

The International Workshop on Radiation and Thyroid Cancer (2014.2.21-23)

Thyroid Survey Plans for TEPCO Workers

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contents

- | Emergency workers at the nuclear power plant accident
 - n Radiation exposure
 - n Health management policy

- | Study design
 - n Study subjects
 - u Exposed group
 - u Control group
 - n Ultrasound exam
 - n Diagnostic workup
 - n Data collection/ Analysis

- | Expected results
 - n Statistics of thyroid cancer
 - n Expected proportion of detection among workers

Approximately **31,000** workers worked at Fukushima Daiichi nuclear power plant after 2011.3.14

cumulative dose	workers		
	TEPCO	Contractors	Total
250+	6	0	6
200-	1	2	3
150-	24	2	26
100-	118	20	138
75-	255	112	367
50-	323	850	1,173
20-	607	4,197	4,804
10-	544	3,875	4,419
5-	431	3,687	4,118
1-	707	6,835	7,542
less than 1	1,070	7,717	8,787
Total	4,086	27,297	31,383
max (mSv)	678.8	238.42	678.8
mean (mSv)	23.6	10.97	12.61

) 173

As of Dec 2013

Emergency workers: Those who had worked at Fukushima Daiichi nuclear power plant during the period of 2011.3.14 to 2011.12.16, when radiation exposure dose limit was tentatively raised to 250 mSv from 100 mSv

n 19,592 emergency workers

(3,290 from TEPCO, 16,302 from contractors)

6 workers 250 mSv or over

173 workers 100 mSv or over

900 workers 50 mSv or over

n “Certification” was issued to 18,874 workers

Health management policy for emergency workers (by the Ministry)

For all emergency workers

- I Health check-up required by occupational safety law (98% participated)
- I Mental health counselling

For those who were exposed 50 mSv or more

- I Eye exam for cataract (68% participated)

For those who were exposed 100 mSv or more

- I Thyroid exam (TSH, T3, T4)(ultrasound, if necessary)
- I Cancer screening (stomach, lung , colorectal) (95% participated)

Health management policy for emergency workers (by TEPCO)

For those who were exposed over 100 mSv of equivalent dose for thyroid gland (corresponding to 5 mSv of effective dose)

- I Thyroid exam (ultrasound)

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Study Design

Exposed group: those who were exposed **more than 100 mSv** of equivalent dose for thyroid gland (corresponding to 5 mSv of effective dose) ... **1,972 workers**



- n Screening (questionnaire, ultrasound exam)
- n Re-evaluate exposed dose (esp. internal dose)
- n Cumulative dose before accident (from central registry)



Control group: those who were exposed **less than 100 mSv** of equivalent dose for thyroid ... approximately **2,000 workers** (mainly from TEPCO)



- n Screening (questionnaire, ultrasound exam)
- n Cumulative dose before accident (from central registry)



Compare the proportion of detection for thyroid nodule and cancer

Age distribution of exposed group

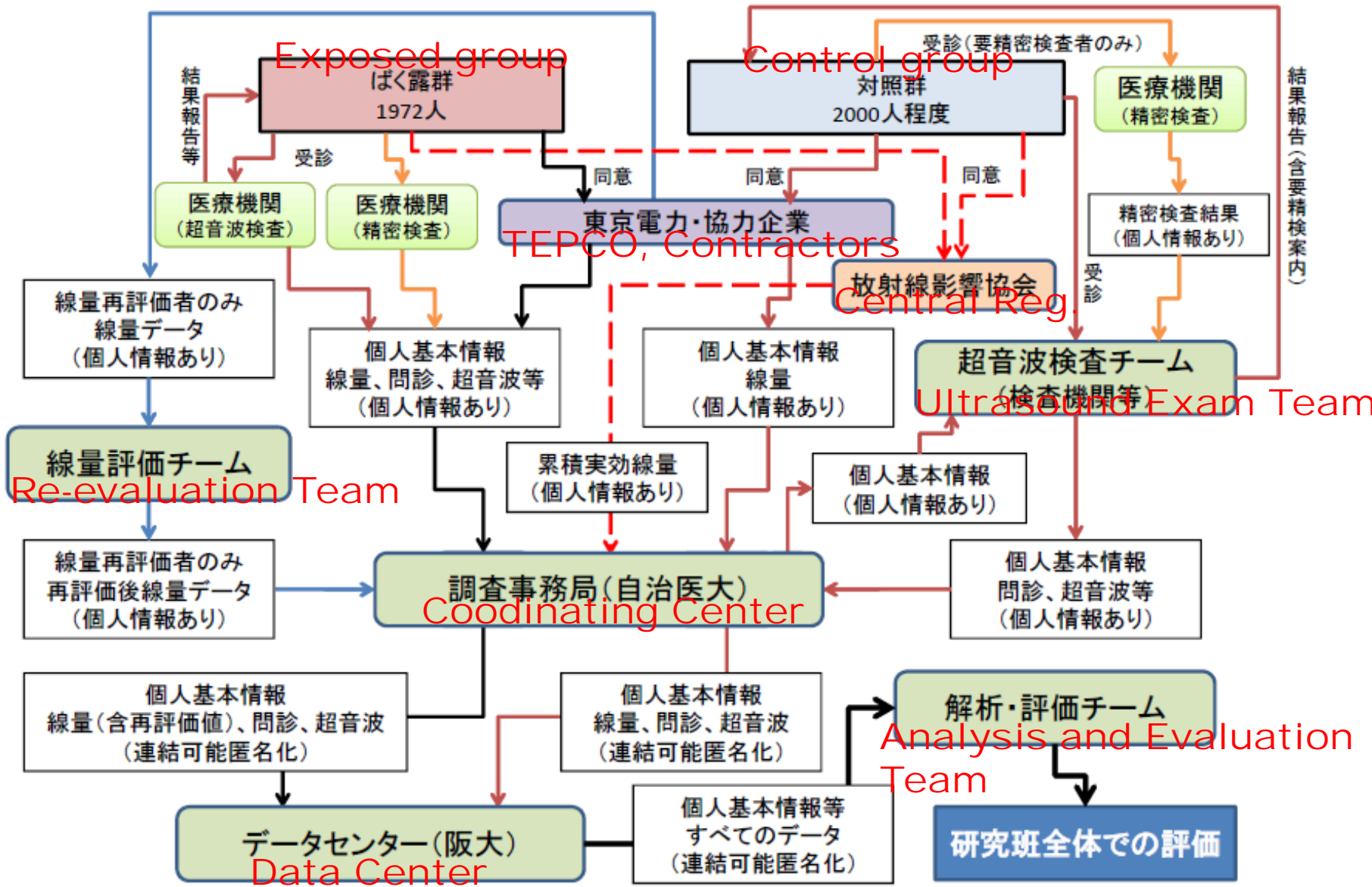
	TEPCO		Contractor		Total	
	number	%	number	%	number	%
20-24	76	7.8%	26	2.6%	102	5.2%
25-29	102	10.5%	65	6.5%	167	8.5%
30-34	99	10.1%	73	7.3%	172	8.7%
35-39	139	14.2%	115	11.5%	254	12.9%
40-44	143	14.7%	133	13.4%	276	14.0%
45-49	136	13.9%	140	14.1%	276	14.0%
50-54	161	16.5%	171	17.2%	332	16.8%
55-59	104	10.7%	143	14.4%	247	12.5%
60-64	15	1.5%	105	10.5%	120	6.1%
65-69	1	0.1%	22	2.2%	23	1.2%
70-74	0	0.0%	3	0.3%	3	0.2%
Total	976	100.0%	996	100.0%	1,972	100.0%

Ultrasound Exam

- | Diagnostic criteria: Guidelines for Clinical Practice for the Management of Thyroid Nodules in Japan 2013 (The Japan Thyroid Association)
 - n A1: no abnormal findings
 - n A2: nodule less than 5.0 mm or cyst less than 20mm
 - n B: nodule more than 5.1 mm or cyst more than 20.1mm
 - n C: need immediate further diagnostic exam

- | Those who had B or C will refer to further diagnostic workups (such as biopsy, free T4, TSH, anti-thyroglobulin Ab, anti-thyroid microsome Ab, anti-thyroid peroxidase Ab etc) 。

Data flow



Meeting at Fukushima Daini Nuclear Power Plant (2014.1.15)



contents

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 - n Radiation exposure
 - n Health check-up policy

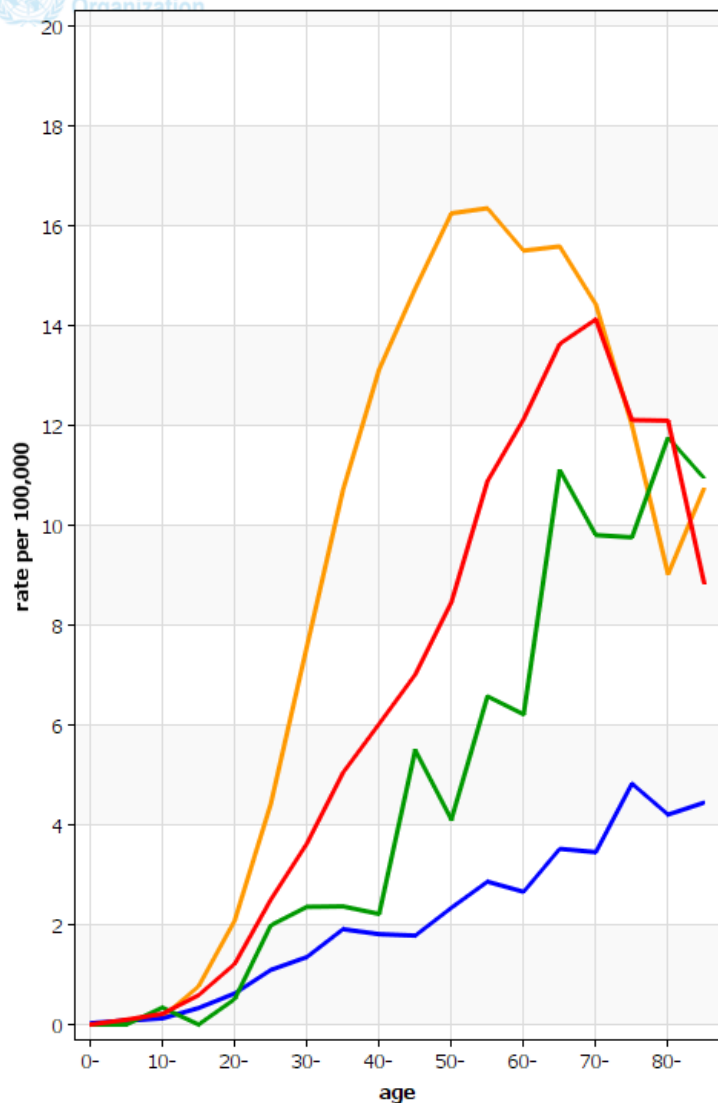
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Age-specific incidence from population-based cancer registries (Cancer Incidence in Five Continents Vol. 10) (2003-2007)

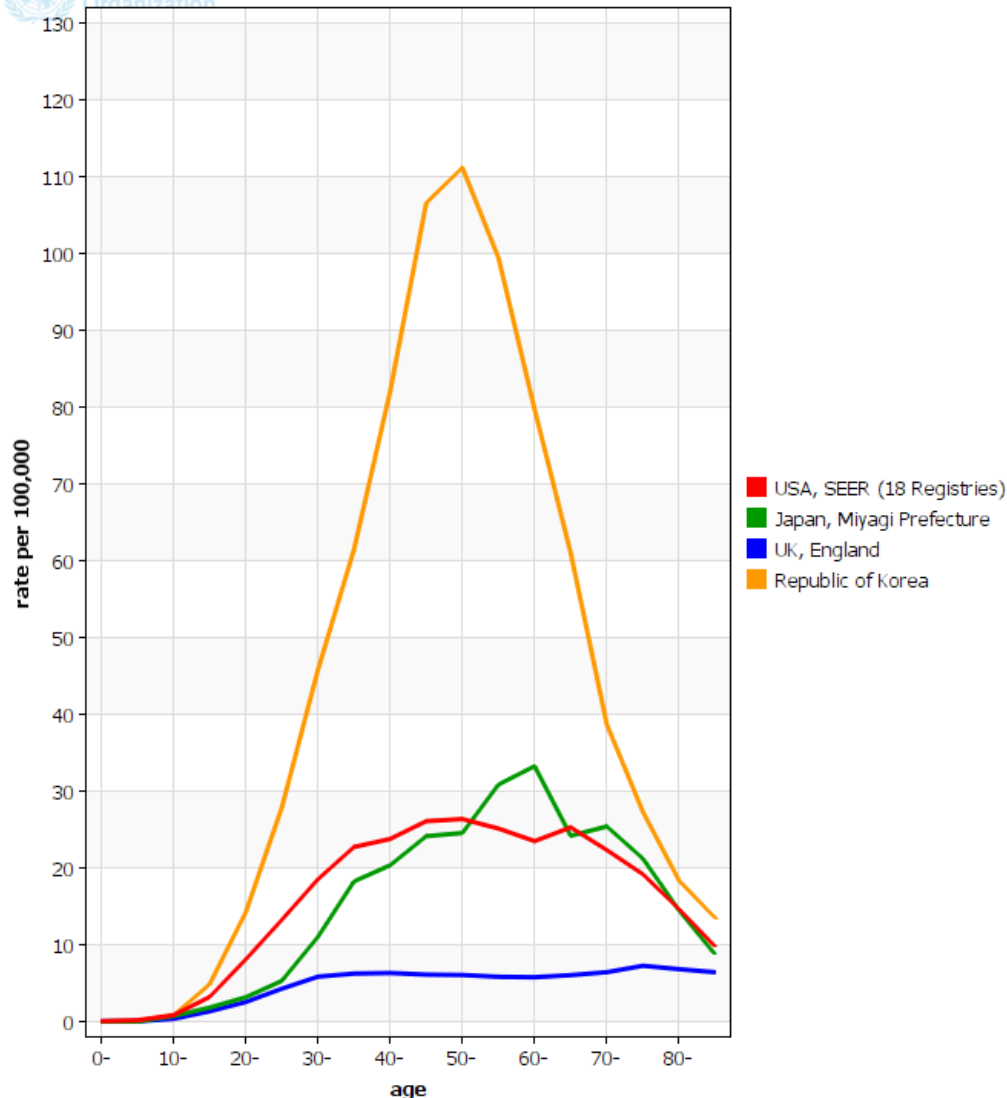
International Agency for Research on Cancer
World Health Organization

Thyroid, Male



International Agency for Research on Cancer
World Health Organization

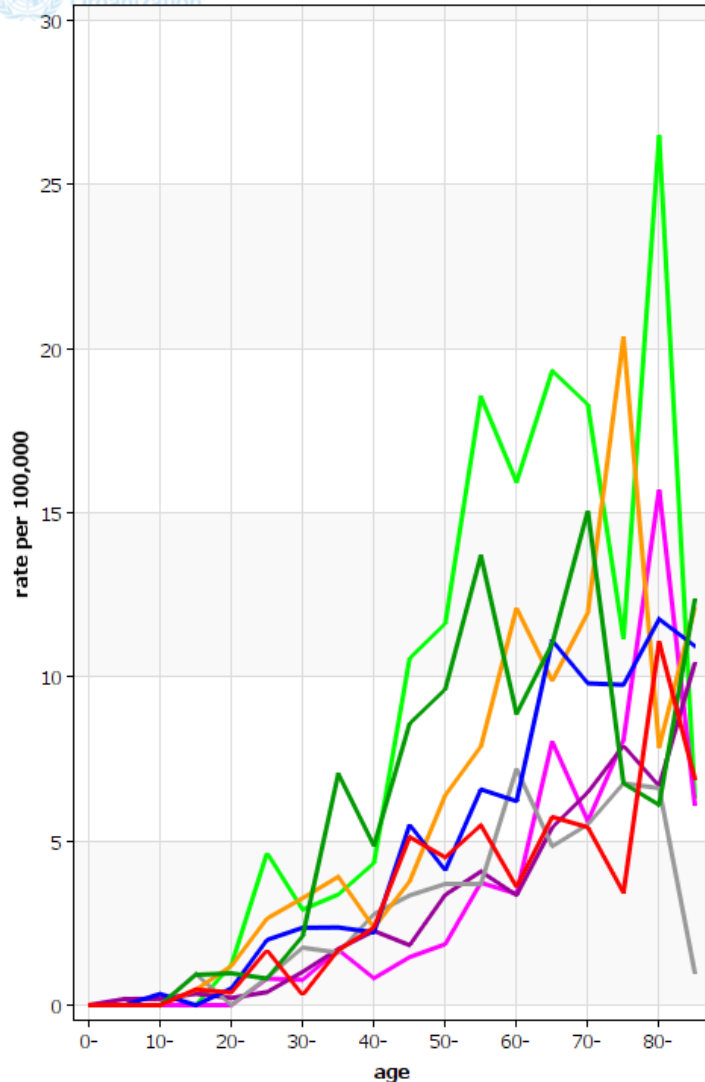
Thyroid, Female



Age-specific incidence from population-based cancer registries (Cancer Incidence in Five Continents Vol. 10) (2003-2007)

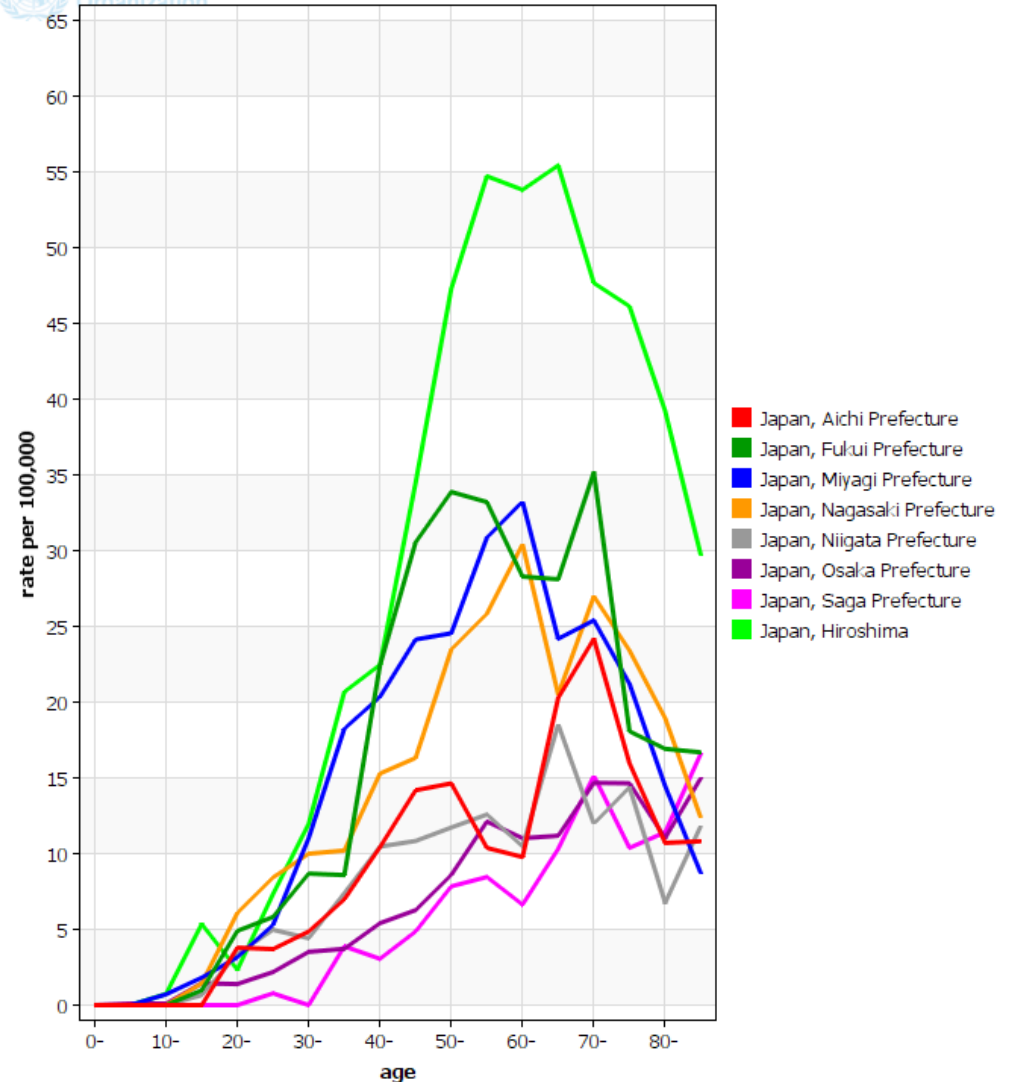
International Agency for Research on Cancer
World Health Organization

Thyroid, Male

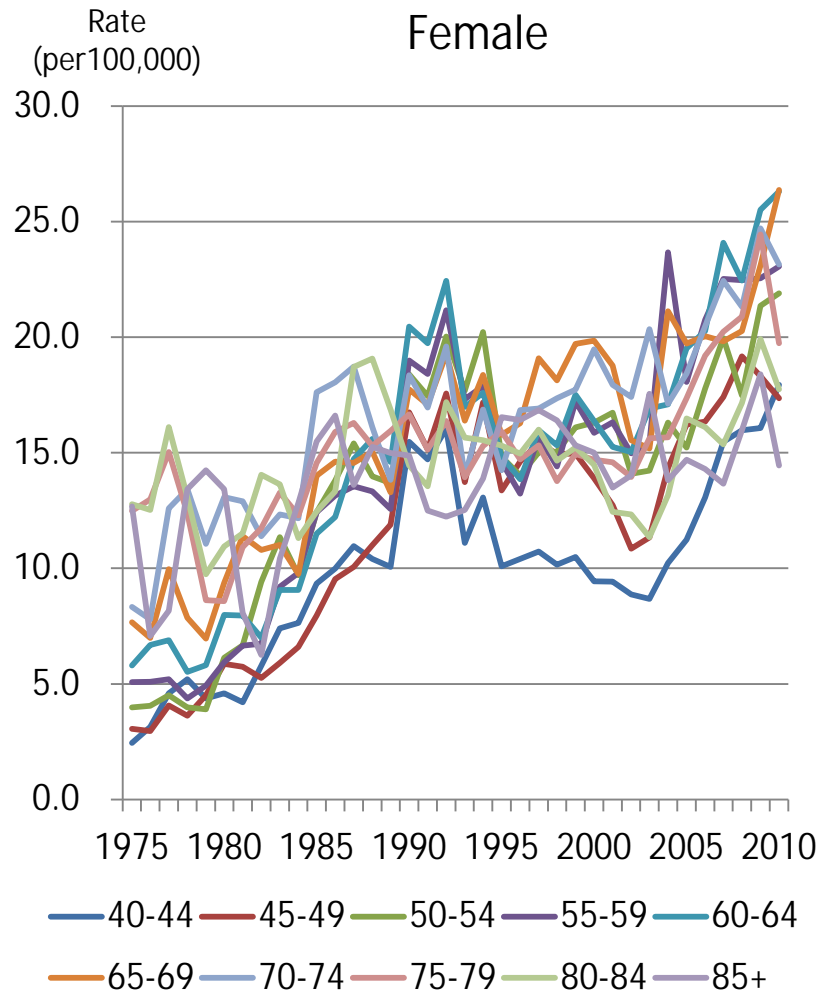
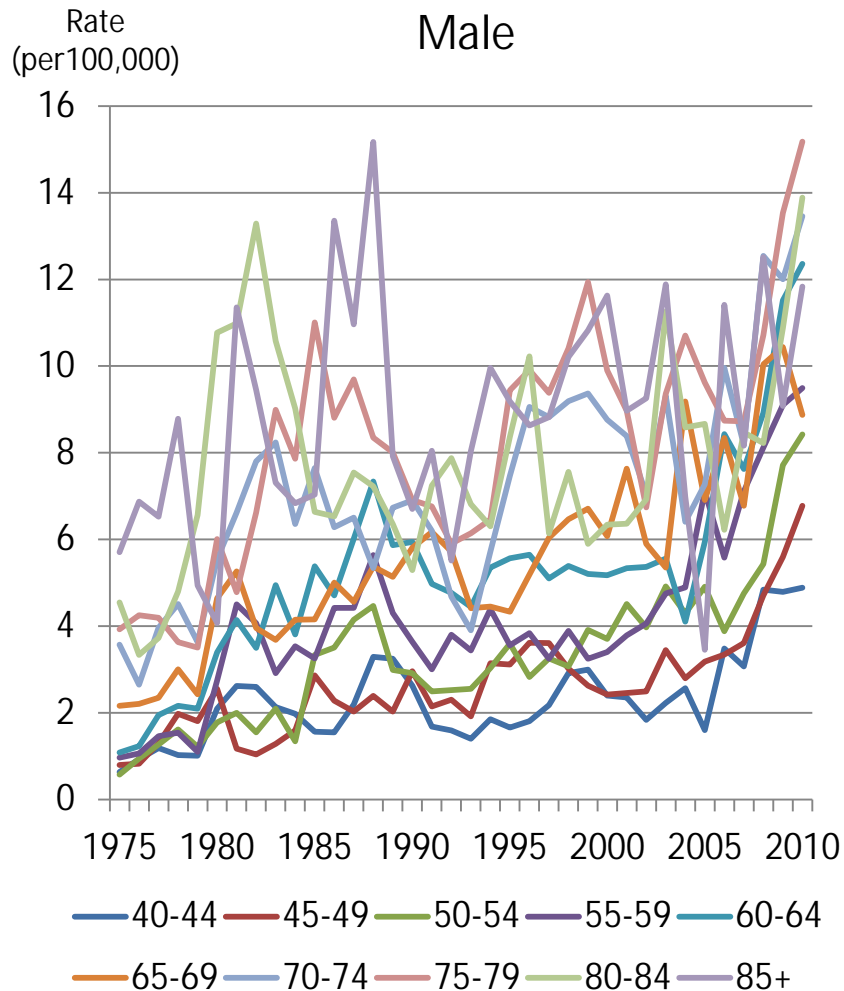


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Thyroid, Female

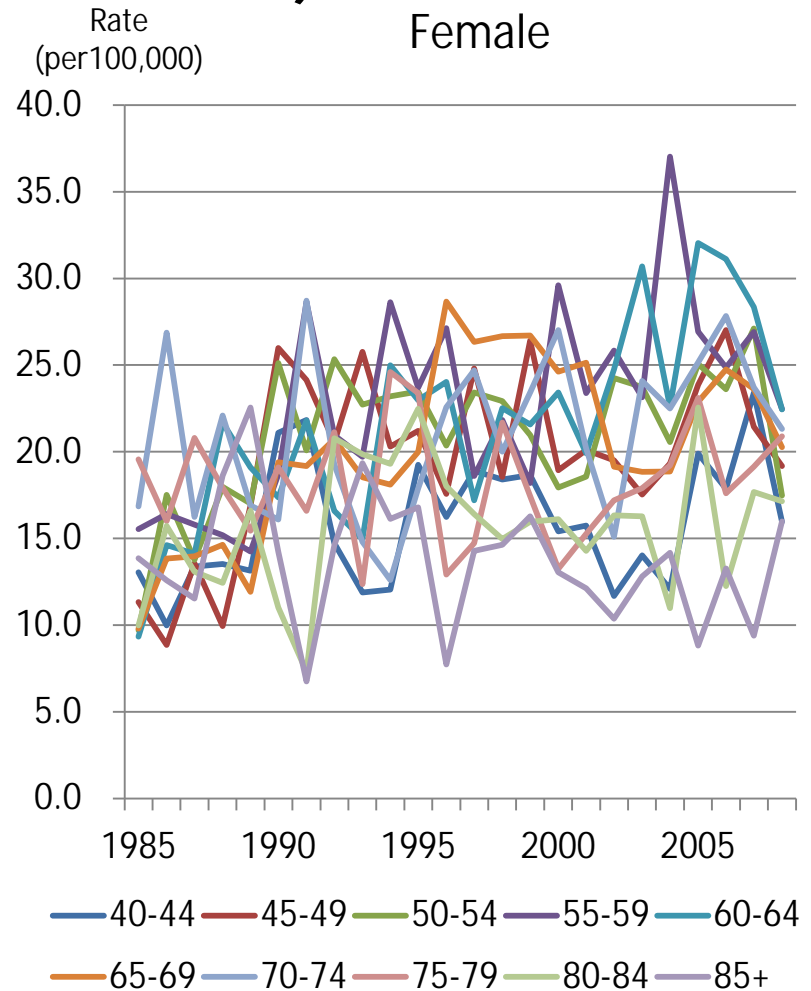
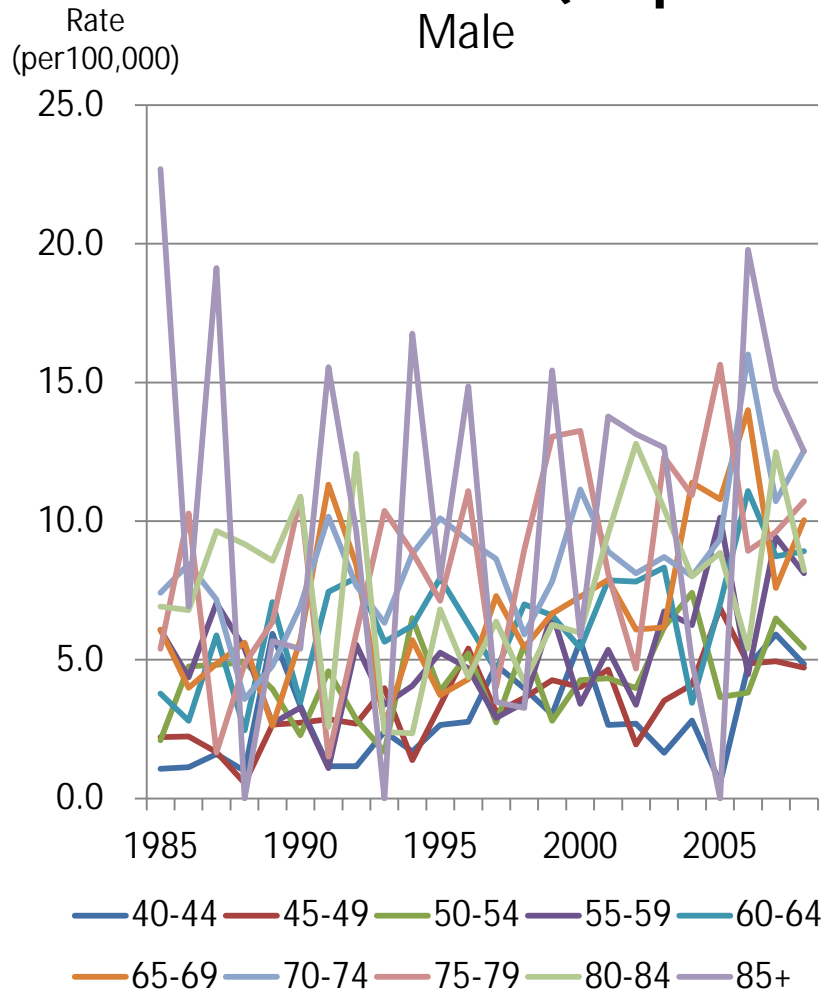


Age-specific incidence rate (estimated)



Source: Center for Cancer Control and Information Services,
National Cancer Center, Japan

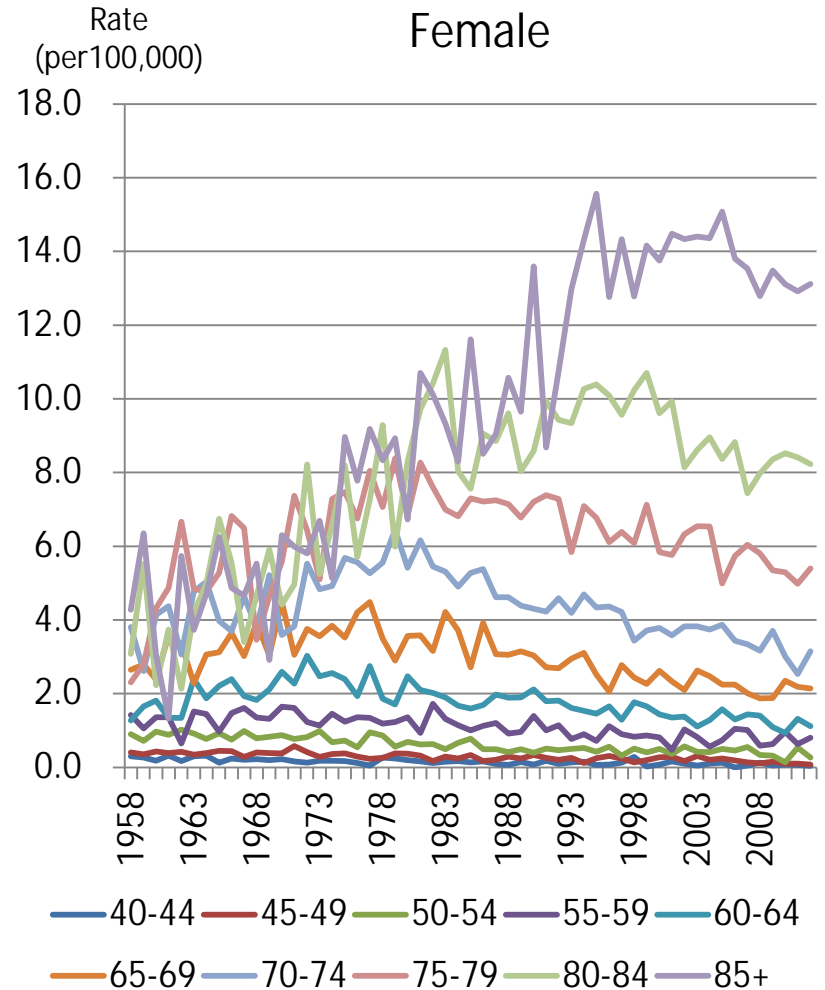
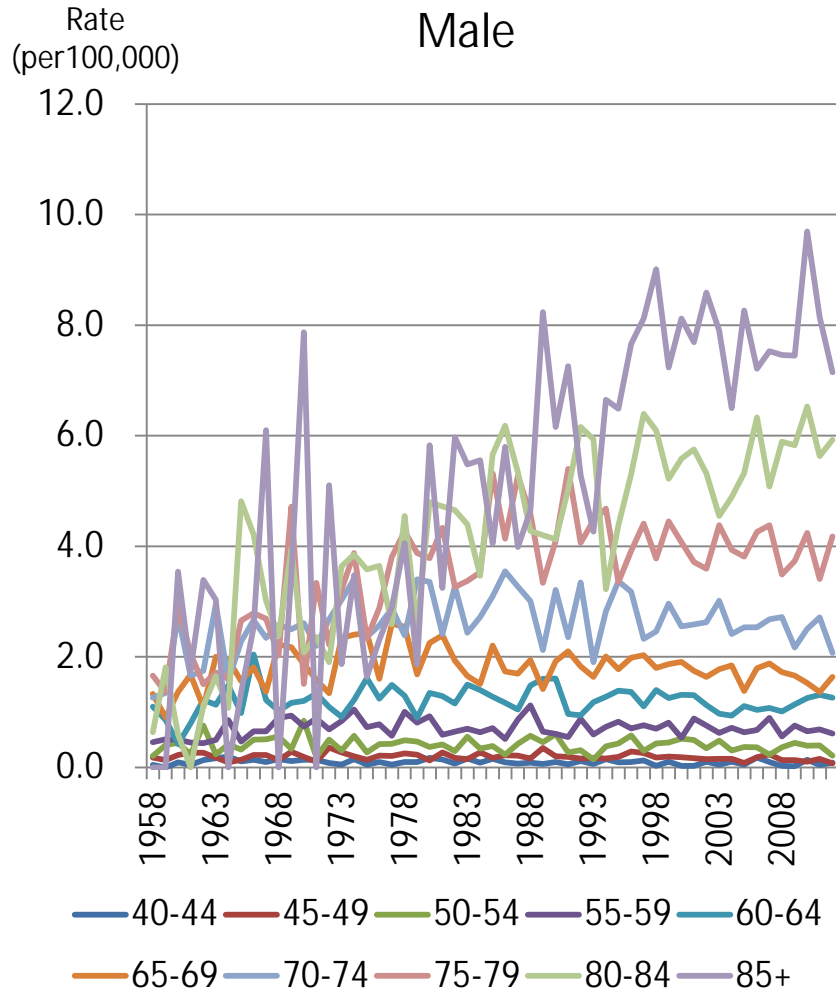
Age-specific incidence rate (4 prefectures*)



*Miyagi, Yamagata, Fukui, Nagasaki

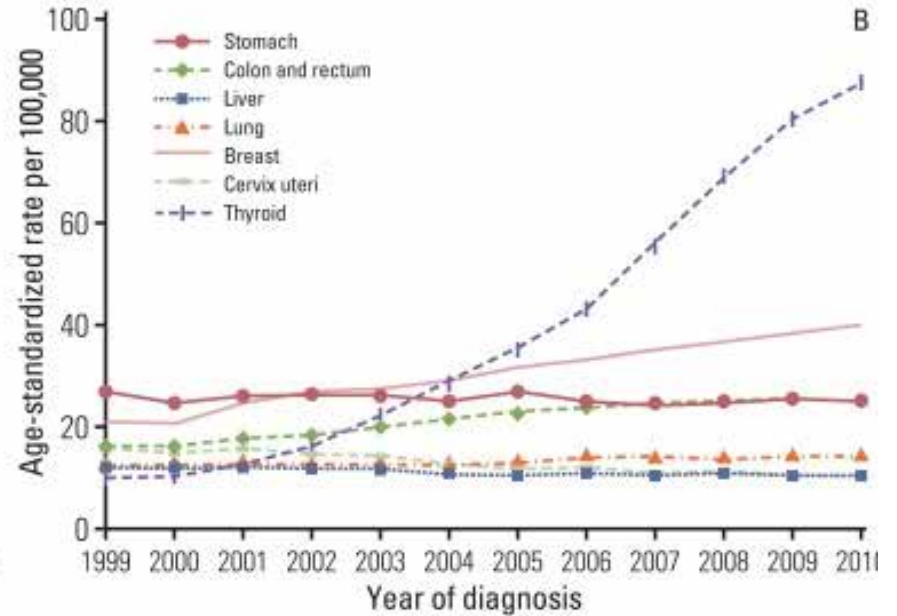
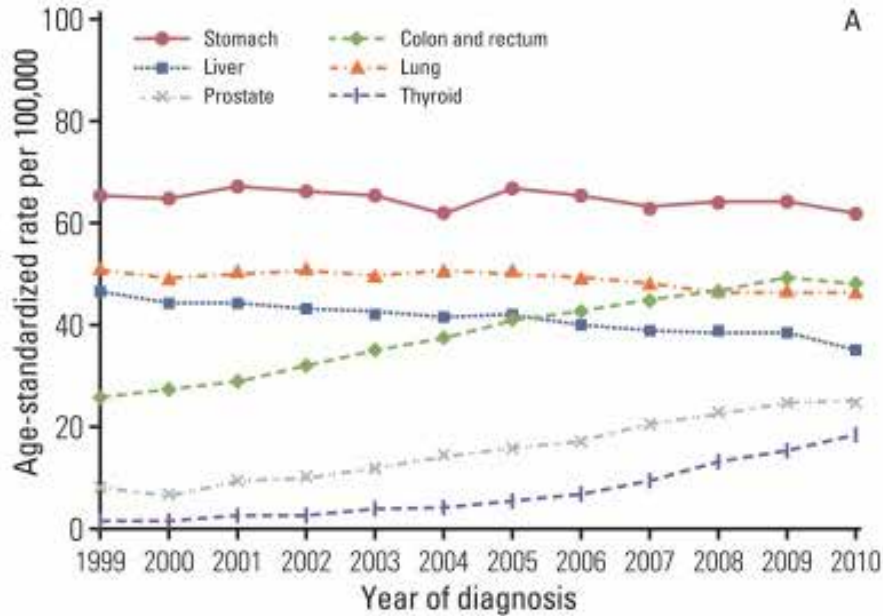
Source: Center for Cancer Control and Information Services,
National Cancer Center, Japan

Age-specific mortality rate



Source: Center for Cancer Control and Information Services,
National Cancer Center, Japan

Time trends of age-standardized cancer incidence rates in Korea



Jung KW, Won YJ, Kong HJ, Oh CM, Seo HG, Lee JS.
 Cancer statistics in Korea: incidence, mortality, survival and prevalence in 2010.
 Cancer Res Treat. 2013 Mar;45(1):1-14

Proportion of detection for thyroid nodule and cancer using palpation and ultrasound exam among asymptomatic population

Method	Area	Sex	Nodule		Cancer	
			n	Prop. of Detection %	n	Prop. of Detection %
Palpation	Japan	M	88,858	0.64	128,664	0.08
		F	289,973	1.64	469,070	0.18
	Others	M	9,080	0.76		
		F	9,990	3.10		
Ultrasound	Japan	M	16,811	16.63	37,459	0.26
		F	21,907	28.14	38,524	0.66
	Others	M	45,500	20.08		
		F	40,658	26.73		

The Japan Thyroid Association: Guidelines for Clinical Practice for the Management of Thyroid Nodules in Japan 2013

発見割合

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Proportion of detected thyroid cancer

Annual incidence rate (1/year)

Average sojourn time (years)

Sensitivity (%)

=

x

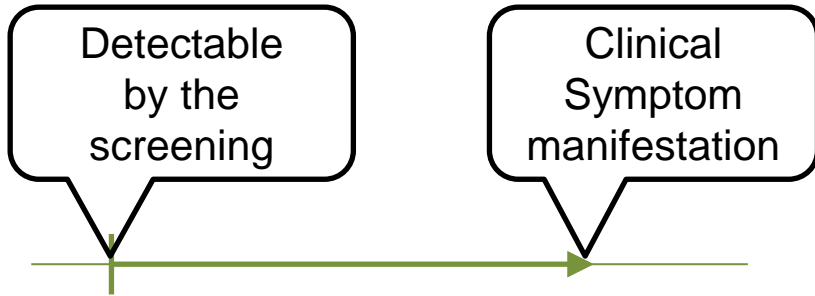
x

0.26%
260/100,000

5-20/100,000

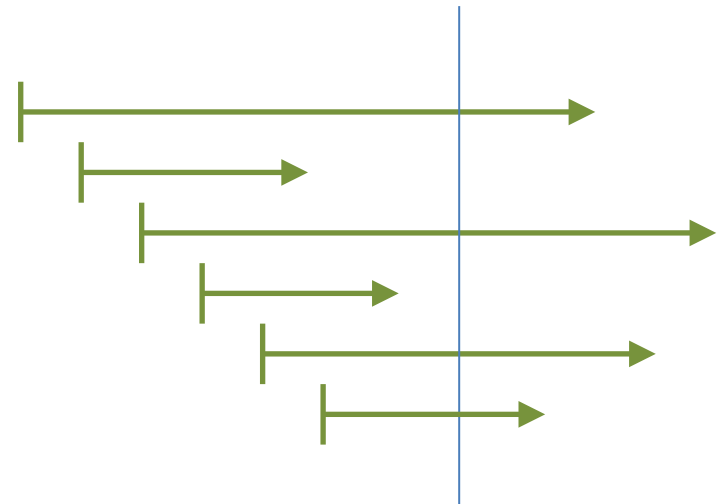
10-50 years?

100%

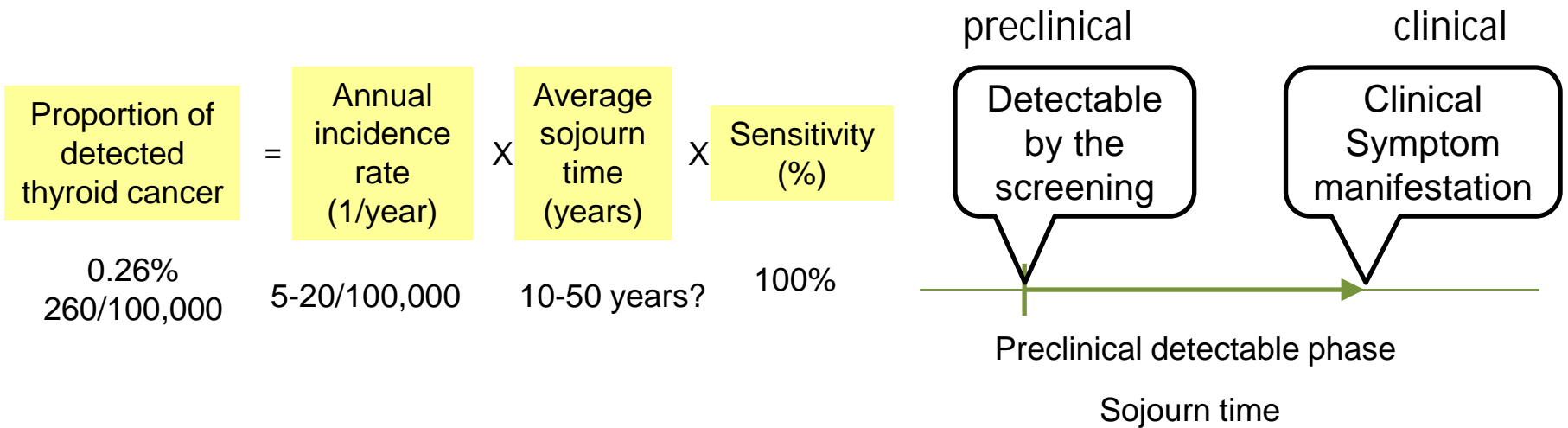


Preclinical detectable phase
(前臨床発見可能期間)

Sojourn time
(滞在時間)



screening



- | Incidence rate (preclinical) > incidence rate (clinical)
 - n Overdiagnosis (infinite sojourn time, die of other causes)
 - n Regression
- | Non-identifiability of sojourn time and sensitivity
 - n e.g. 5/100 proportion of detection
 - > 1/100 incidence rate x 5 years x 100%
 - > 1/100 incidence rate x 10 years x 50%
 - both combinations of sojourn time and sensitivity can explain the same finding

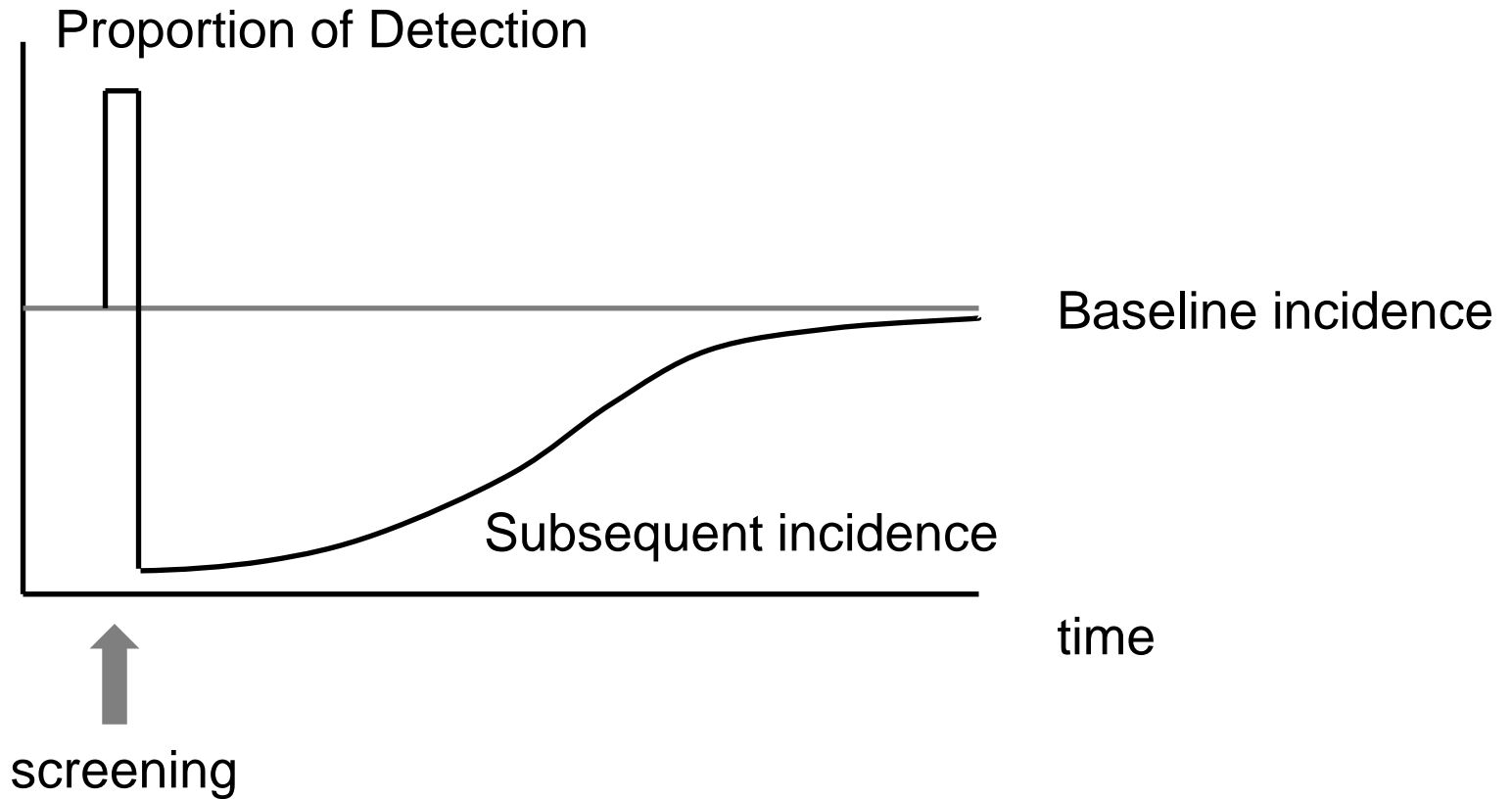
Expected proportion of thyroid cancer detected by ultrasound exam among exposed group

Age group	Number of subjects	Incidence rate (per 100,000)	Expected number of detected thyroid cancer according assumed average sojourn time					
			1-year	5-years	10-years	20-years	30-years	50-years
20-24	102	1.2	0.00	0.01	0.01	0.02	0.04	0.06
25-29	167	2.3	0.00	0.02	0.04	0.08	0.12	0.19
30-34	172	3.4	0.01	0.03	0.06	0.12	0.18	0.29
35-39	254	2.8	0.01	0.04	0.07	0.14	0.21	0.36
40-44	276	4.9	0.01	0.07	0.14	0.27	0.41	0.68
45-49	276	6.1	0.02	0.08	0.17	0.34	0.51	0.84
50-54	332	8.2	0.03	0.14	0.27	0.54	0.82	1.36
55-59	247	9.2	0.02	0.11	0.23	0.45	0.68	1.14
60-64	120	11.7	0.01	0.07	0.14	0.28	0.42	0.70
65-69	23	8.8	0.00	0.01	0.02	0.04	0.06	0.10
70-74	3	12.6	0.00	0.00	0.00	0.01	0.01	0.02
Total	1972		0.11	0.57	1.15	2.30	3.44	5.74
Proportion of detection			0.01%	0.03%	0.06%	0.12%	0.17%	0.29%

n Incidence rate was estimated using 27 prefecture-wide population-based cancer registries in 2010

n Assumed 100% sensitivity

Pattern of proportion of detection and subsequent incidence rates



Guideline: IOM definition (2011)

Old definition: “systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances.”

New definition: Clinical practice guidelines are statements that include **recommendations** intended to optimize patient care that are informed by a **systematic review** of evidence and an assessment of the **benefits and harms** of alternative care options.

Benefits and Harms of cancer screening

Benefits

- | Mortality reduction
- | Improvement of QOL
- | Reduction of medical cost
- | Relief due to true negative

Harms

- | Overdiagnosis/treatment
- | Unnecessary diagnostic test due to false positive
- | Treatment delay due to false negative
- | Complication due to screening

		Disease	
		Positive	Negative
Test	Positive	True Positive	False Positive
	Negative	False Negative	True Negative

Screening for Prostate Cancer

Current Recommendation

Release Date: May 2012

The USPSTF recommends against PSA-based screening for prostate cancer.

Grade: [D Recommendation](#).

“Prostate cancer is a serious health problem that affects thousands of men and their families. But before getting a PSA test, all men deserve to know what the science tells us about PSA screening: there is a very small potential benefit and significant potential harms. **We encourage clinicians to consider this evidence and not screen their patients with a PSA test** unless the individual being screened understands what is known about PSA screening and makes the personal decision that even a small possibility of benefit outweighs the known risk of harms.”

前立腺がんは、数千人の男性とその家族を巻き込む重大な健康問題である。しかし、PSA検査を受ける前に、全ての男性は、現在の科学がPSAについて語っていることを知るべきである。それは、非常に小さな利益をもたらすかもしれないが、大きな不利益をもたらすかもしれない、という点である。我々は臨床家がこの証拠を考慮して、個々の受診者がPSA検査について理解し、小さな利益の可能性でも不利益を上回る価値があると個々に判断しない限り、**PSA検査を行わないことを勧める。**

Benefits and Harms of prostate cancer screening using PSA

Possible benefit of screening

The reduction in prostate cancer deaths from prostate-specific antigen (PSA) screening is at most very small. A large U.S. study showed no benefit from screening. A large European study that found the highest reported benefit suggests:

- **1 man in 1,000 – at most – avoids death from prostate cancer because of screening**

Expected harms of screening

Most prostate cancers found by PSA screening are slow growing, not life threatening, and will not cause a man any harm during his lifetime. However, there is currently no way to determine which cancers are likely to threaten a man's health and which will not. As a result, almost all men with PSA-detected prostate cancer opt to receive treatment. In addition to the frequent complications of biopsy that lead to a cancer diagnosis, there can be serious harms from treatment of screen-detected prostate cancer.

For every 1,000 men who are screened with the PSA test:

- **30 to 40 men will develop erectile dysfunction or urinary incontinence due to treatment**
- **2 men will experience a serious cardiovascular event, such as a heart attack, due to treatment**
- **1 man will develop a serious blood clot in his leg or lungs due to treatment**

For every 3,000 men who are screened with the PSA test:

- **1 man will die due to complications from surgical treatment**