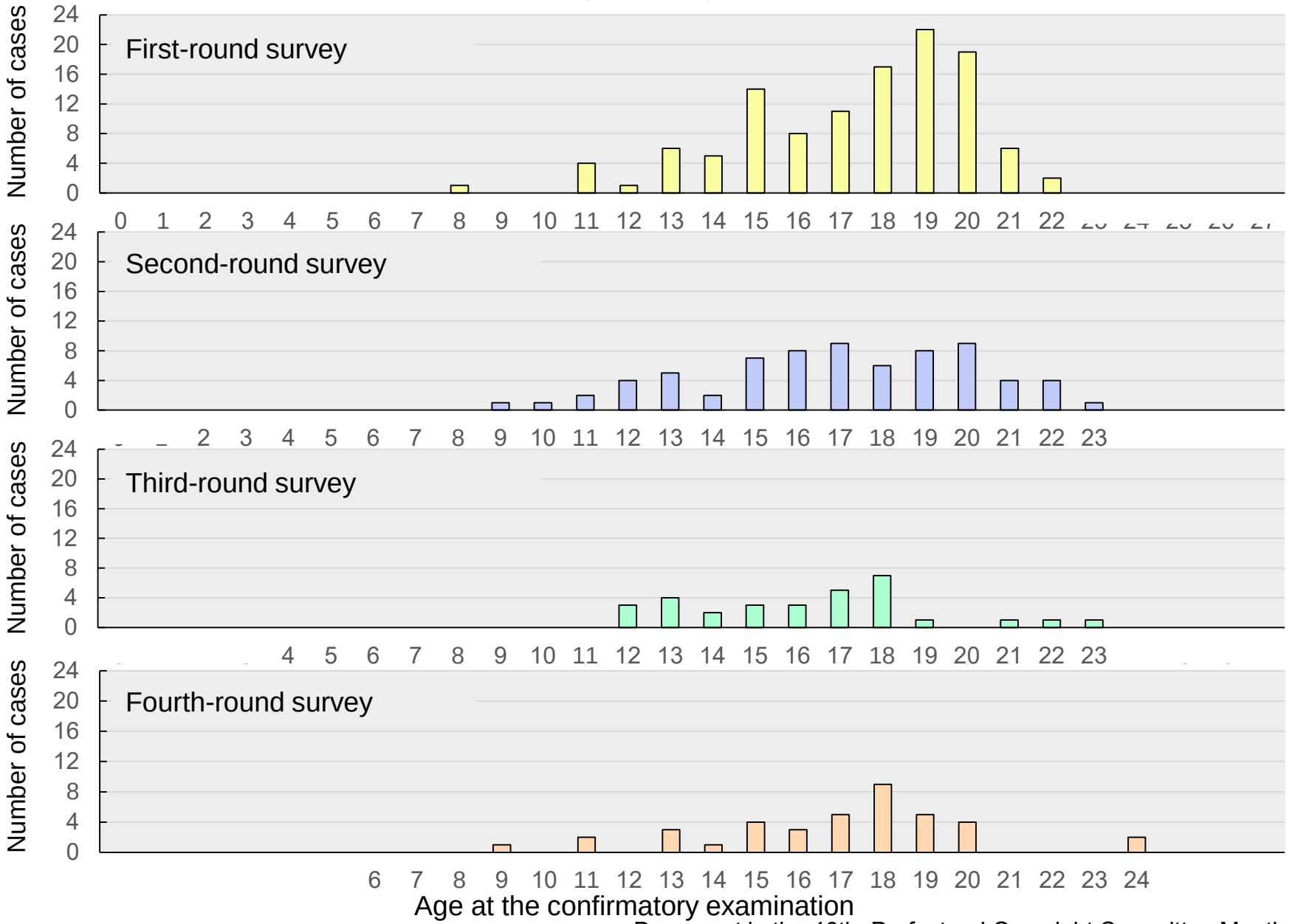
*As of March 31, 2018, **As of March 31, 2022, ***As of March 31, 2021, ****As of June 30, 2022

Rate of Grade B (nodule > 5mm or cyst > 20mm)

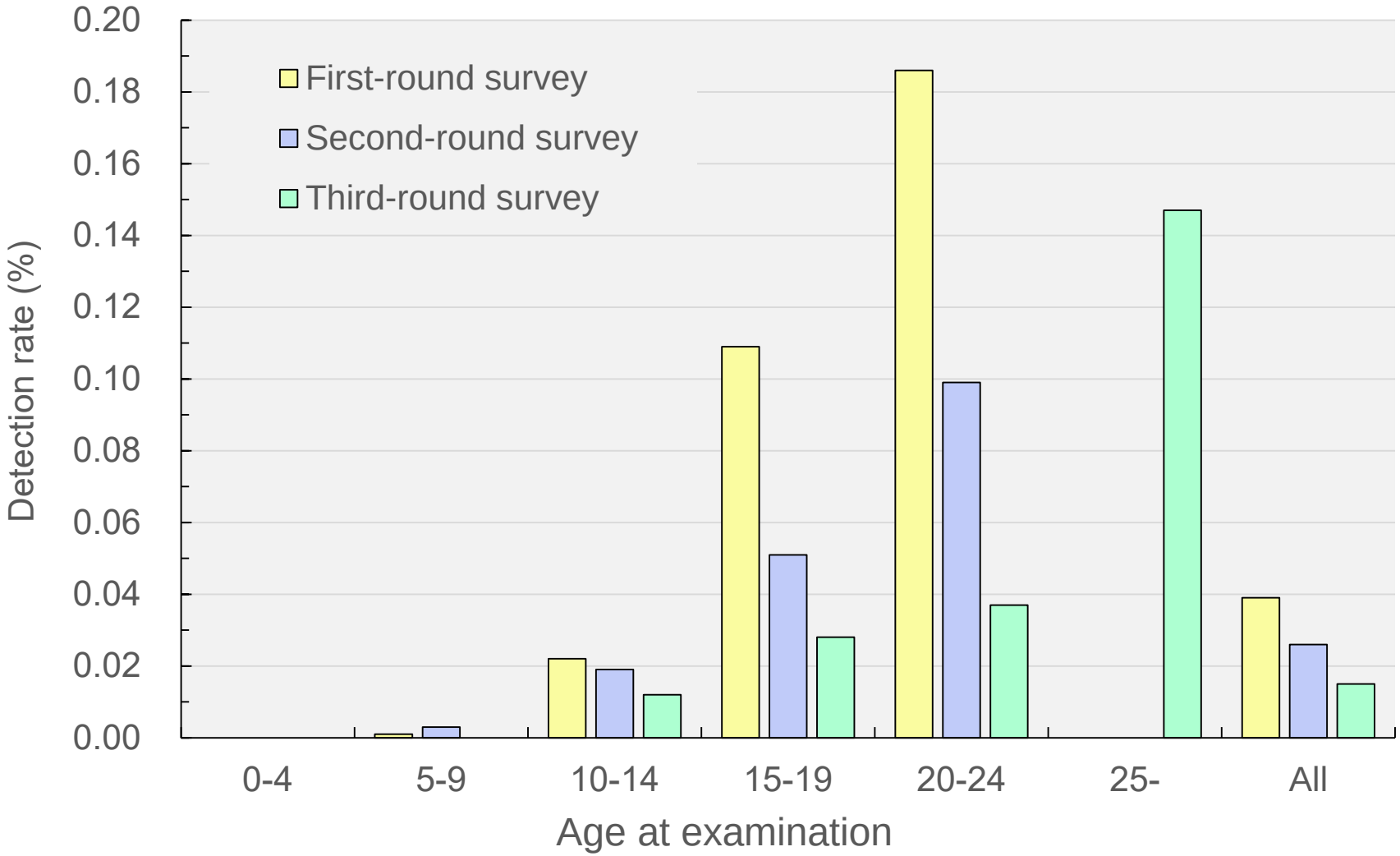




Number of cases diagnosed as malignant or suspicious for malignancy

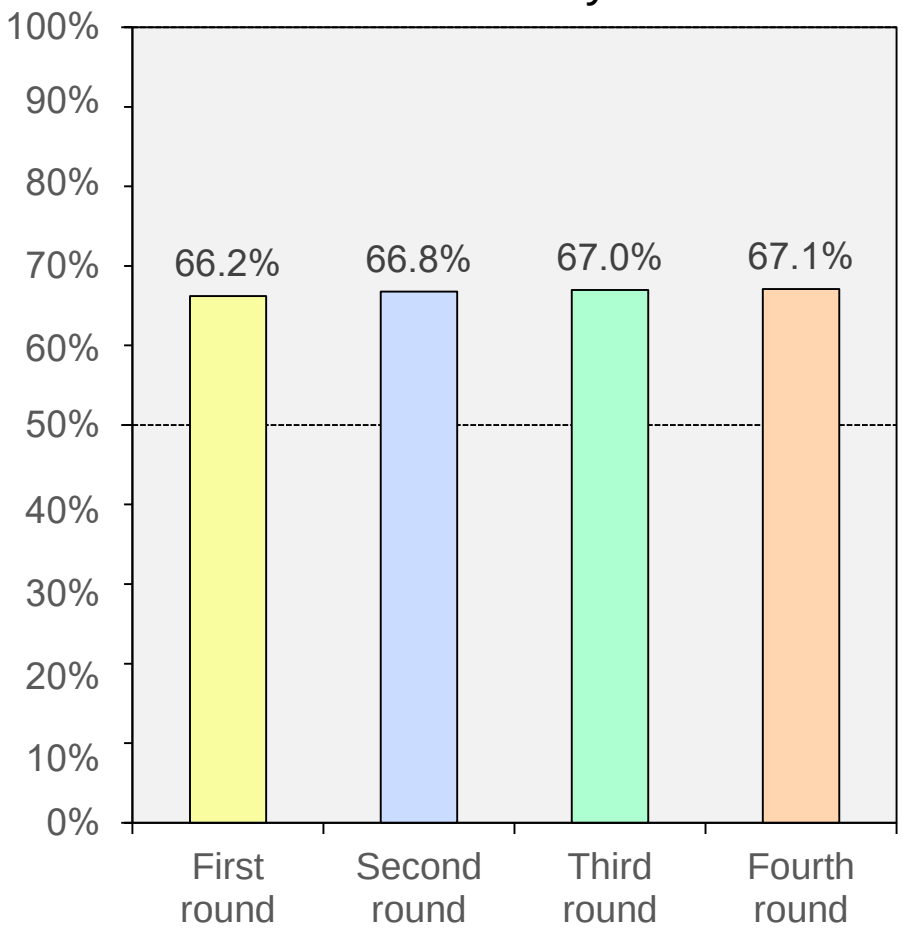


Detection rate of nodules diagnosed as malignant or suspicious for malignancy

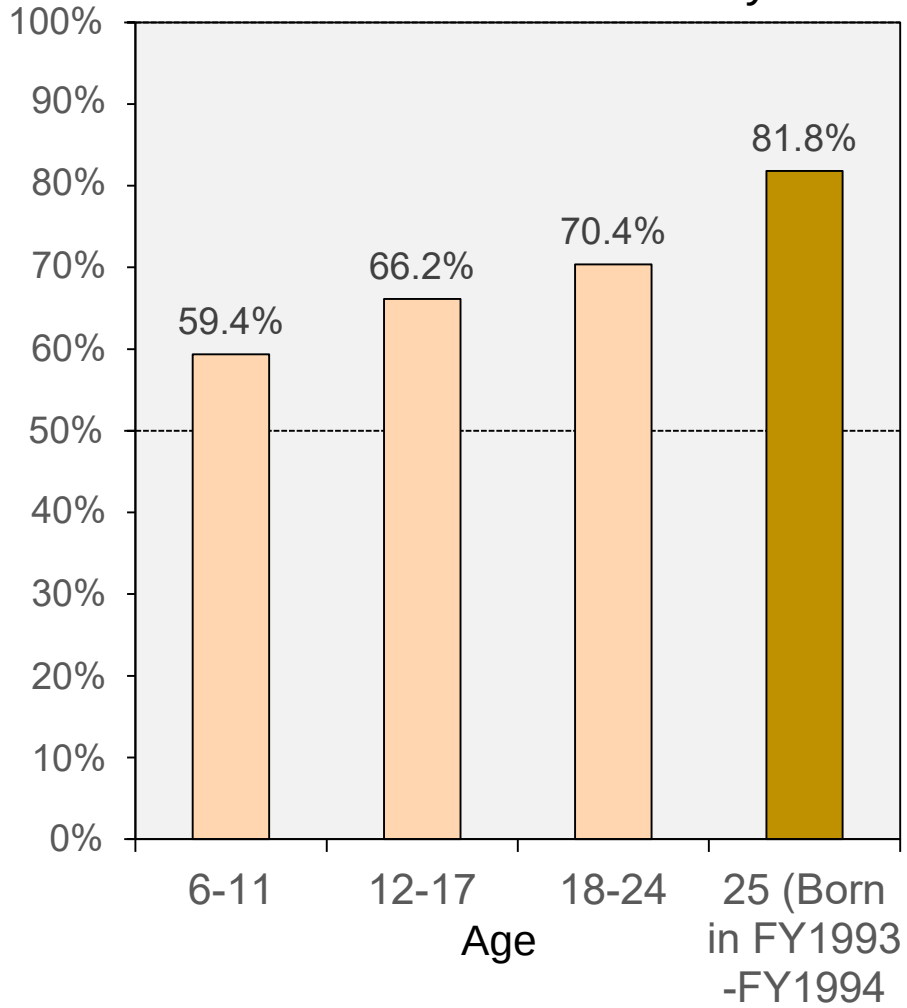


Percentage of female in examinees with Grade B

Percentage of female in each round of survey

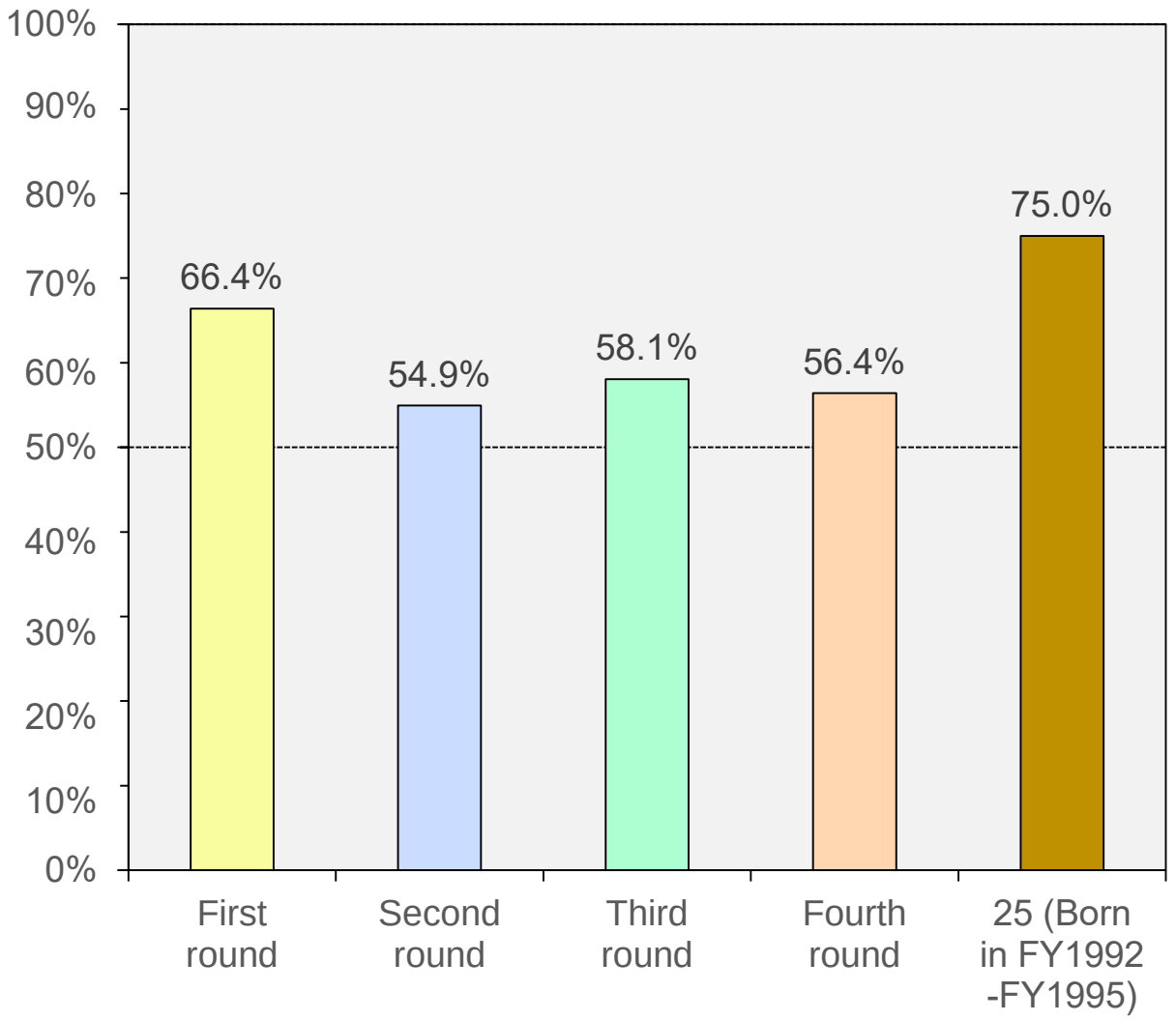


Percentage of female by age groups in the fourth-round survey



Document in the 27th, 31st, 42nd, 45th, and 46th Prefectural Oversight Committee Meeting

Percentage of female in examinees with nodules diagnosed as malignant or suspicious for malignancy



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Flow chart of Thyroid Ultrasound Examination program

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By visiting all towns and schools in Fukushima

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Interpretation of US images

Others

Nodule ≥ 5.1mm or cyst ≥20.1mm

Voluntary participation

Confirmatory examination

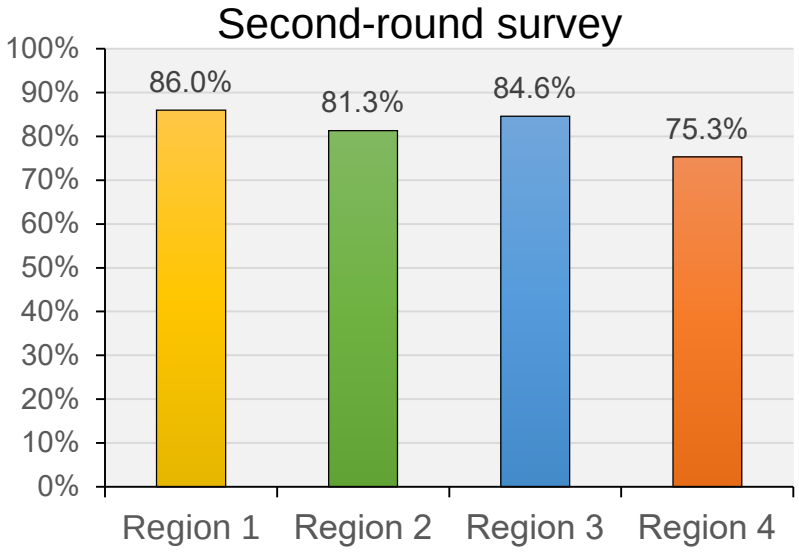
（US, blood and urine exam., FNAC when needed）

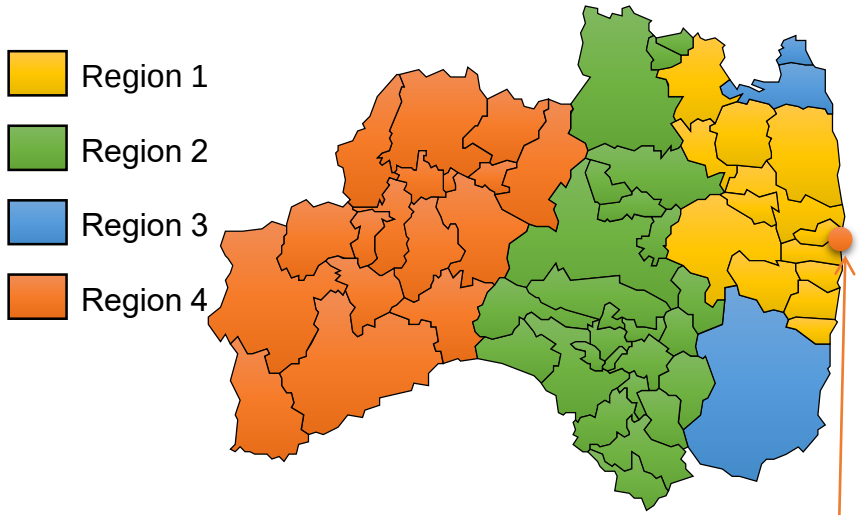
Next examination

(2 years-interval in childhood, 5 years-interval in > 20 y/o)

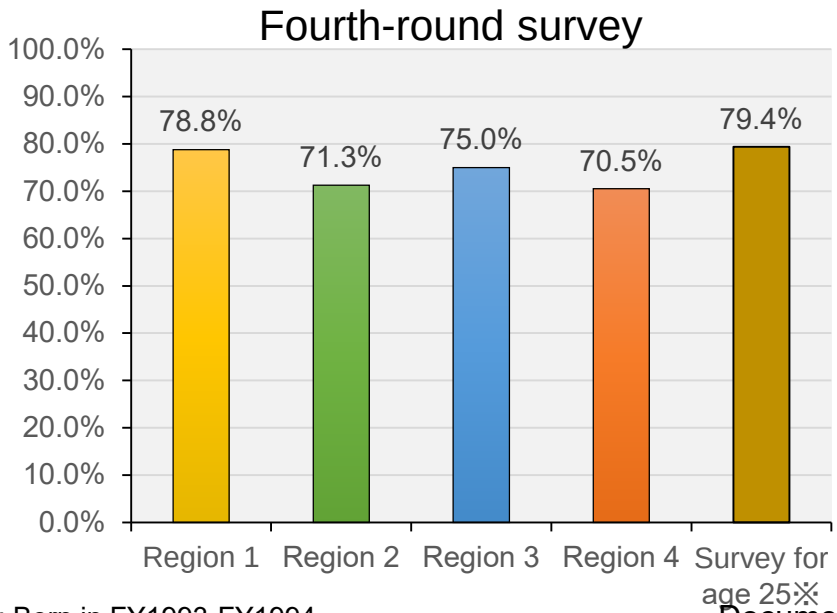
Surgical treatment or medical follow-up

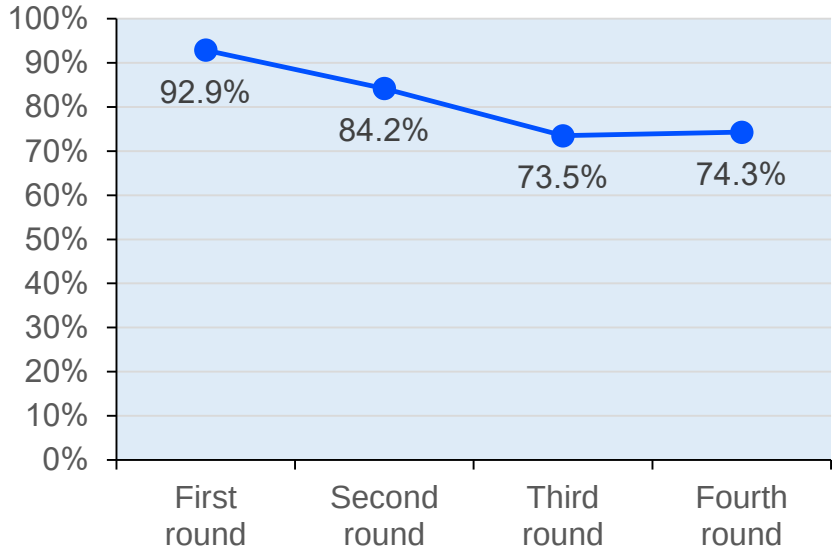
Regional differences and changes in the participation rate of confirmatory examination





Fukushima Daiichi Nuclear Power Plant

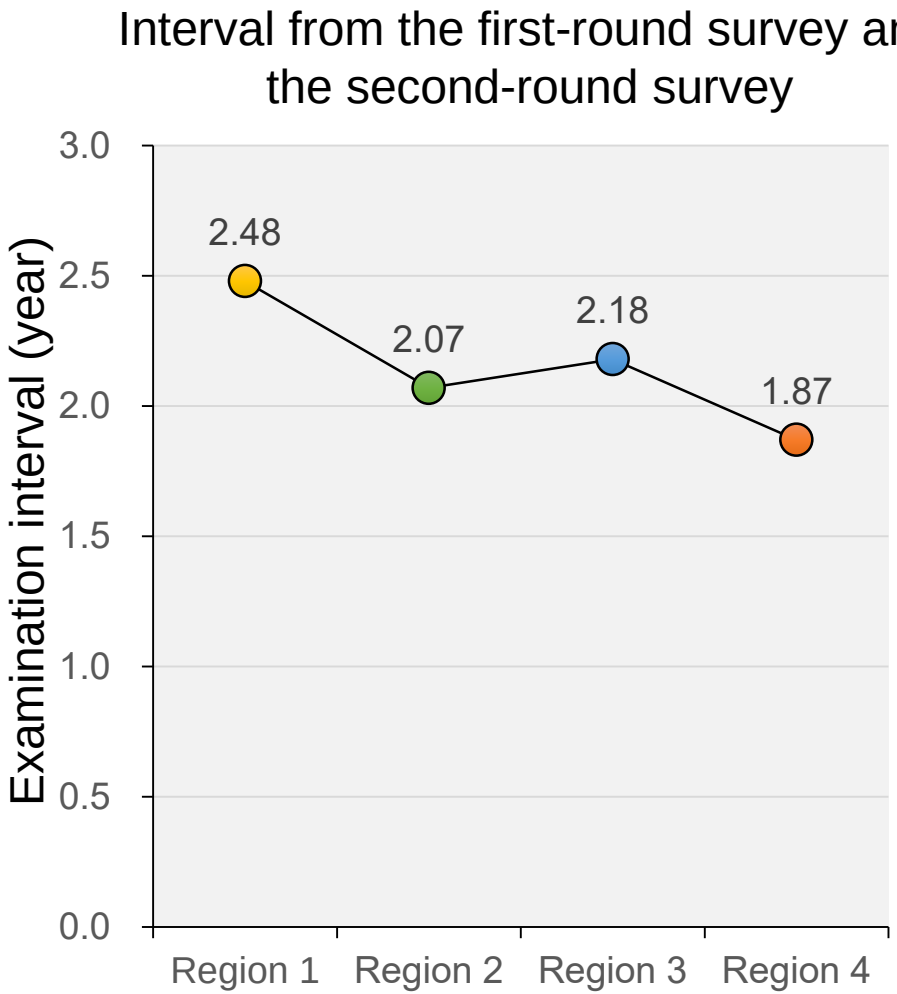


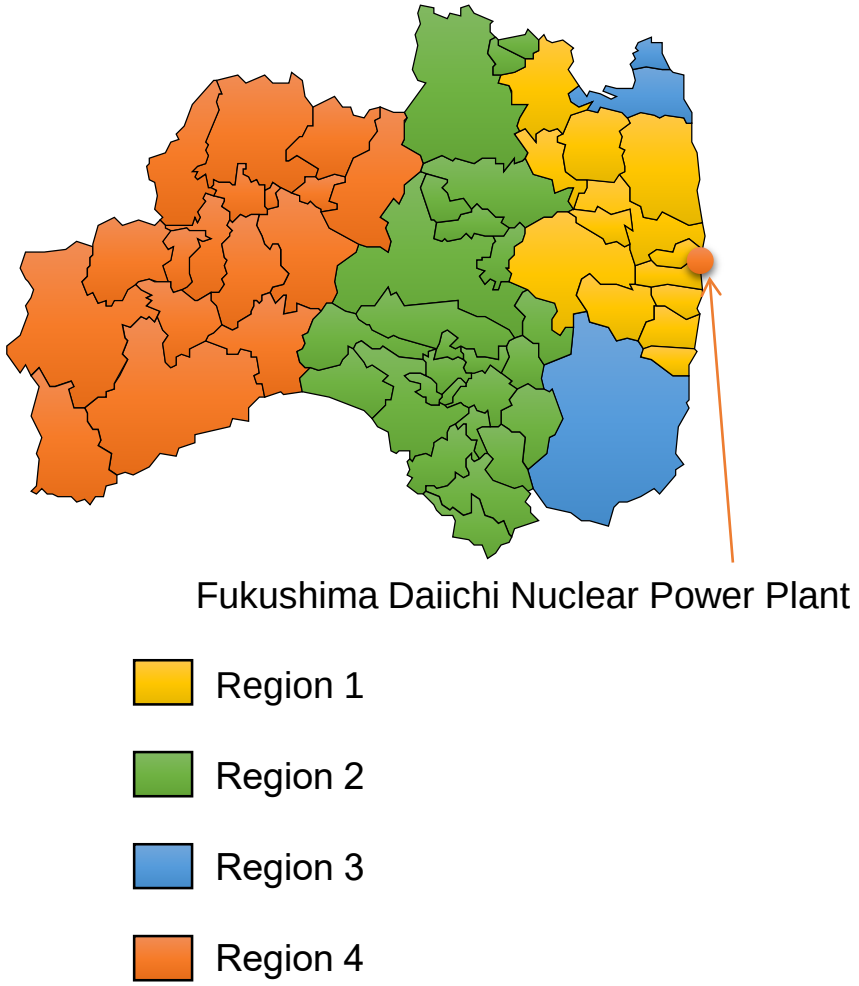


*: Born in FY1993-FY1994

Document in the 31st, 45th, and 46th Prefectural Oversight Committee Meeting

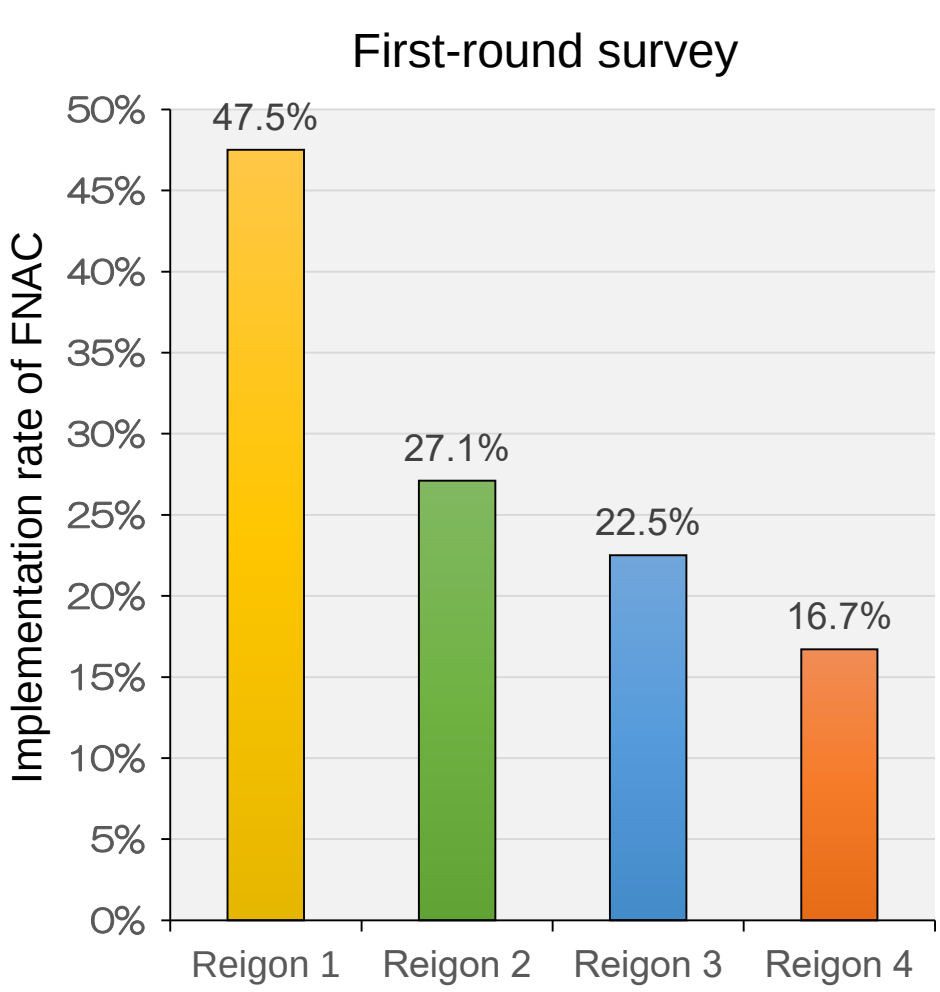
Regional differences in the interval between examinations since the last examination

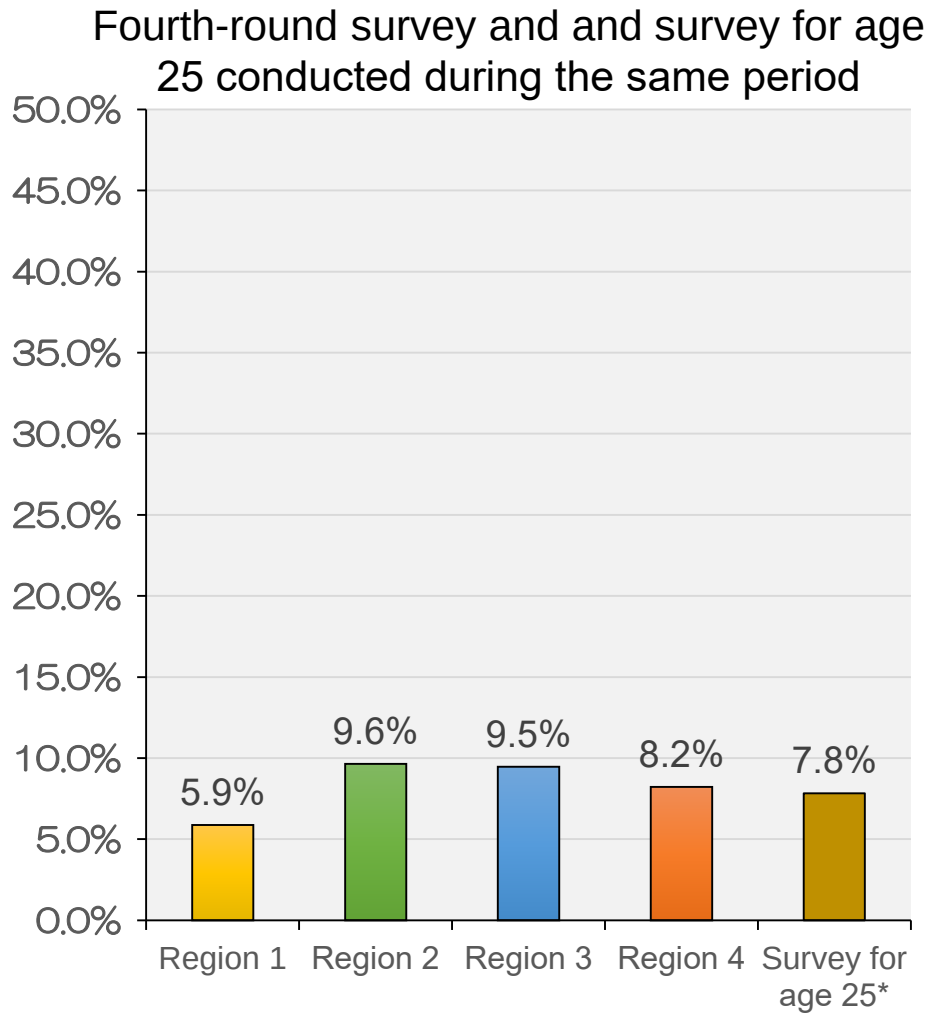




Regional difference in the implementation rate of FNAC

FNAC implementation rate among examinees who diagnosed as Grade B in the conf exam





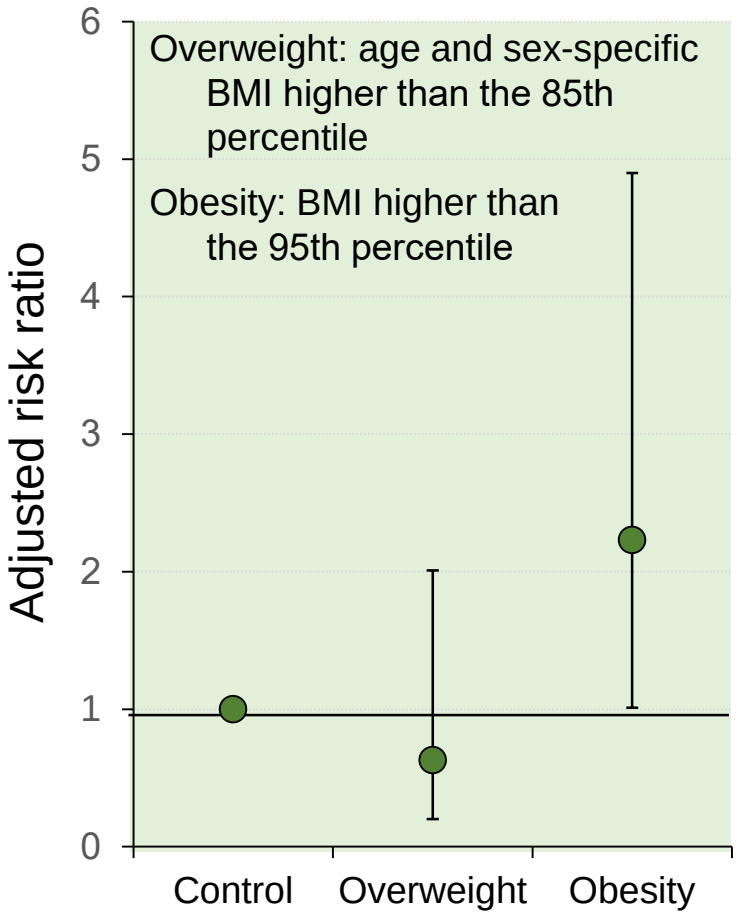
*: Born in FY1993-FY1994

Document in the 31st, 45th, and 46th Prefectural Oversight Committee Meeting

Association between obesity and thyroid cancer risk

	Control	Over weight	Obesity
Participant (n)	200,202	22,395	14,633
Female (%)	50.9	44.5	42
Age at the accident	8.2	7.2	6.9
Age at the 2nd-round examination	12.2	11.3	10.9
Percentage of Grade B (%)	0.84	0.80	0.89
Participation rate of confirmatory exam (%)	81	87	82
No. of cases diagnosed with M or SM	56	3	7
Multivariable-adjusted* RR	1	0.62 (0.20-2.01)	2.23 (1.01-4.90)

*: Adjusted for age, sex, and location group by external radiation doses.

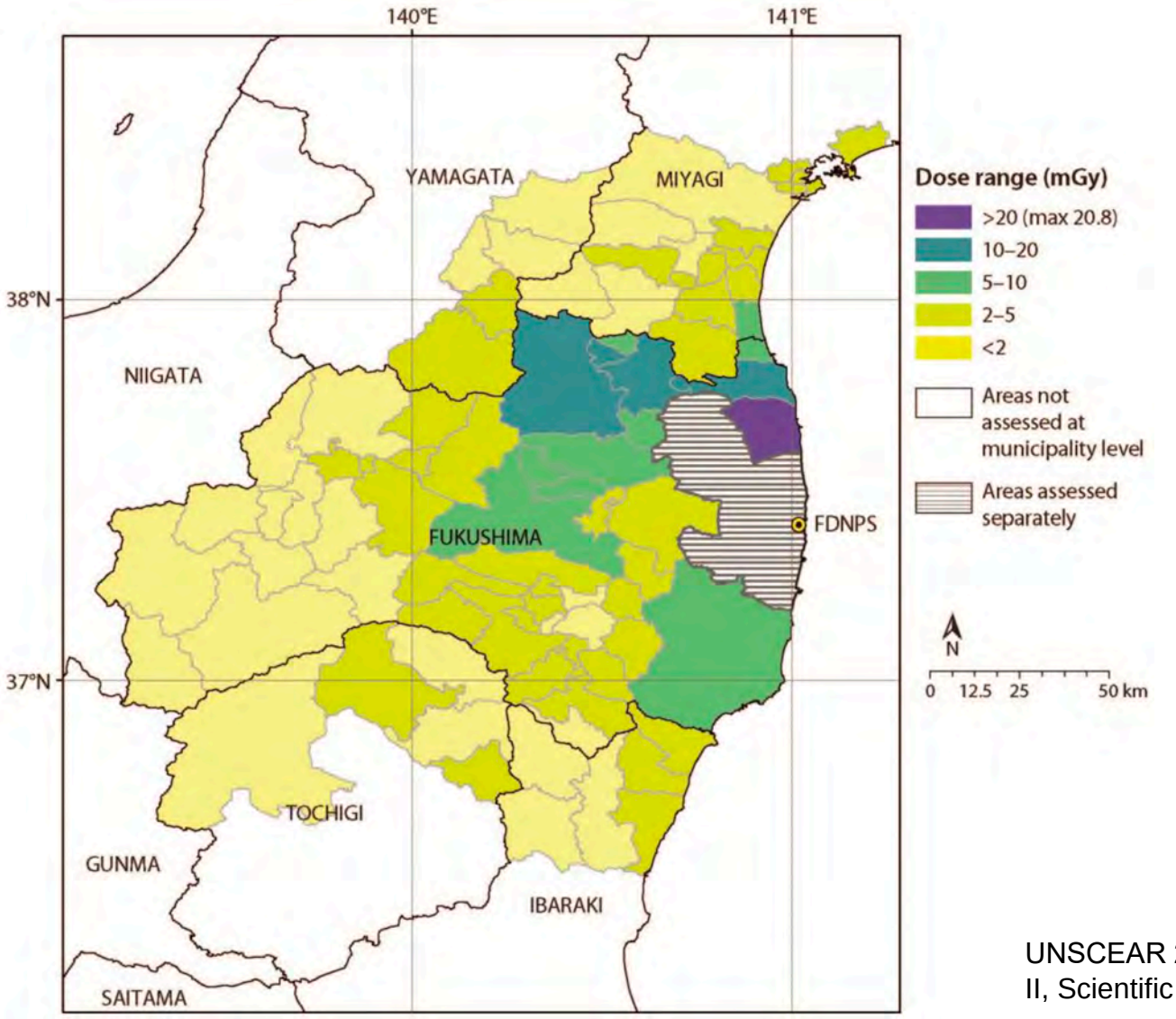


Ohira T. et al. Epidemiology 30: 853-860, 2019.

Brief summary

- The detection rate of thyroid nodules and cancer increased with age.
- The detection rates of thyroid nodules and cancer were higher in female, but the percentage of female increased with age.
- Regional differences in the participation rate of confirmatory examination and examination intervals were observed among the examinees, which might affect the detection rate of thyroid cancer.
- Regional differences were observed in the implementation rate of FNAC in the confirmatory examination.
- Independent of sex, age, and external radiation dose, obesity was significantly associated with the detection rate of thyroid cancer.

Absorbed doses to the thyroids of 1-year-old infants estimated in the UNSCEAR 2020/2021 Report (excluding evacuated area)

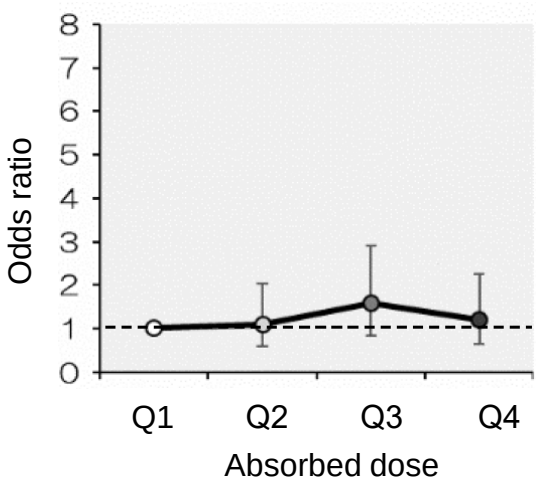


UNSCEAR 2020/2021 Report, Volume II, Scientific Annex B Figure A-VII

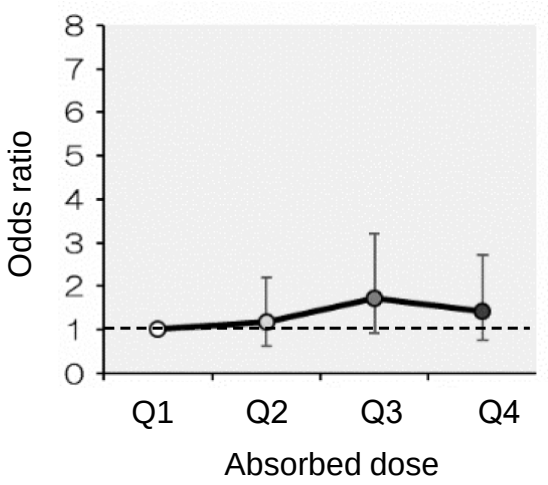
Relationship between absorbed doses to the thyroids estimated in the UNSCEAR 2020 Report and the detection rate of malignant nodules in Full-Scale Survey (longitudinal analysis)

	Q1 0.5-2.6 mGy	Q2 2.7-4.3 mGy	Q3 4.5-7.0 mGy	Q4 7.0-15 mGy
Female (%)	50.3	50.0	49.1	49.6
Age at the earthquake (mean)	8.3	9.3	6.7	7.9
Examination Interval （%）				
< 3 years	25.3	26.9	18.1	19.4
≥ 3 but < 3.5 years	12.5	4.2	3.7	2.1
≥ 3.5 but < 4 years	50.9	11.8	19.0	13.4
≥ 4 but < 4.5 years	8.3	38.4	42.1	52.7
≥ 4.5 years	3.0	18.6	17.0	12.4
M or SM (n)	16	28	28	27
Detection rate （per 100,000）	34.0	43.5	39.9	37.5

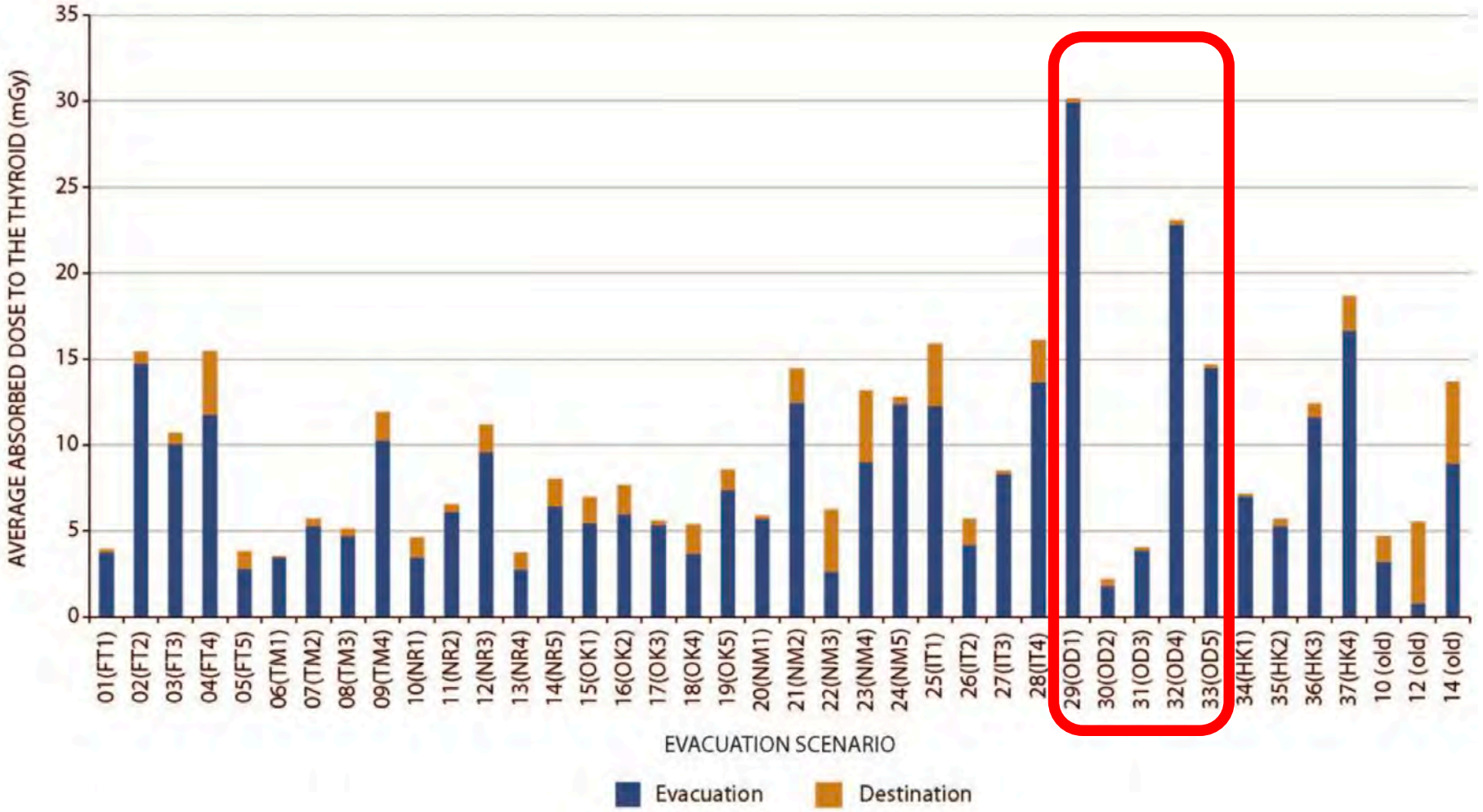
Adjusted with sex and age



Adjusted with sex, age, interval



Absorbed doses to the thyroids of 1-year-old infants estimated in UNSCEAR 2020 Report (evacuated area)



UNSCEAR 2020 Report, Scientific Annex B Figure A-IX

Estimation of personal internal exposure dose (thyroid equivalent dose)

1. As internal exposure doses, thyroid equivalent doses (mSv) exposed from tap water + inhalation for 14 days after the nuclear power plant accident was estimated based on the detailed version of behavior report in the Basic Survey form from March 12 to March 25, 2011.
2. External exposure doses were calculated by multiplying the doses assessed in the Basic Survey by the correction factor of 1.1.
3. Cases were those with nodules cytologically diagnosed as malignant or suspicious for malignancy in the first- to third-round surveys and the survey for 25 years (born in FY1992) who have behavior records of the Basic Survey.
4. Controls were matched to cases by sex, age at the time of the earthquake, concurrent round of participation in last two visits with thyroid cancer detection in cases, and randomly selected at a ratio of 1:10 cases to controls.

Characteristics of cases and controls in the case-control study

(Cases were selected in the TUE only)

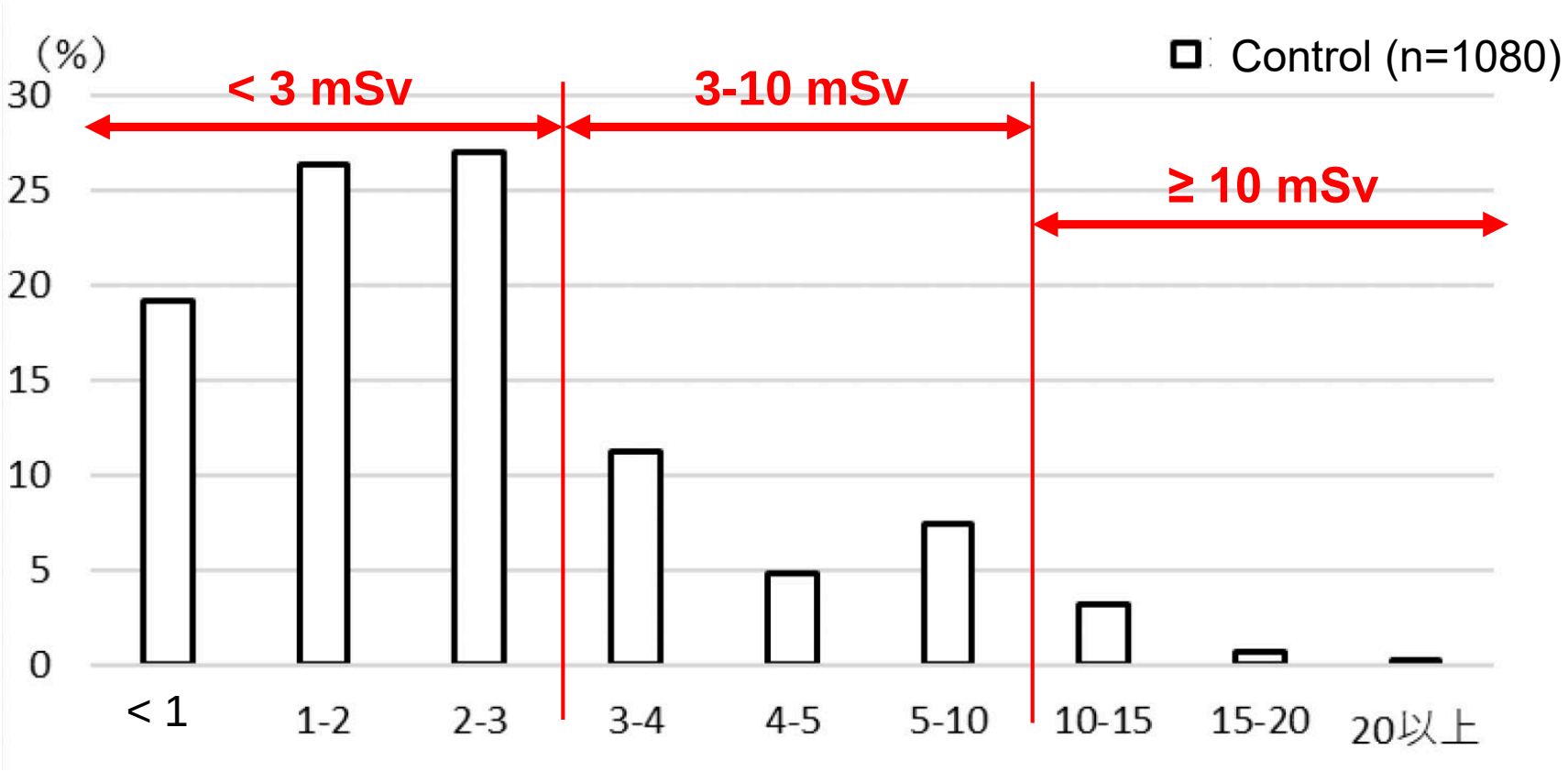
	Cases	Controls	Total
Cases (M or SM) (n)	108	0	108
Controls (n)	0	1080	1080
Age at the earthquake (mean)	13.7	13.7	13.7
Thyroid equivalent dose (mSv)			
Median	2.2	2.1	2.1
Min – Max	0.11–22.70	0.10 – 21.65	0.10 – 22.70
Grade B or C (%)	100	2.0	10.9

Characteristics of cases and controls in the case-control study

(Cases were selected in TUE and National Cancer Registry)

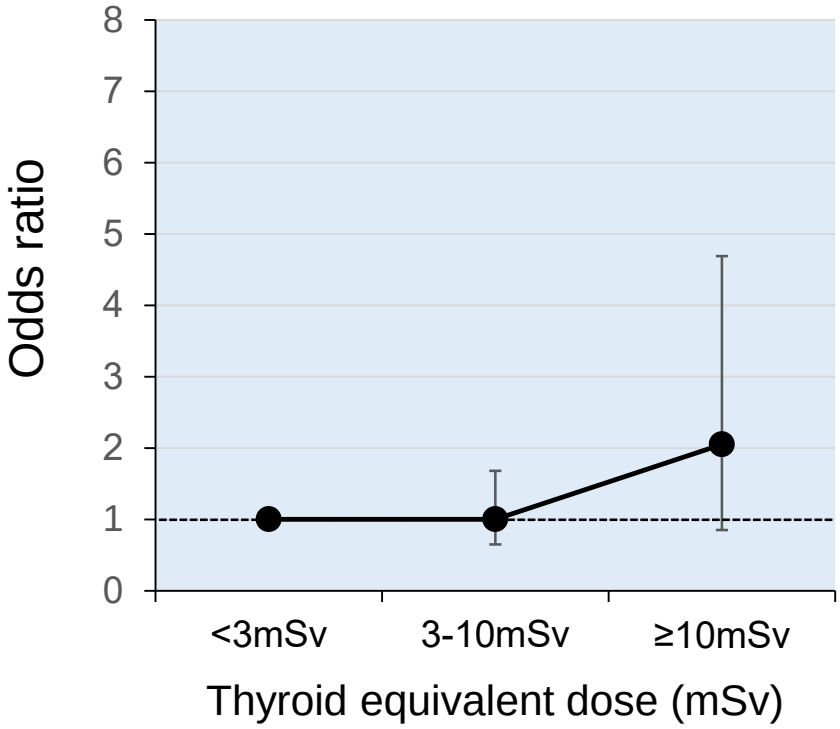
	Cases	Controls	Total
Cases (M or SM) (n)	131	0	131
Controls (n)	0	1310	1310
Age at the earthquake (mean)	13.5	13.5	13.5
Thyroid equivalent dose (mSv)			
Median	2.2	2.2	2.2
Min – Max	0.11–22.70	0.10 – 21.65	0.10 – 22.70
Grade B or C (%)	95.4	1.8	10.3

Distribution of thyroid equivalent doses in the control group

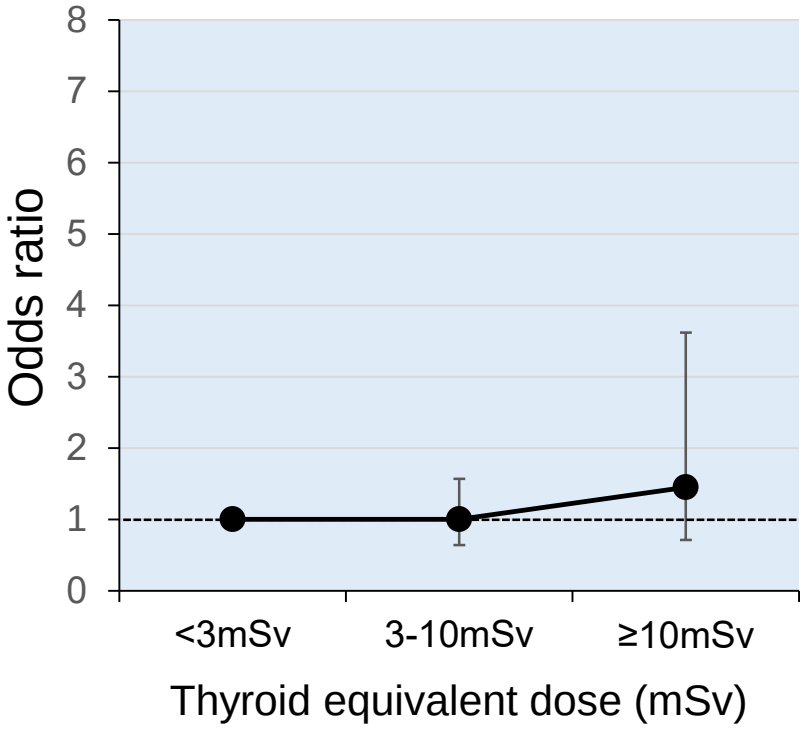


Odds ratio for detection of nodules diagnosed as malignant or suspicious for malignancy in each thyroid equivalent dose group

With cases selected in the TUE only



With cases selected in TUE and National Cancer Registry



Document 3-2, 3-7 in the 19th meeting of Prefectural Subcommittee for the TUE program

Conclusions

- ✓ In addition to age and sex, regional differences in the participation rate of confirmatory examination, the implementation rate of FNAC, and examination intervals were confounding factors affecting to the detection rate of thyroid cancer.
- ✓ As in previous reports on thyroid cancer, an association between obesity and an increase in thyroid cancer has been observed.
- ✓ As for the association with radiation exposure, no statistically significant dose-response relationship between radiation dose and the detection rate of malignant nodules has been found at this time.

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YASUMURA Seiji
OHTO Hitoshi
KAMIYA Kenji
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Department of Thyroid and Endocrinology

SUZUKI Shinichi
IWADATE Manabu

Thyroid and Endocrine Center

YOKOYA Susumu

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2023年 福島県立医科大学『県民健康調査』国際シンポジウム
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