

Childhood Thyroid Cancer in Korea

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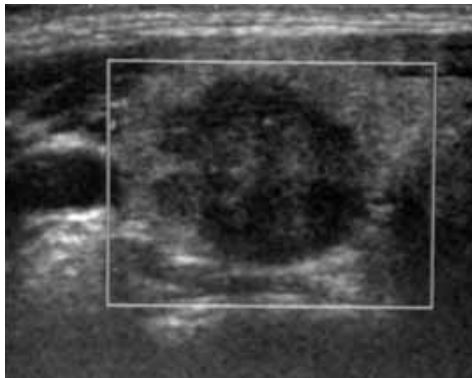
**Recent increase of thyroid cancer
in Koreans**

Prevalence of thyroid nodule & cancer - Samsung Medical Center in 2009 -

N=15,415 (men 1,951, women 13,464)

Visitors for regular health check-up at Samsung Medical Center

Real-time US with a 10-12 MHz linear transducer



		Total
All nodule	Solid nodule	39%
	Cyst	19%
Cancer	All subjects	2.2%
	Subjects with nodule	5.7%

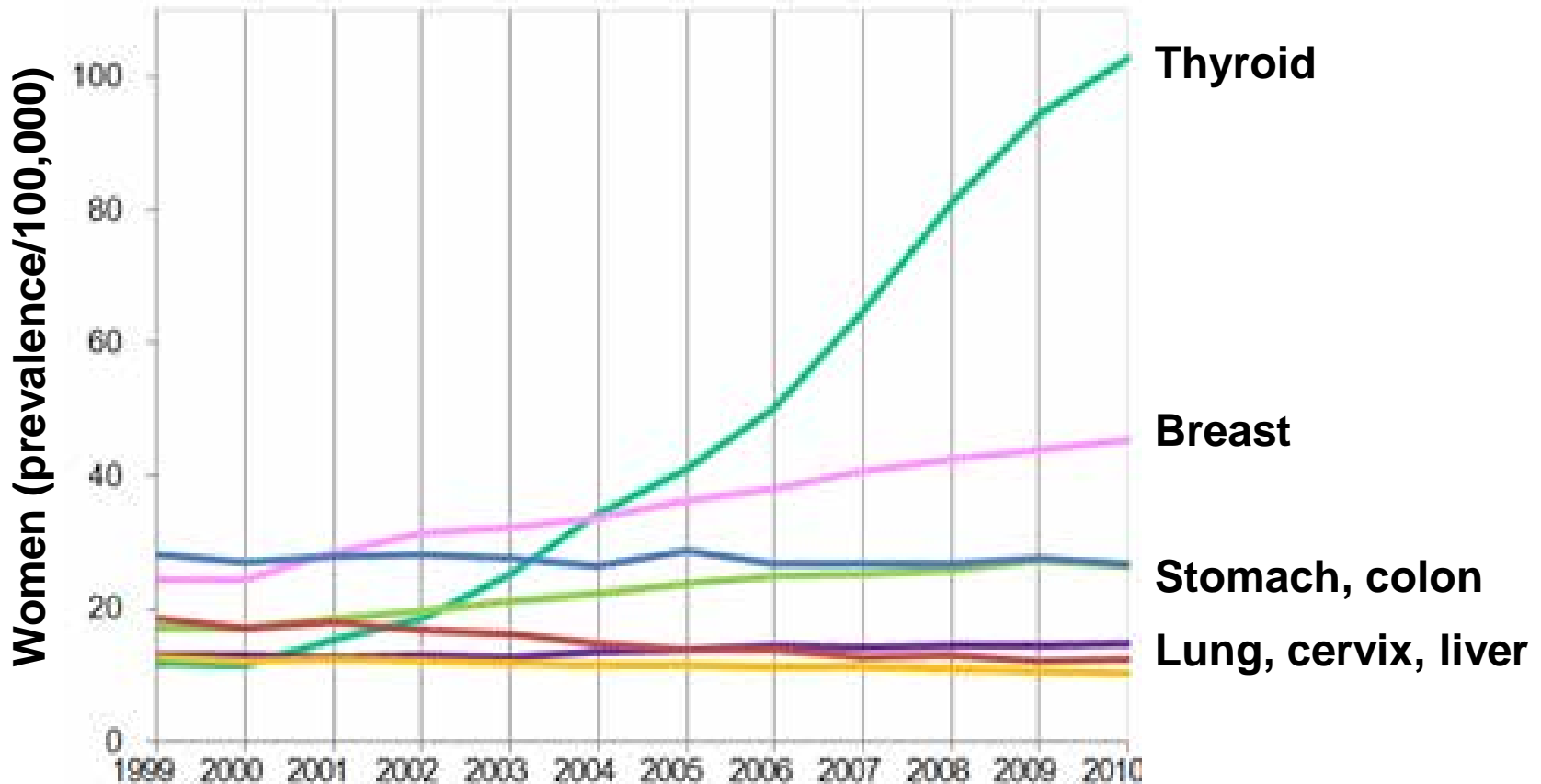
Korean Cancer Registry in 2010

Rank	Overall			Men			Women		
	All	202,053	100%	All	103,014	100%	All	99,039	100%
1	Thyroid	36,021	17.8	Stomach	20,179	19.6	Thyroid	29,790	30.1
2	Stomach	30,092	14.9	Colon	15,612	15.2	Breast	14,208	14.3
3	Colon	25,782	12.8	Lung	14,650	14.2	Colon	10,170	10.3
4	Lung	20,711	10.3	Liver	11,818	11.5	Stomach	9,913	10
5	Liver	15,921	7.9	Prostate	7,848	7.6	Lung	6,061	6.1
6	Breast	14,277	7.1	Thyroid	6,231	6	Liver	4,103	4.1
7	Prostate	7,848	3.9	Bladder	2,752	2.7	Uterus	3,857	3.9
8	Biliary	4,877	2.4	Biliary	2,532	2.5	Biliary	2,345	2.4
9	Pancreas	4,637	2.3	Kidney	2,520	2.4	Pancreas	2,132	2.2
10	Lymphoma	3,940	1.9	Pancreas	2,505	2.4	Ovary	1,981	2

From the data of Ministry of Health & Welfare, Korea

Abrupt increase of thyroid cancer (1999-2010)

Annual increment: thyroid Ca. 25% vs. other Ca. 3.3%



From the data of Ministry of Health & Welfare, Korea

Change of thyroid cancer subtypes in Korea

	1983	1986	1990	2008	2009
Authors	Park	Choi	Hong	Cancer Registry	Cancer Registry
Number	337	406	1,847	26,746	31,774
Papillary	77%	80%	80%	94%	95%
Follicular	16%	15%	16%	1.7%	1.5%
Medullary	2%	1.5%	1.2%	0.4%	0.5%
Anaplastic	3.9%	3-3.5%	1.7-2.3%	0.2%	0.2%
Lymphoma	0.3%	0.7%	0.1%	-	-
Others	1.2%	-	1%	4.1%	2.6%

Park SH et al., *Inje Med J* 4: 349-364, 1983

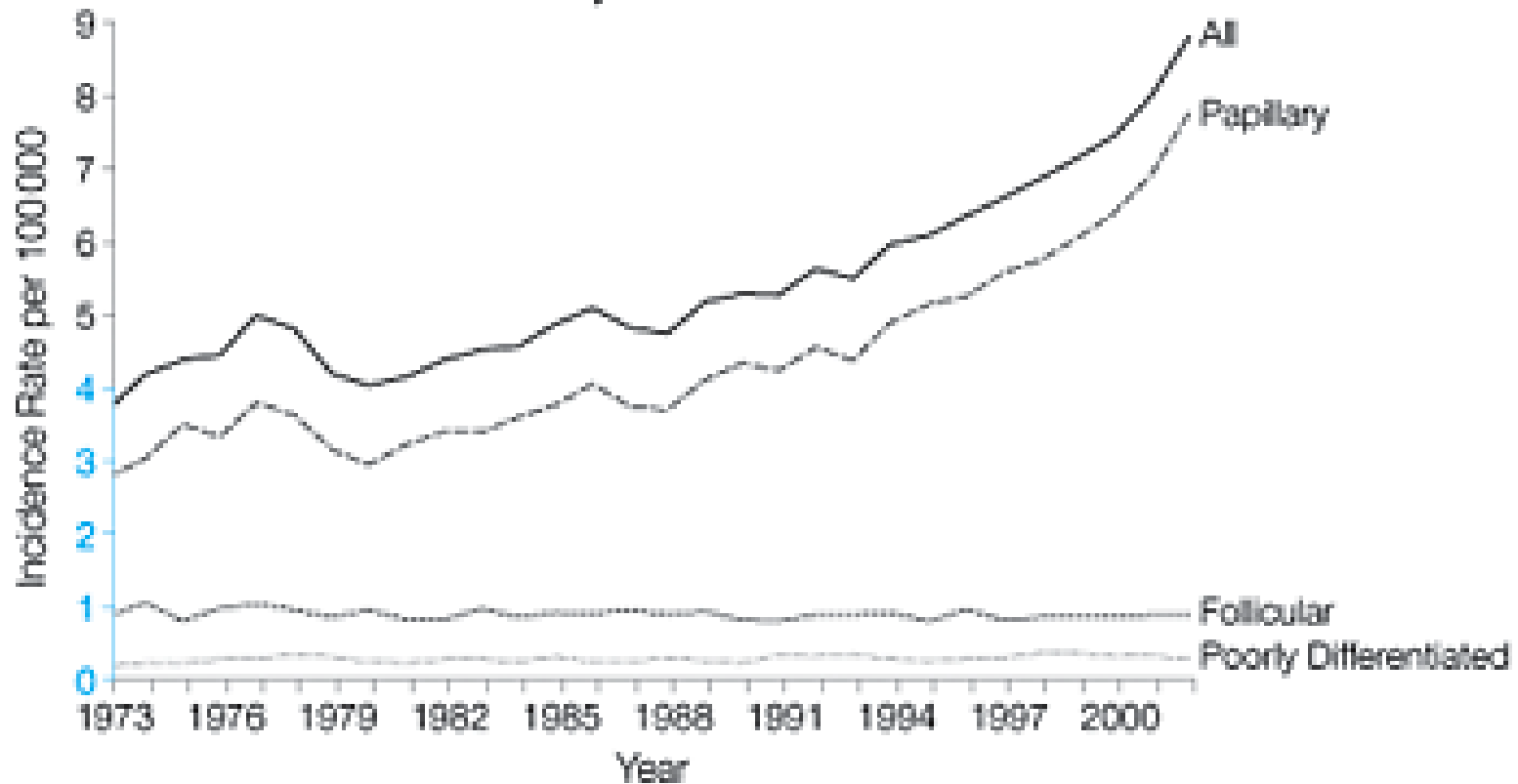
Choi CW et al. *Kor J Nuc Med* 20: 59-65, 1986

Hong EK & Lee JD: *J Kor Med Sci* 5: 1-12, 1990

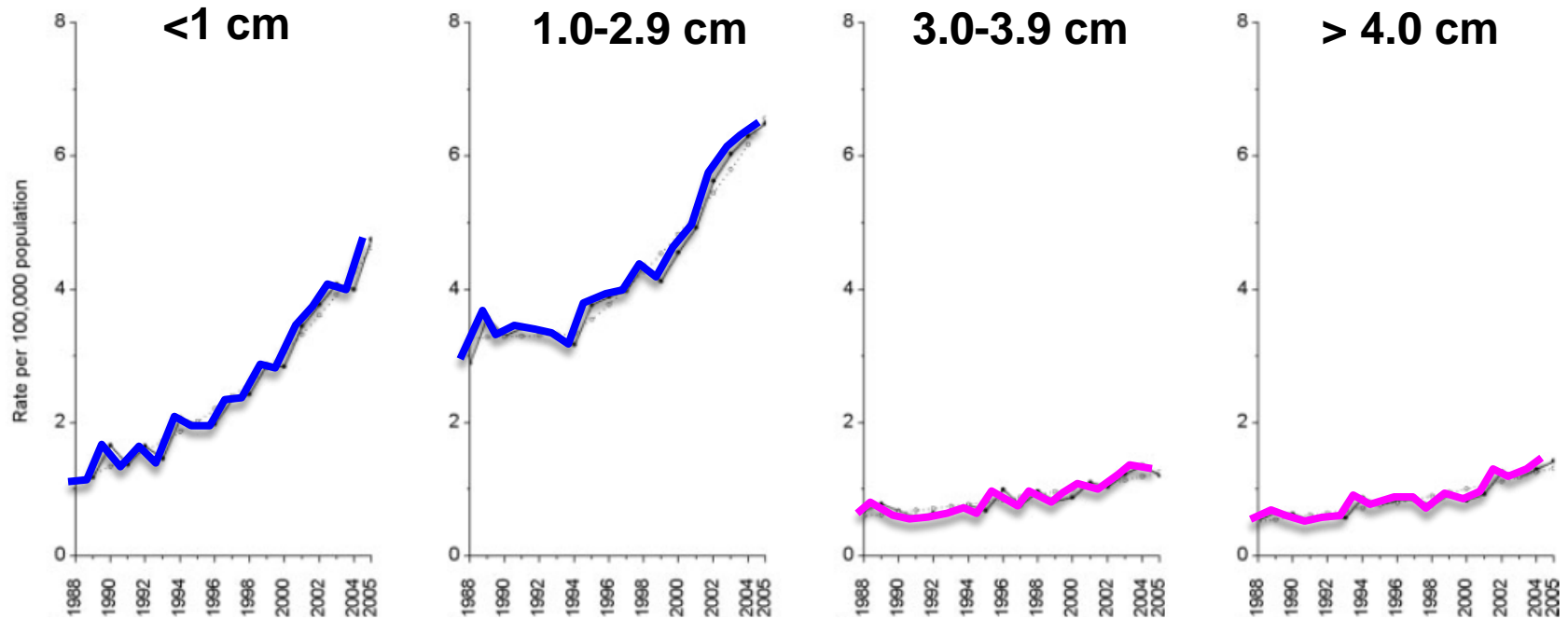
Cancer Registry, Ministry of Health & Welfare, 2008, 2009

Increase of thyroid cancer in the world

Trends in Incidence of Thyroid Cancer (1973-2002) in the USA



Increase of small & large thyroid cancer



SEER (Surveillance, Epidemiology and End Results) program-NCI (1980-2005)

- 1) Davies L. et al., *JAMA* 295:2164, 2006
- 2) Amy Y et al., *Cancer* 115: 3801, 2009
- 3) Enewold L et al., *Cancer Epidemiol Biomarkers Prev* 18: 784, 2009

Rising thyroid cancer incidence in the United States by demographic and tumor characteristics, 1980-2005

Enewold L, Zhu K, Ron E, Marrogi AJ, Stojadinovic A, Peoples GE, Devesa SS.

United States Military Cancer Institute, Department of Pathology and Area Laboratory Service, Walter Reed Army Medical Center

Since 1992-1995, half the overall increase in papillary carcinoma rates was due to increasing rates of very small (≤ 1.0 cm) cancers, 30% to cancers 1.1 to 2 cm, and 20% to cancers > 2 cm.

Medical surveillance and more sensitive diagnostic procedures cannot completely explain the observed increases in papillary thyroid cancer rates. Thus, other possible explanations should be explored.

Cancer Epidemiol Biomarkers Prev. 2009 Mar;18(3):784-791

Genetic susceptibility to
thyroid cancer in Koreans

Thyroid cancer: genetic > environmental

Genetic & environmental factors in 15 common cancers using the nationwide Swedish Family-Cancer Database.

	Genetic	Environmental
Stomach	0.01	0.15/0.71
Colon	0.13	0.12/0.69
Lung	0.08	0.09/0.79
Breast	0.25	0.09/0.60
Thyroid	0.53	0.01/0.36

Structural equation modeling was used to derive estimates of the importance of two effects.

The estimate of cancer susceptibility, accounted for by genetic effect, was highest in thyroid Ca.

Genetically susceptible in East Asia

Evaluation of risk of thyroid cancer in the 2nd generation of immigrants to Sweden from various counties

Birth region	Gender(SIR)	
	Men	Women
Sweden	1.00	1.00
All	1.09	1.36
Europe	0.59-1.47	0.76-1.76
N. America	0.35	0.76
S. America	1.37	1.99
Africa	0.90	1.19
East Asia	2.20	2.43

Risk of thyroid cancer is highest in the immigrants from East Asia.

Familial nonmedullary thyroid carcinoma

defined as occurring when **two or more first-degree relatives (parents, offspring, siblings)** have nonmedullary thyroid carcinoma in the absence of other known associated cancers

Authors	Journal	Nation	Year	Number	Prevalence
Uchino S et al.	World J Surg	Japan	2002	6,458	4.0%
Maxwell EL et al.	Laryngoscope	Canada	2004	543	4.4%
Capezzone M et al.	Endocr Relat Cancer	Italy	2008	300	11.3%
Ito K et al.	Surgery	Japan	2009	6,015	4.5%
Moses W et al.	Thyroid	USA	2011	402	8.8%
Park YJ et al.	Thyroid	Korea	2012	3,056	9.6%

Prevalence of BRAF mutation in Korean PTC

Authors	Journal	Year	No.	Method	Prevalence
Kim et al.	JCEM	2010	263	PCR, sequencing	84%
Kim et al.	Dian Mol Path	2008	81	Pyosequencing	78%
Jo et al.	JCEM	2006	161	Sequencing	63%
Kim et al.	Clin Endocrinol	2006	112	Sequencing	83%
Kim et al.	Yonsei med J	2004	70	Sequencing	83%
* Meta-analysis, 2005-2011			2,470	32 ~ 59% (45%)	

Thymine-to-adenine transversion at nucleotide 1799 in exon 15 of the BRAF gene results in a **valine-to-glutamate substitution** at residue 600 (V600E).

Genetic alteration of PTC in Korea

	World	Korea
BRAF mutation	29-83%	63-84%
RET/PTC rearrangement	13-43%	13%
RAS mutation	0-21%	4%
NTRK1	0-50%	-
TP53 mutation	0-5%	-

Chung JH et al. Thyroid 9: 1237, 1999

Jung JH et al., J Korean Endocr Soc 22: 203, 2007

Kim SW et al., J Clin Endocrinol Metab 95: 3693, 2010

Kim HJ et al., Endocrinol Metab 27: 45, 2012

Summary

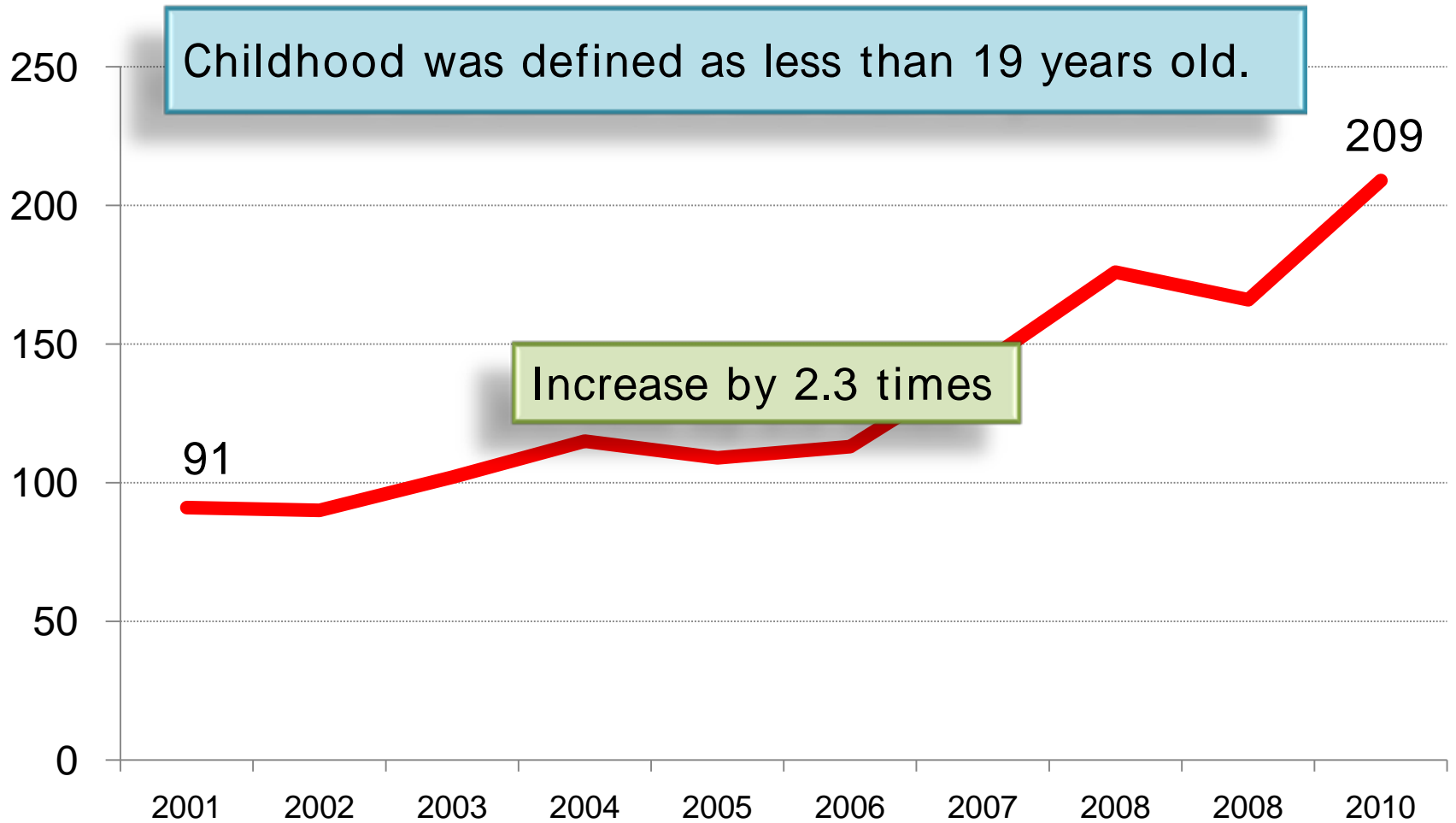
These results suggest that

- 1) the contribution of genetic factors to the pathogenesis of thyroid cancer is highest,
- 2) population living in East Asia, especially Korea is genetically susceptible to thyroid cancer.

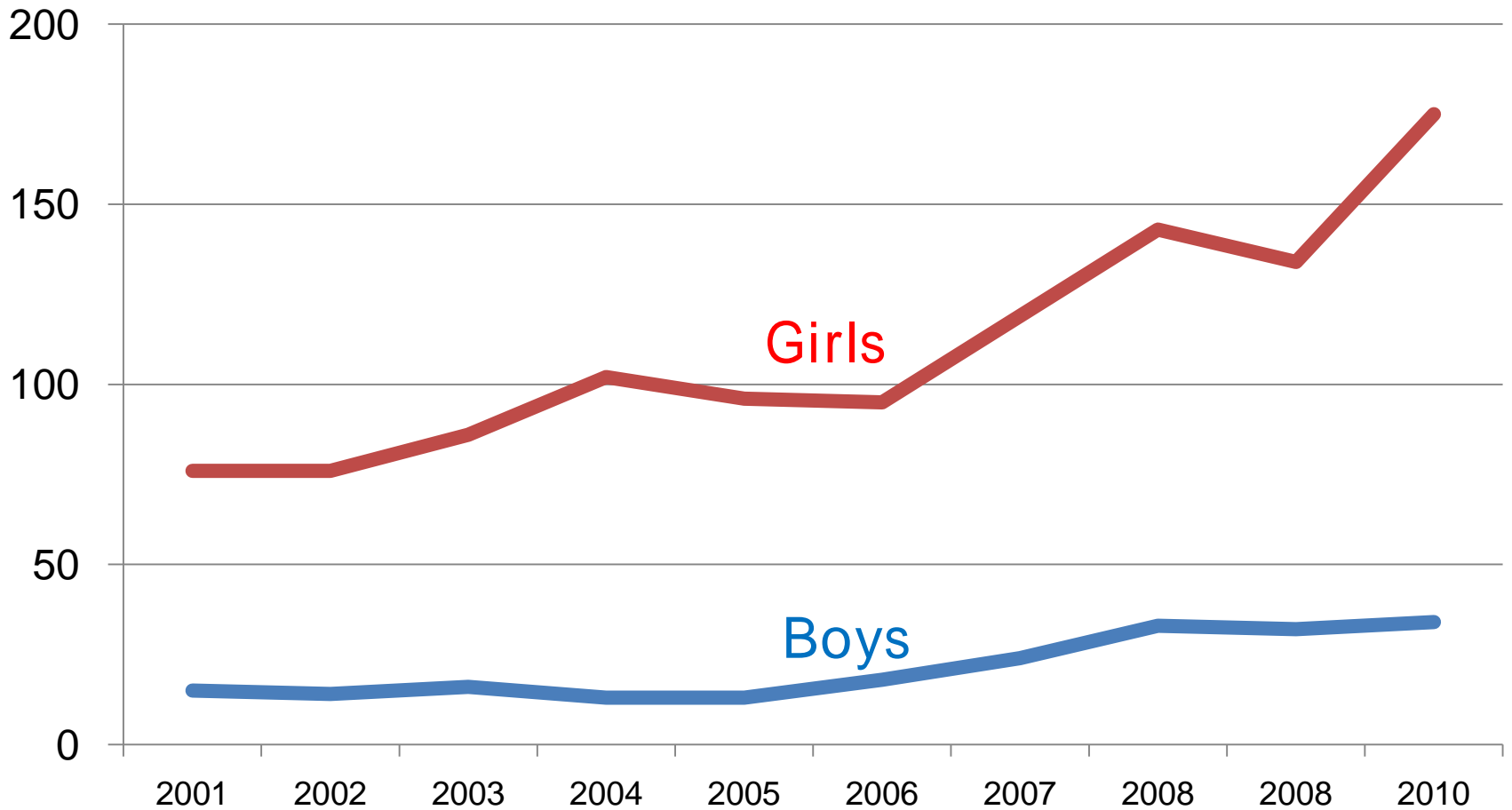
Recent increase of childhood thyroid cancer in Korea

Data provided by Ministry of Health & Welfare,
Korea (2001-2010)

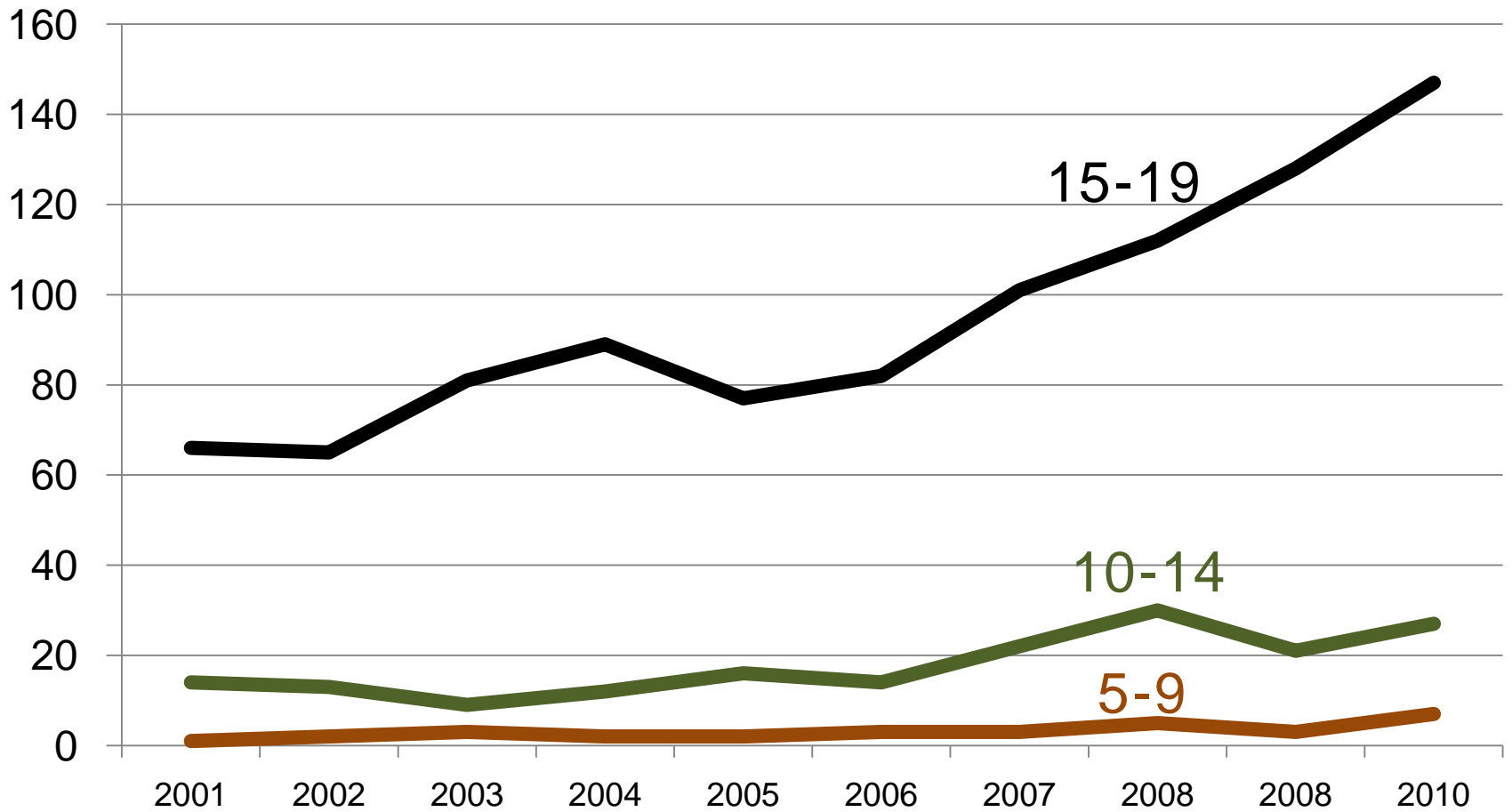
Annual incidence of childhood thyroid cancer in Korea (2001-2010)



Annual incidence of childhood thyroid cancer in Korea (2001-2010) – Gender

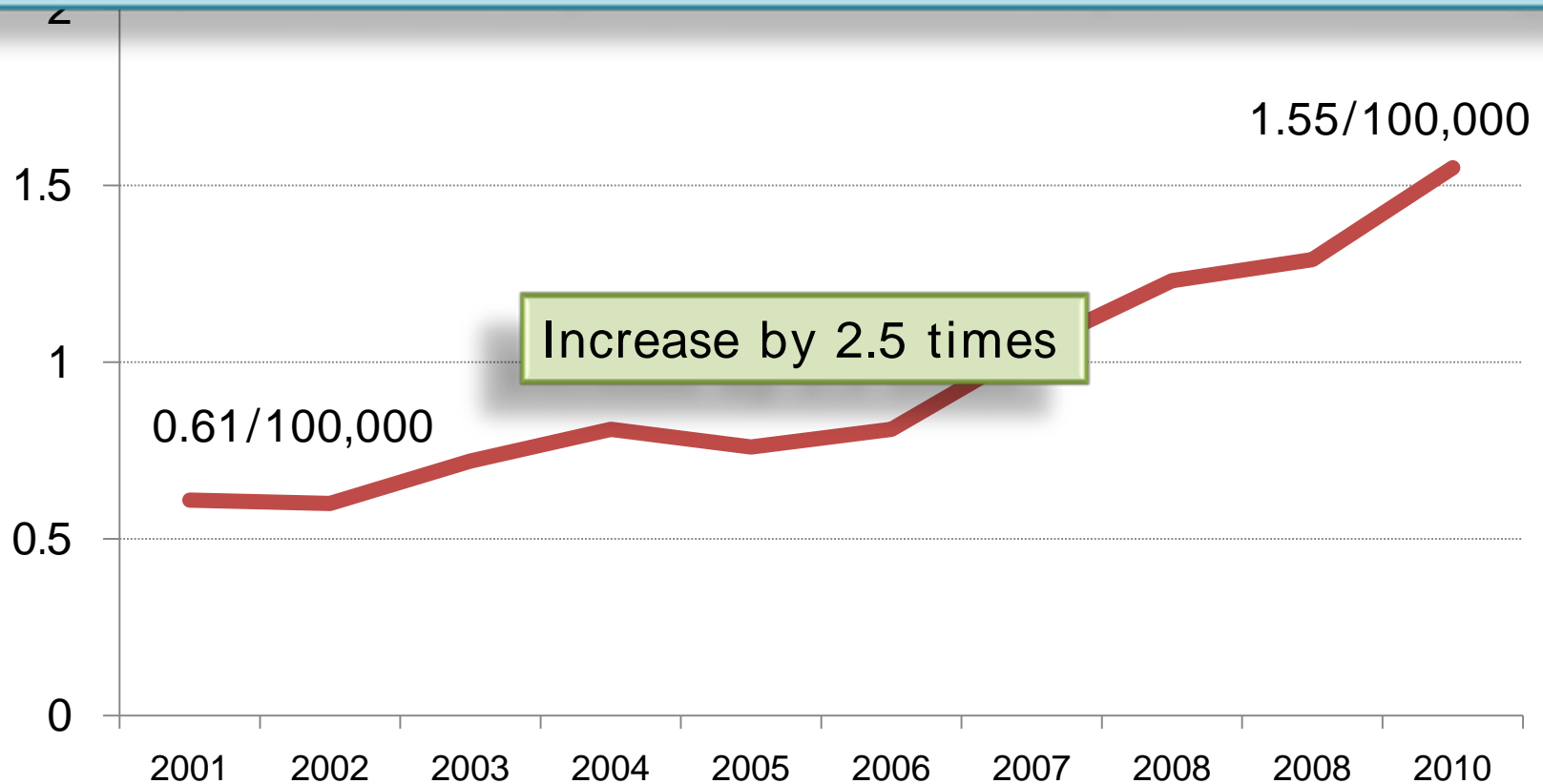


Annual incidence of childhood thyroid cancer in Korea (2001-2010) – Age

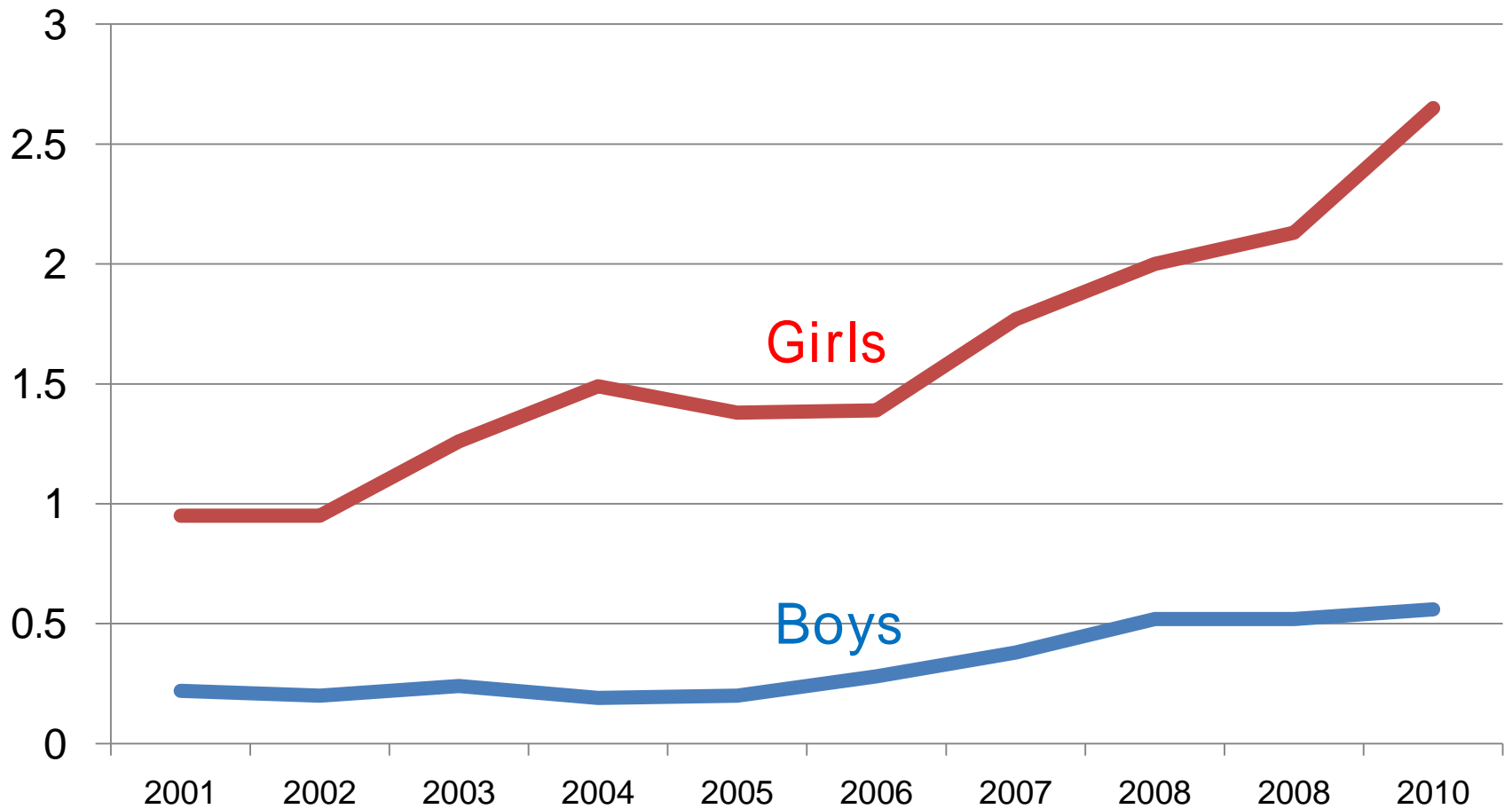


Age-specific CR of childhood thyroid cancer in Korea (2001-2010)

CR (crude rate): total number of patients/total number of persons with same age



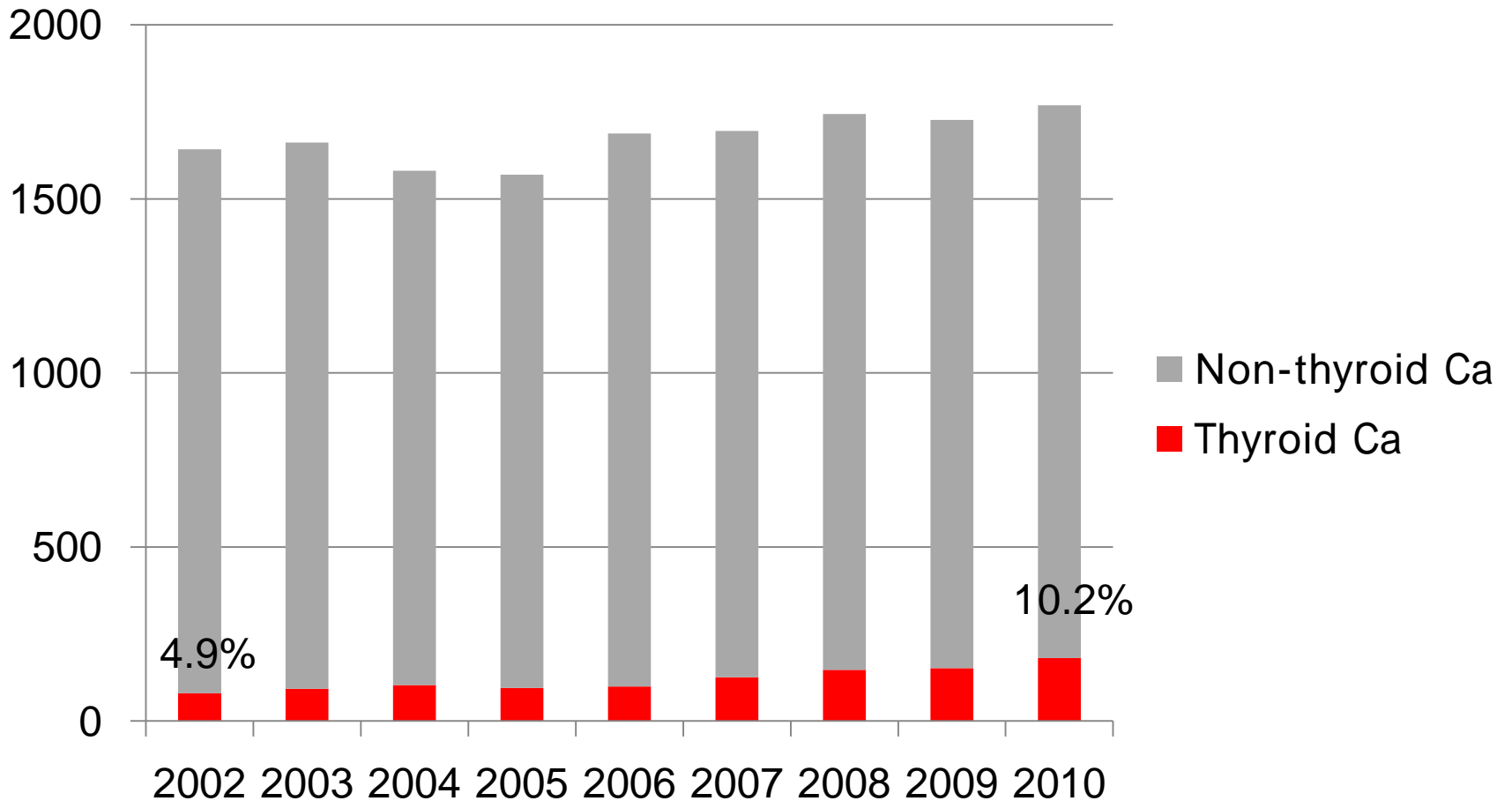
Age-specific CR of childhood thyroid cancer in Korea (2001-2010) -Gender



Incidence of childhood cancer in Korea-2010

	Cancer	Number	CR (per 100,000)
1	Leukemia	452	3.9
2	Brain	233	2.0
3	Lymphoma	199	1.7
4	Bone/soft tissue	194	1.7
5	Thyroid	181	1.6
6	Ovary	82	0.7
7	Adrenal	48	0.4
8	Kidney	45	0.4
9	Marrow	39	0.3
10	Eye	35	0.3
	Total	1,769	15.2

Proportions of thyroid cancer among childhood cancers in Korea



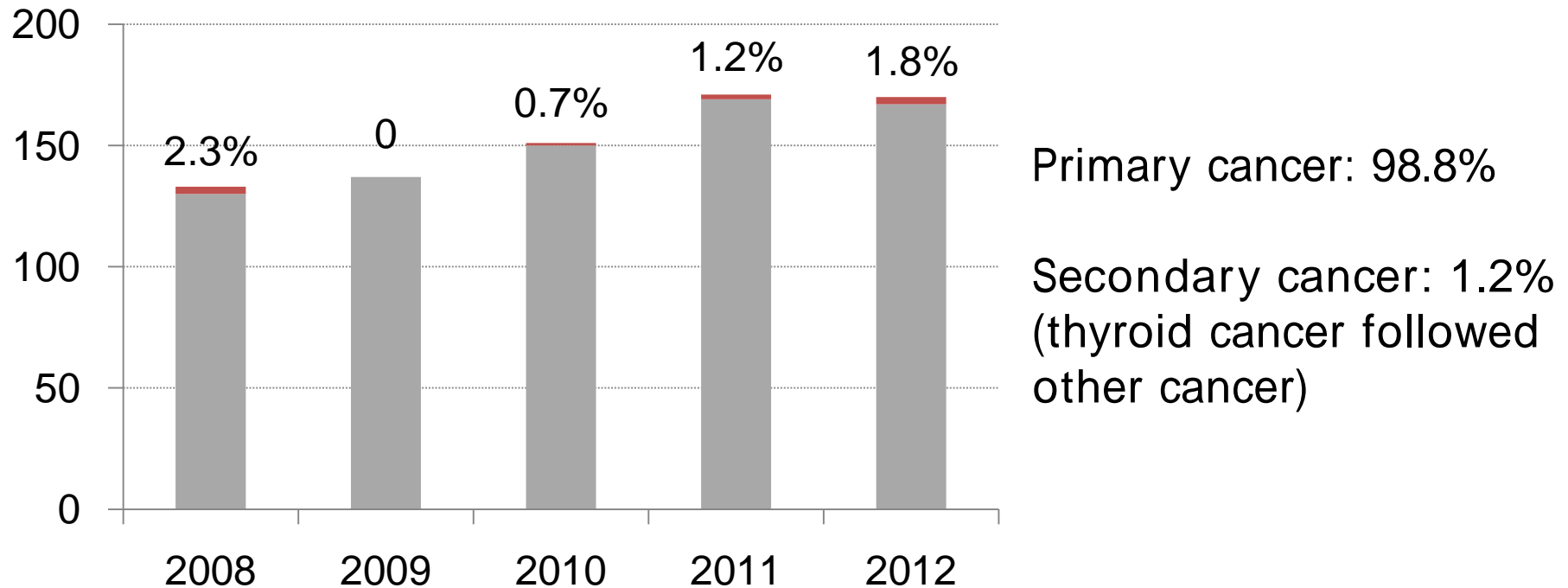
Prevalence of childhood thyroid cancer in Korea - 2010

	0-4	5-9	10-14	15-19	All (0-19)	CR (per 100,000)
All	0	12	58	366	436	3.74
Boys	0	4	16	74	94	1.52
Girls	0	8	42	292	342	6.17

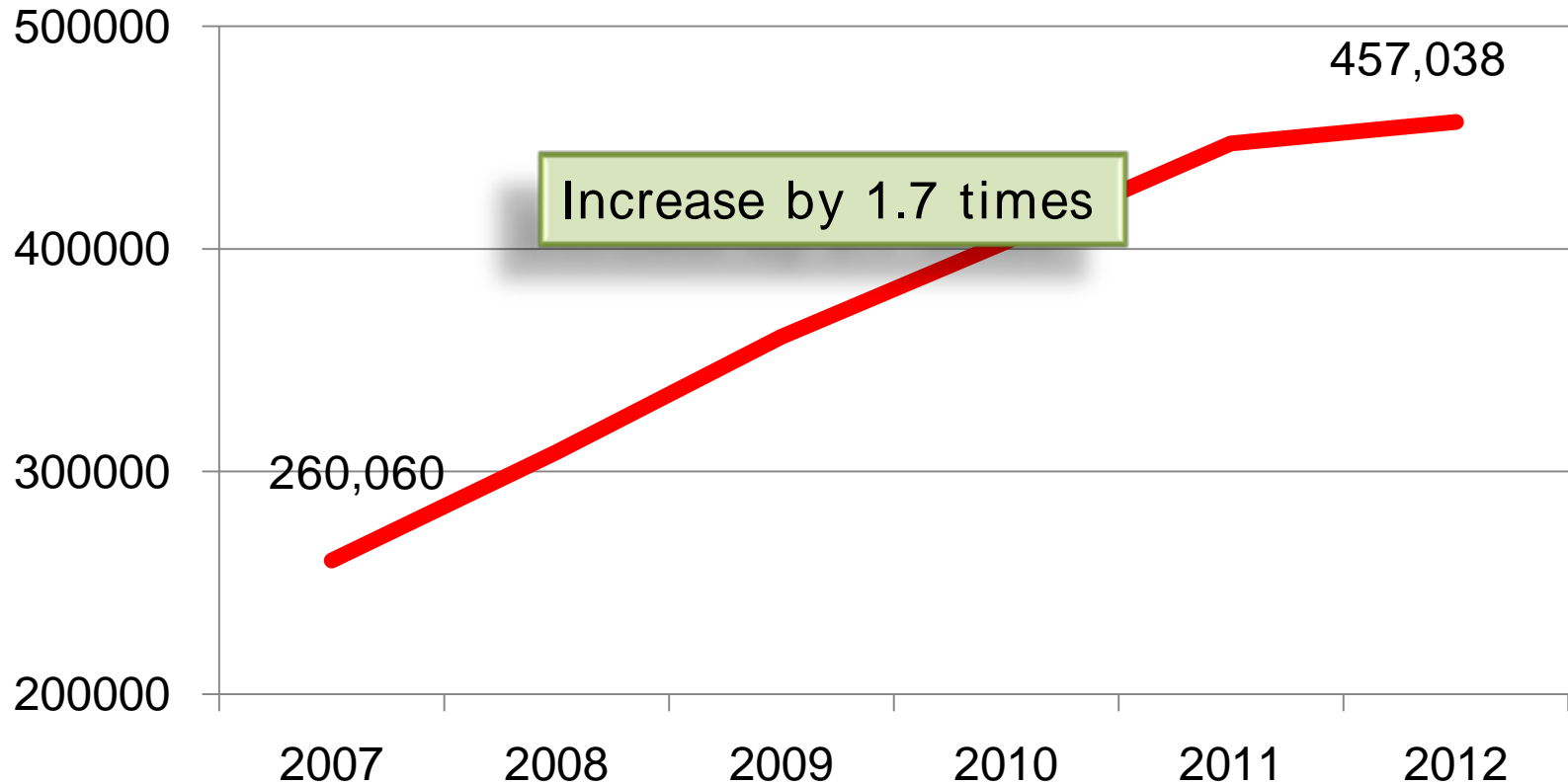
Childhood thyroid cancer as a secondary cancer in Korea

Data provided by Korean Health Insurance
Review and Assessment Service (2007-2012)

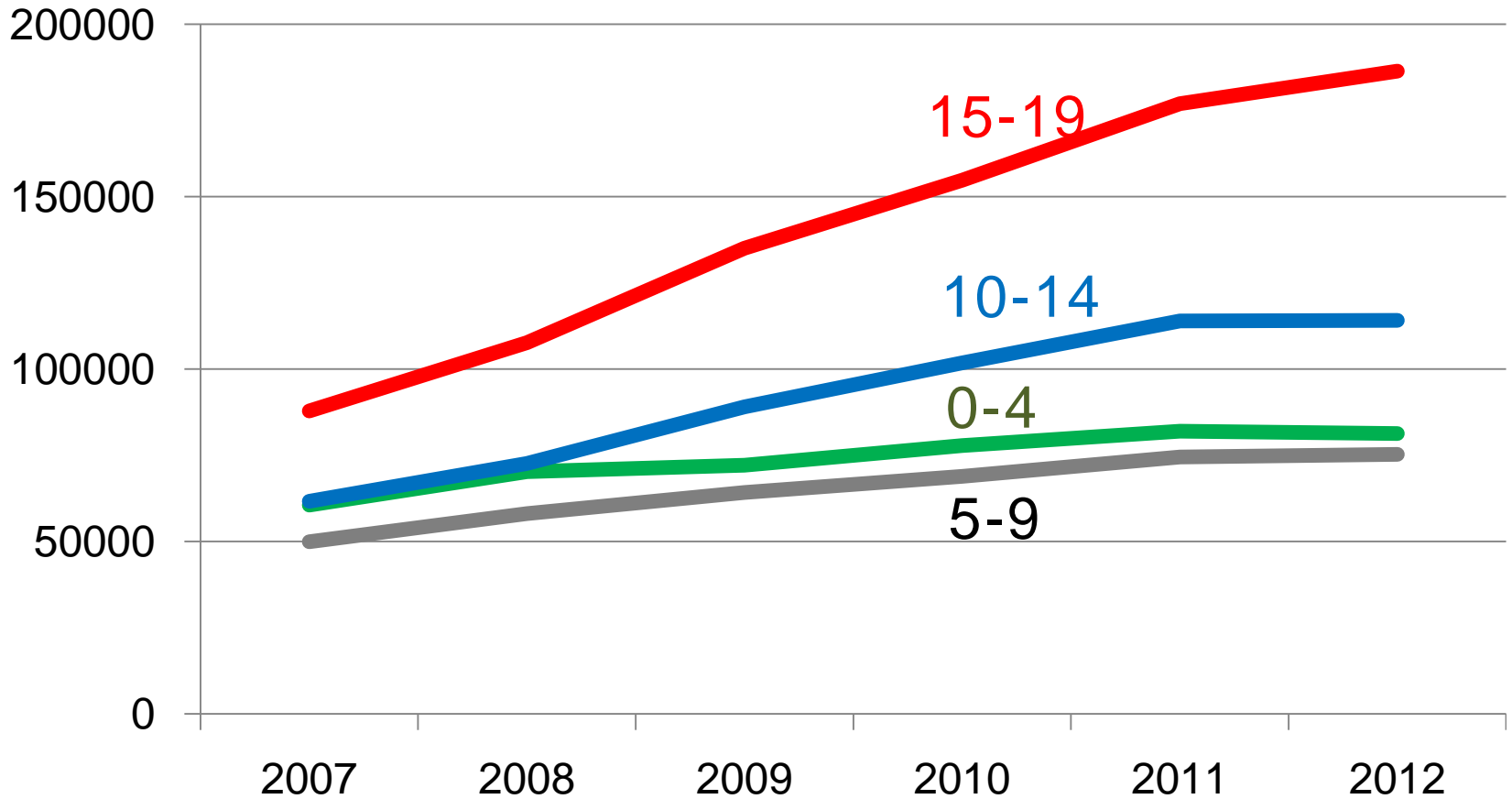
Childhood thyroid cancer as a secondary malignancy in Korea between 2008 and 2012



Number of CT scan in childhood in Korea



Number of CT scan in childhood in Korea - according to age -



Korean Health Insurance Review and Assessment Service

Data of childhood thyroid cancer
in Samsung Medical Center

Childhood thyroid cancer in Samsung Medical Center between 1995 and 2013 (1)

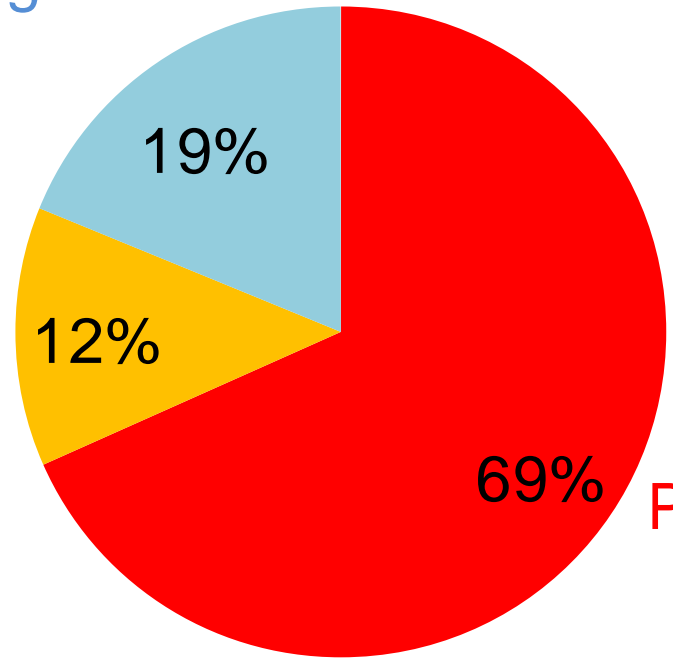
- Total 131 patients: 18 boys (14%), 113 girls (86%)
- Age: median 17 years (8 ~ 19 years)
- Family history (its presence in the first-degree members): 7%
- Secondary Ca (other Ca followed by thyroid Ca): 5%

Childhood thyroid cancer in Samsung Medical Center between 1995 and 2013 (2)

How to detect thyroid cancer?

Incidentally during F/U of other disease

USG screening



Palpable neck mass

Summary-1

- 1 Thyroid cancer is increasing in the world as well as in Korea.
- 2 Thyroid cancer became the most common cancer in Korea.
- 3 Early detection can't completely explain the increase of PTC .
- 4 Contribution of genetic factor is highest in thyroid cancer.
- 5 Koreans are genetically susceptible to thyroid cancer.
- 6 Incidence of childhood thyroid cancer is increasing in Korea.

Summary-2

7 Its increase is mainly found in girls and 15-19 years old.

8 It was the 5th ranked malignancy in Korea.

9 Its prevalence was 3.74/100,000 in 2010 (M 1.52, F 6.17).

10 It was detected as a secondary malignancy only in 1.2%.

11 It was detected by palpable neck mass or incidentally.

12 Medical radiation is also increasing in Korea.

Thank you for your attention

