Thyroid cancer after the Chernobyl accident

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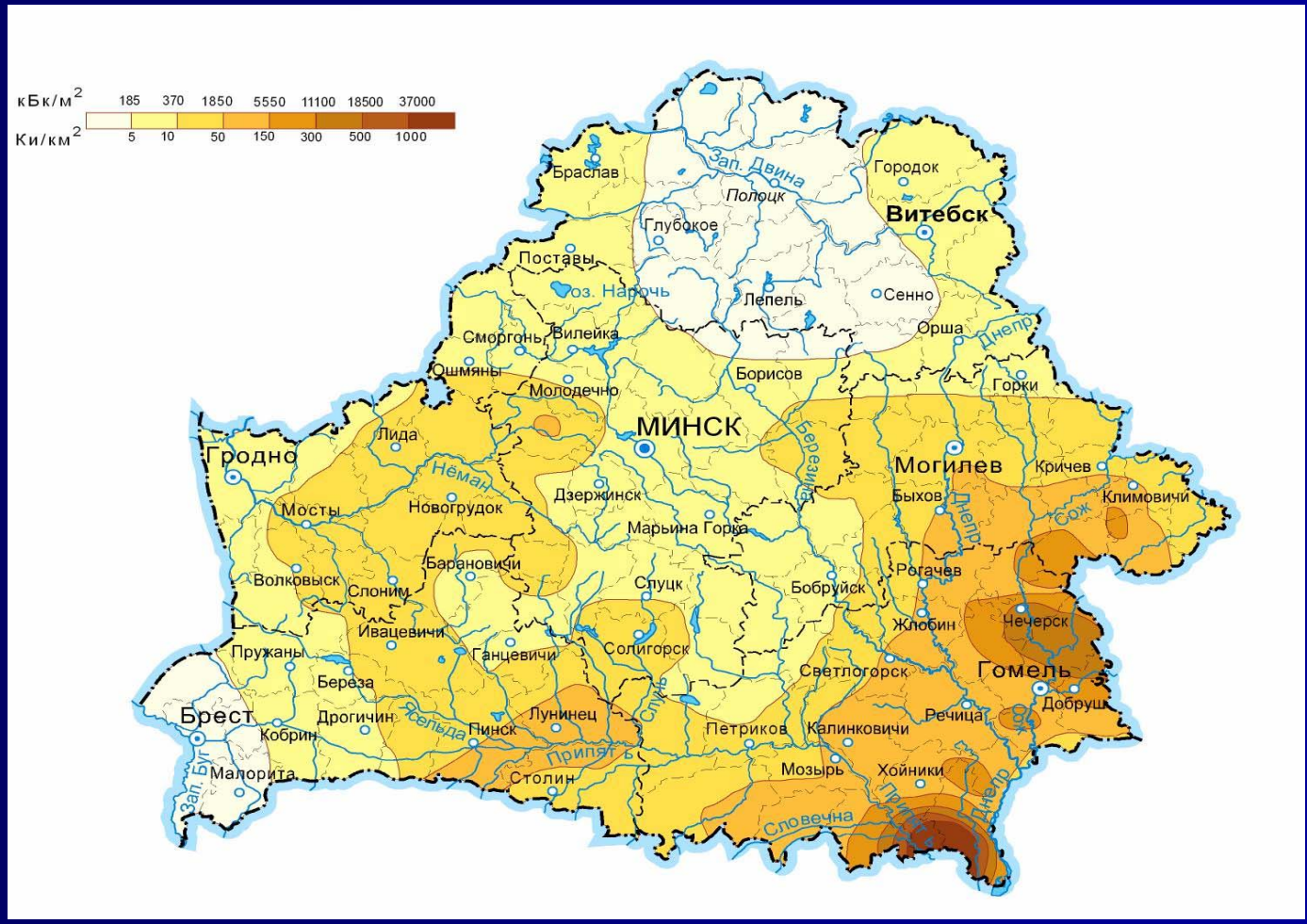
Damaged reactor of Chernobyl NPP

Release of iodine-131

Year	Activity of I-131 in, PBq
Windscail, UK, 1957	0,74
SL-1, Idaho Falls, USA, 1961	0,00037 at 1st 16 h Total 0,003 for 30 days
Hanford,USA, 1963	0,0022
Savanna River, USA, 1964	0,0035 in 1st several days, Total 0,0057 for 26 days
TMI, USA, 1979	0,0006 – 0,0007
Chernobyl,USSR, 1986	1760
Nuclear tests, 1945-1962	740 000

Contamination by I-131 of Belarus (10 May, 1986)



Estimated collective thyroid doses

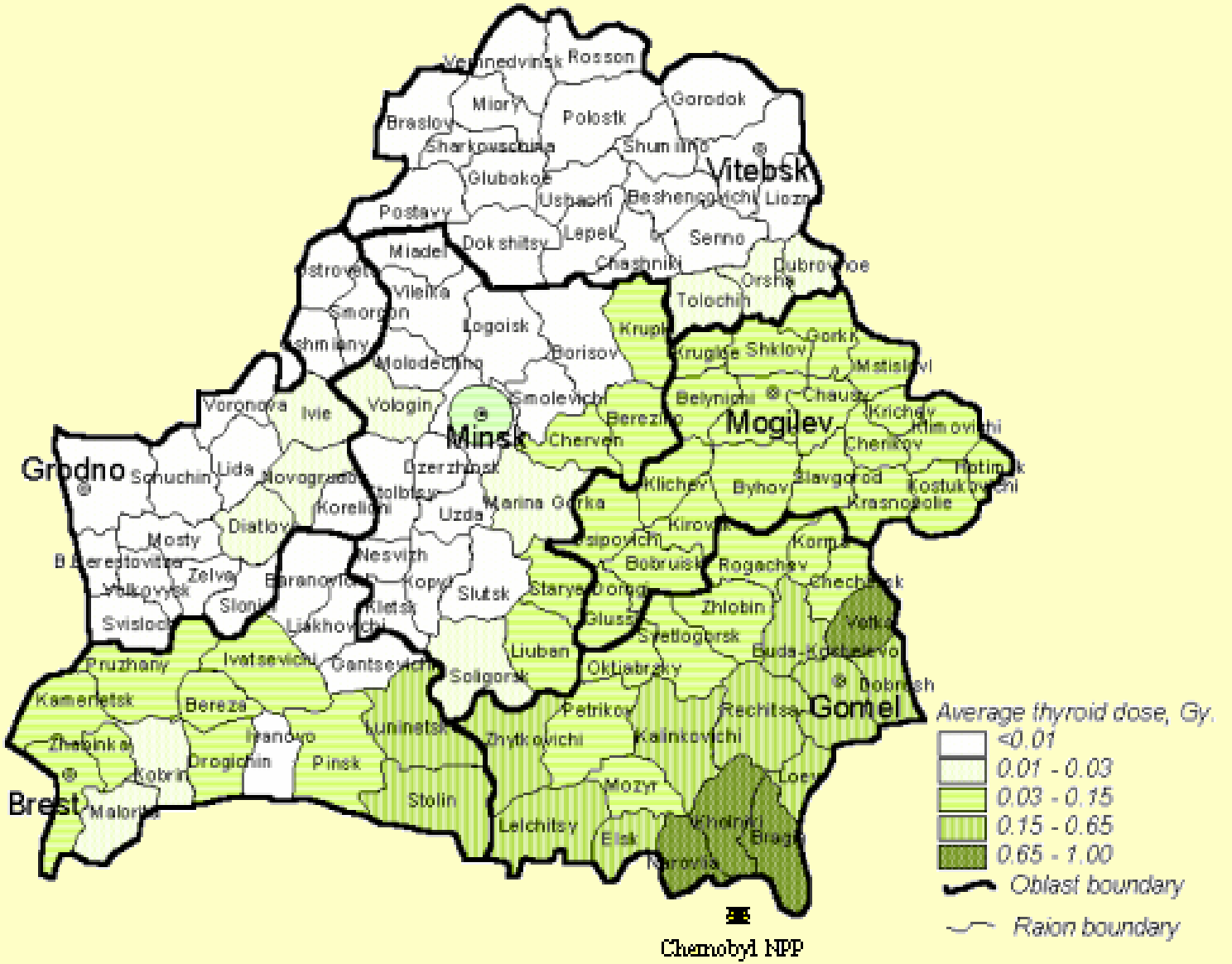
Country	Collective thyroid dose, man-Gy
Belarus	550 000
Russia	300 000
Ukraine	740 000
Total	1 600 000

Distribution of thyroid doses among Belarusian population

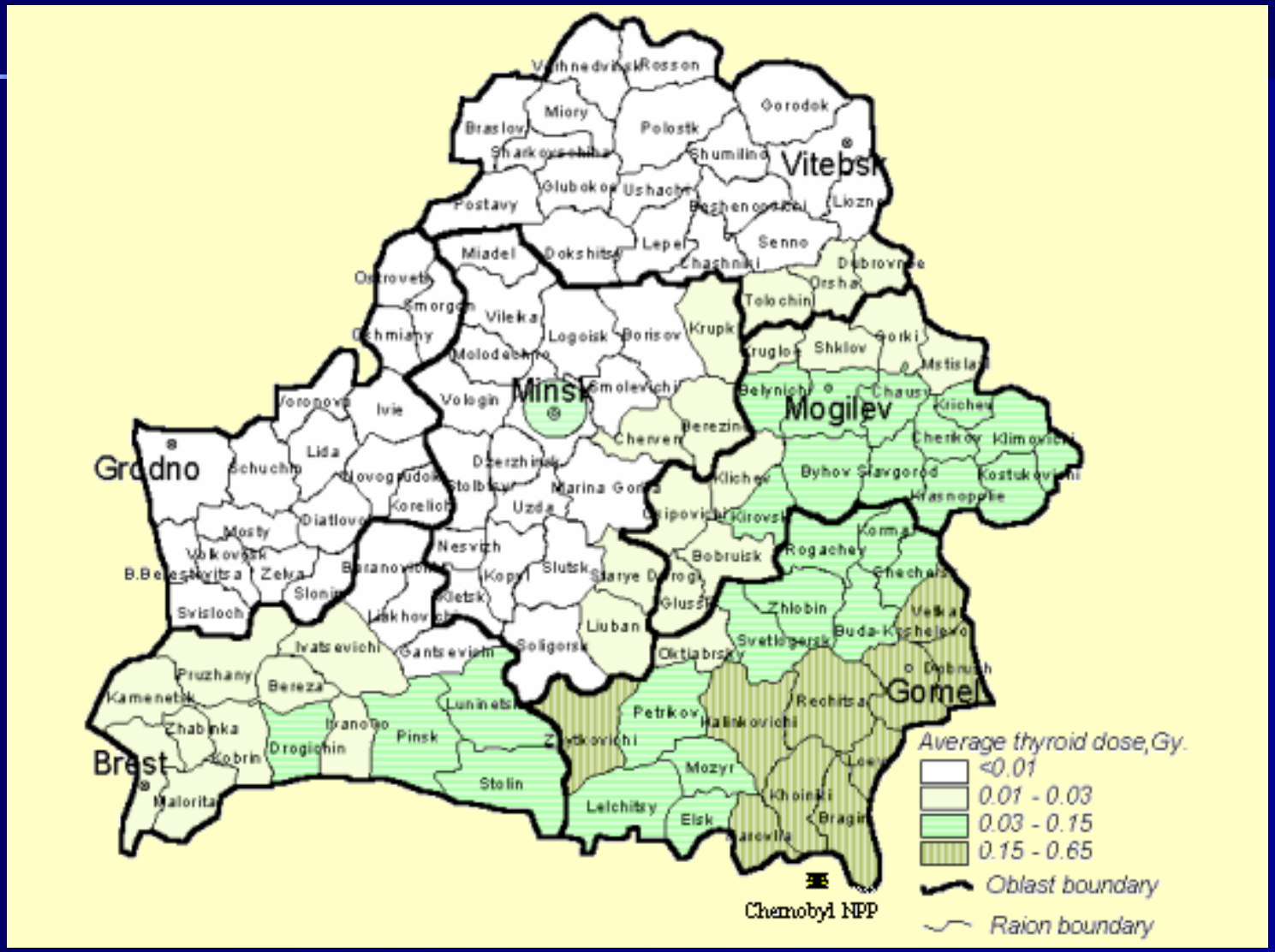
Age group*	Dose interval, Gy					Number of persons
	0-0.05	0.05-0.1	0.1-0.5	0.5-1.0	>1.0	
0 - 18	1 605 129	514 086	434 058	85 164	28 082	2 666 519
19 - +	5 597 593	502 866	727 086	46 966	596	6 875 107
Total	7 202 722	1 016 952	1 161 144	132 130	28 678	9 541 626

* - Age in April, 1986

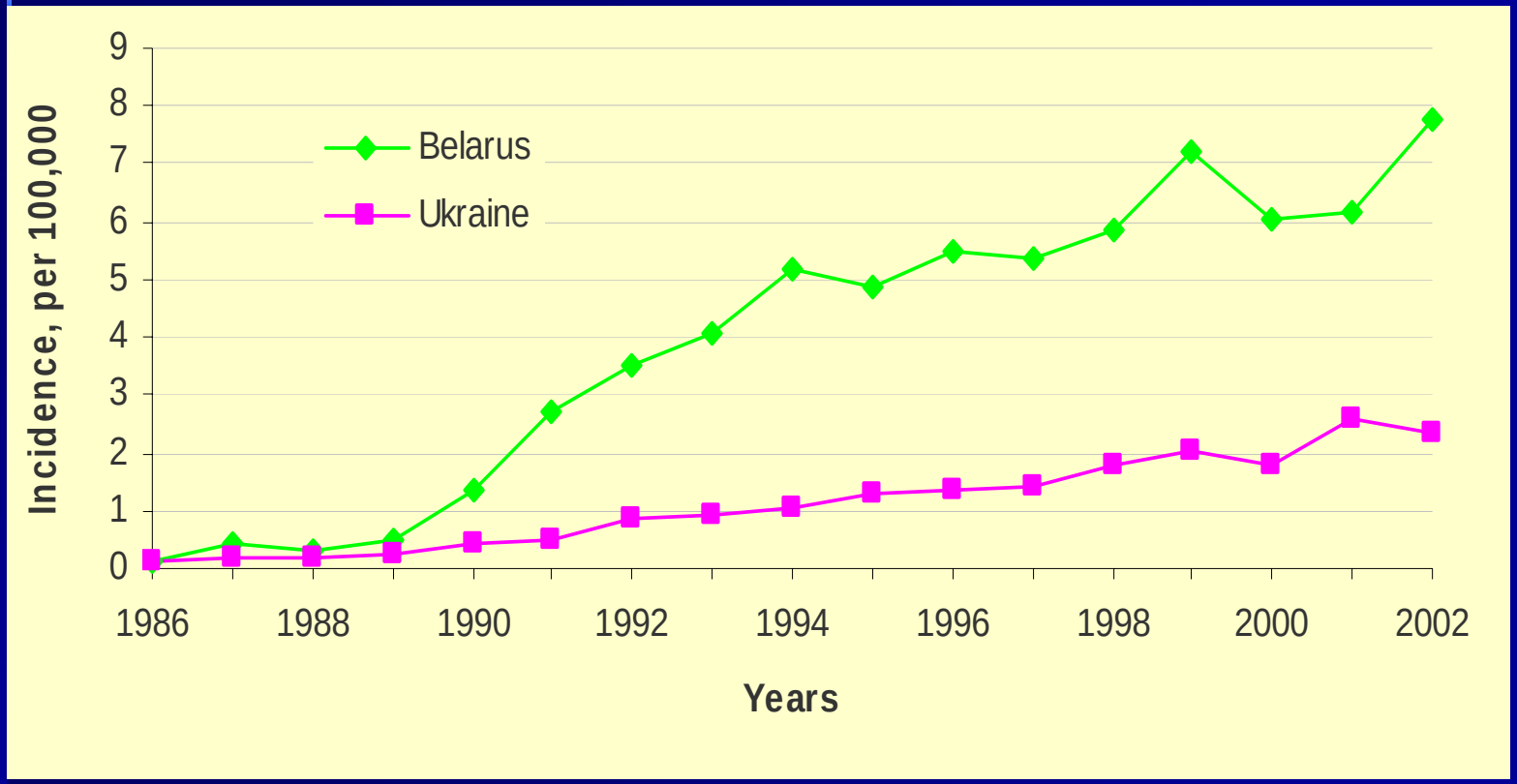
Thyroid dose pattern for children aged 0-18 years



Thyroid dose pattern for adults

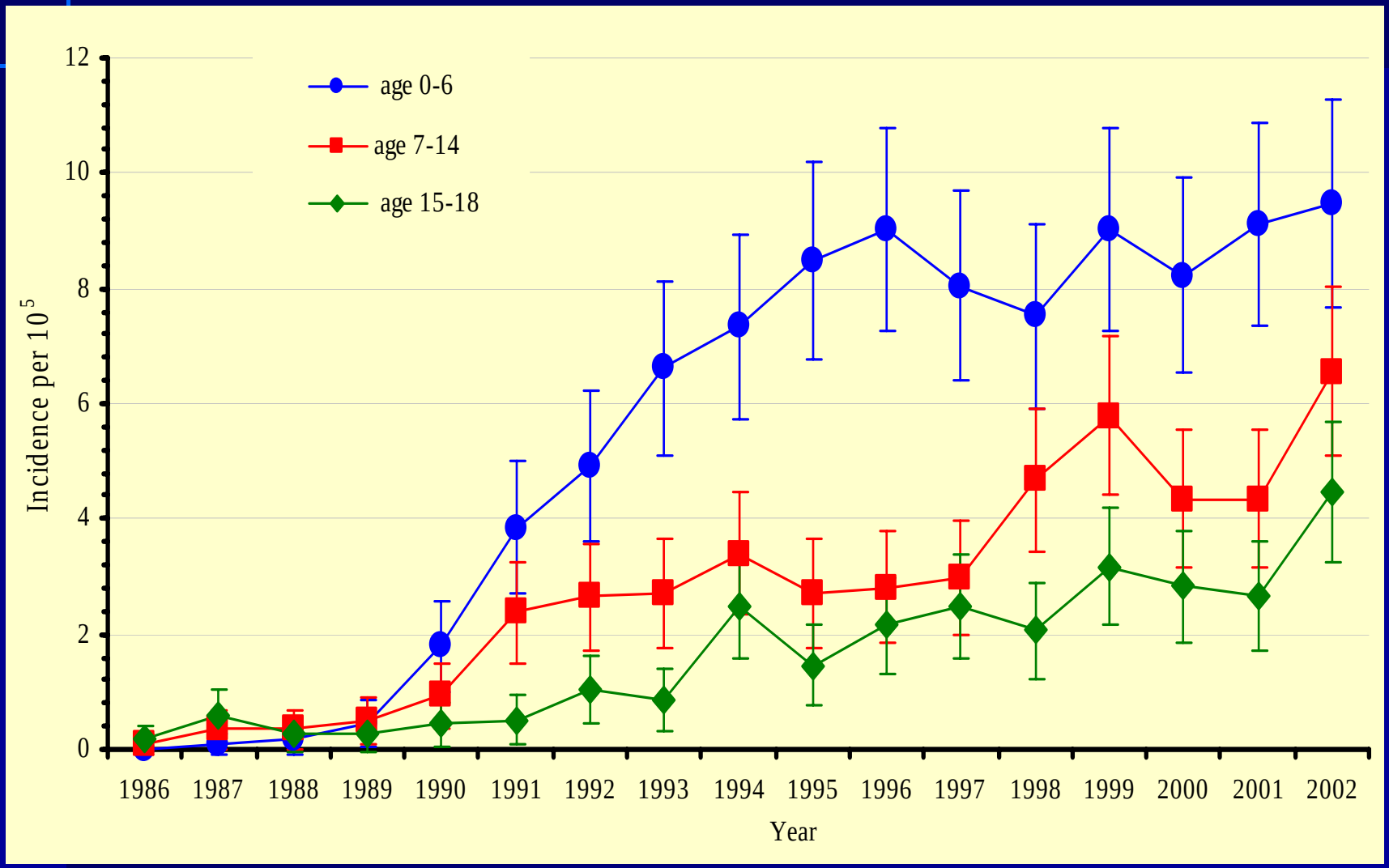


Incidence rate of thyroid cancer in children and adolescents* (Jacob et al., 2005)

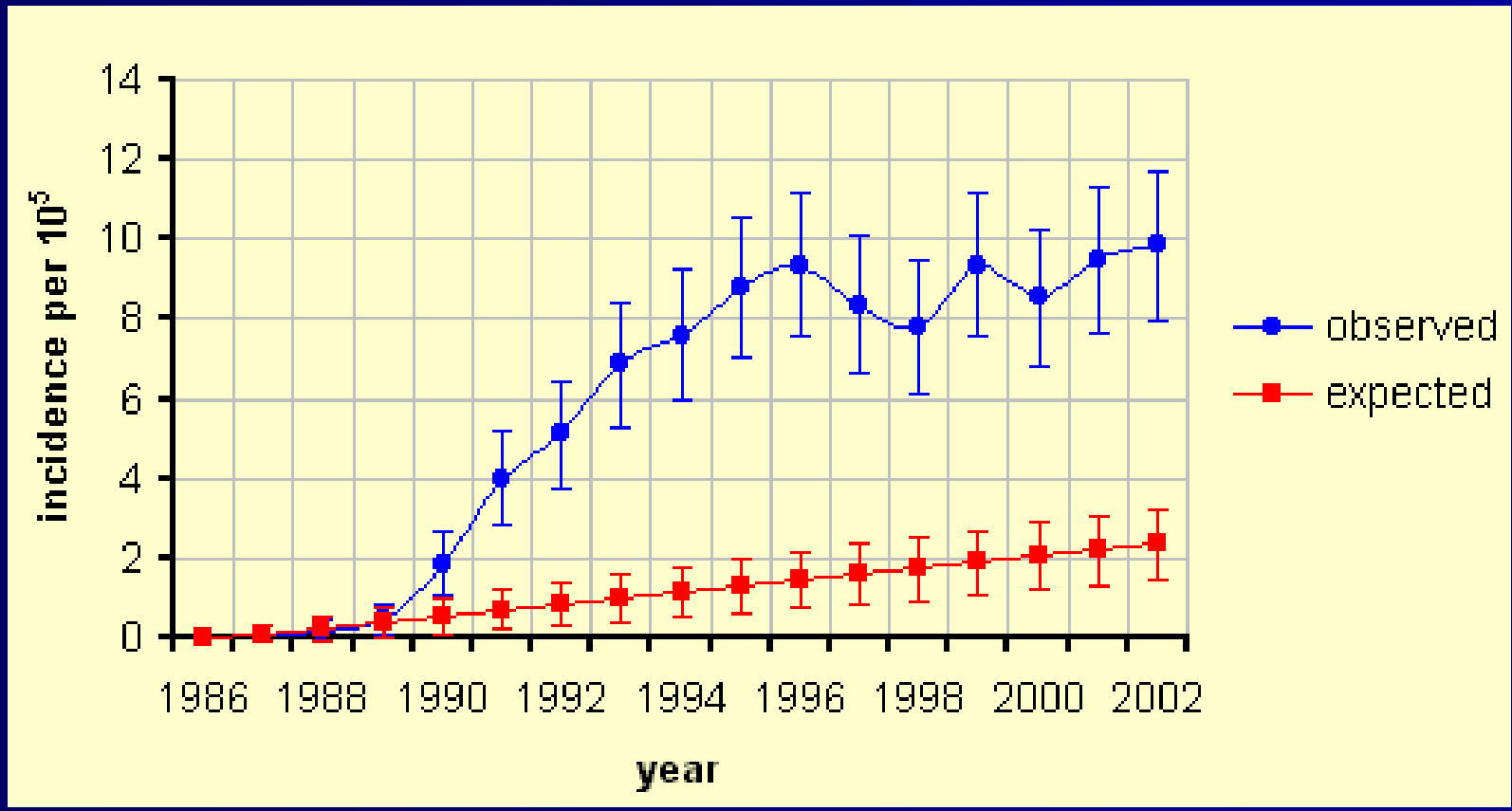


* - Age in April, 1986

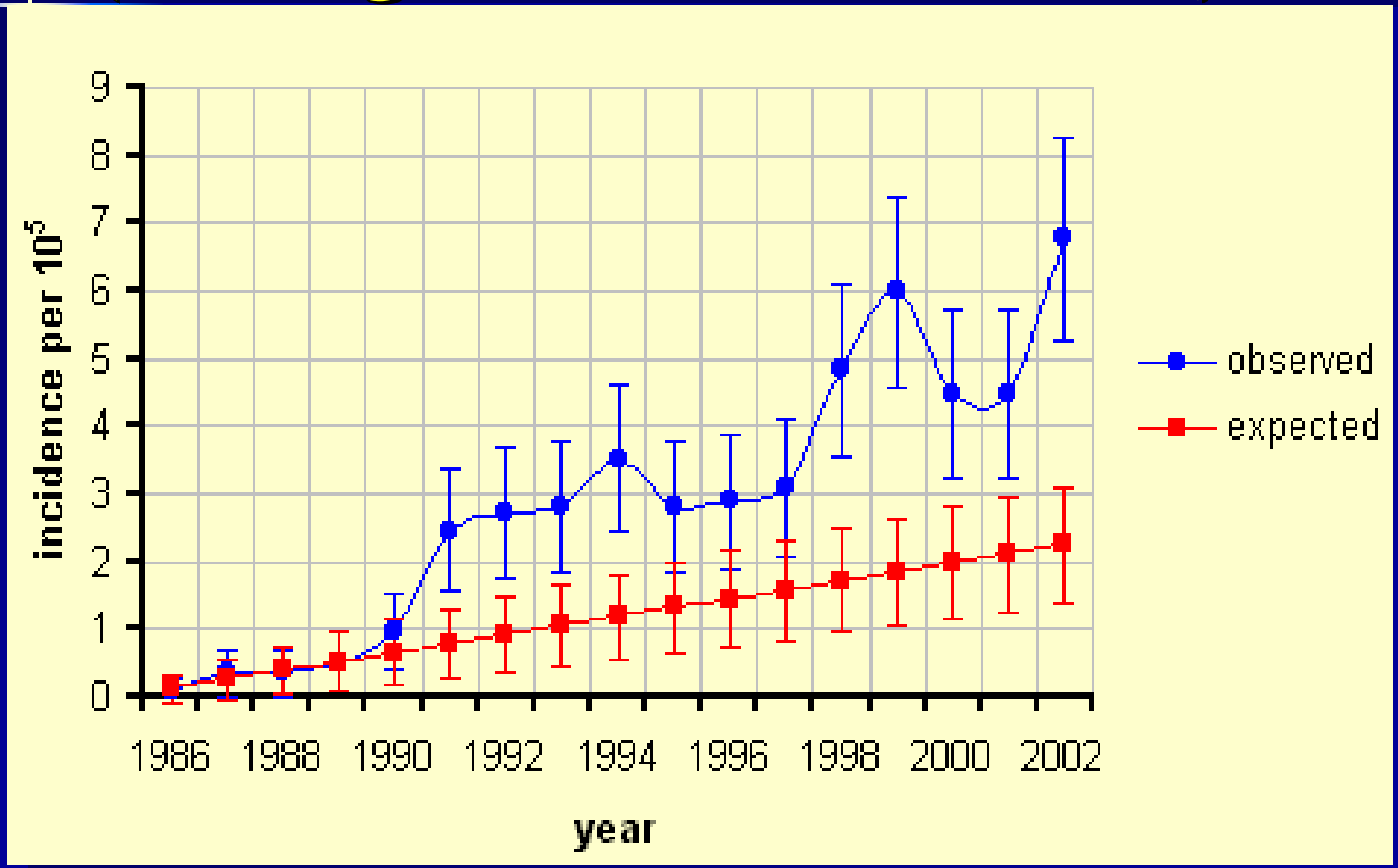
Thyroid cancer incidence (different age at time of accident)



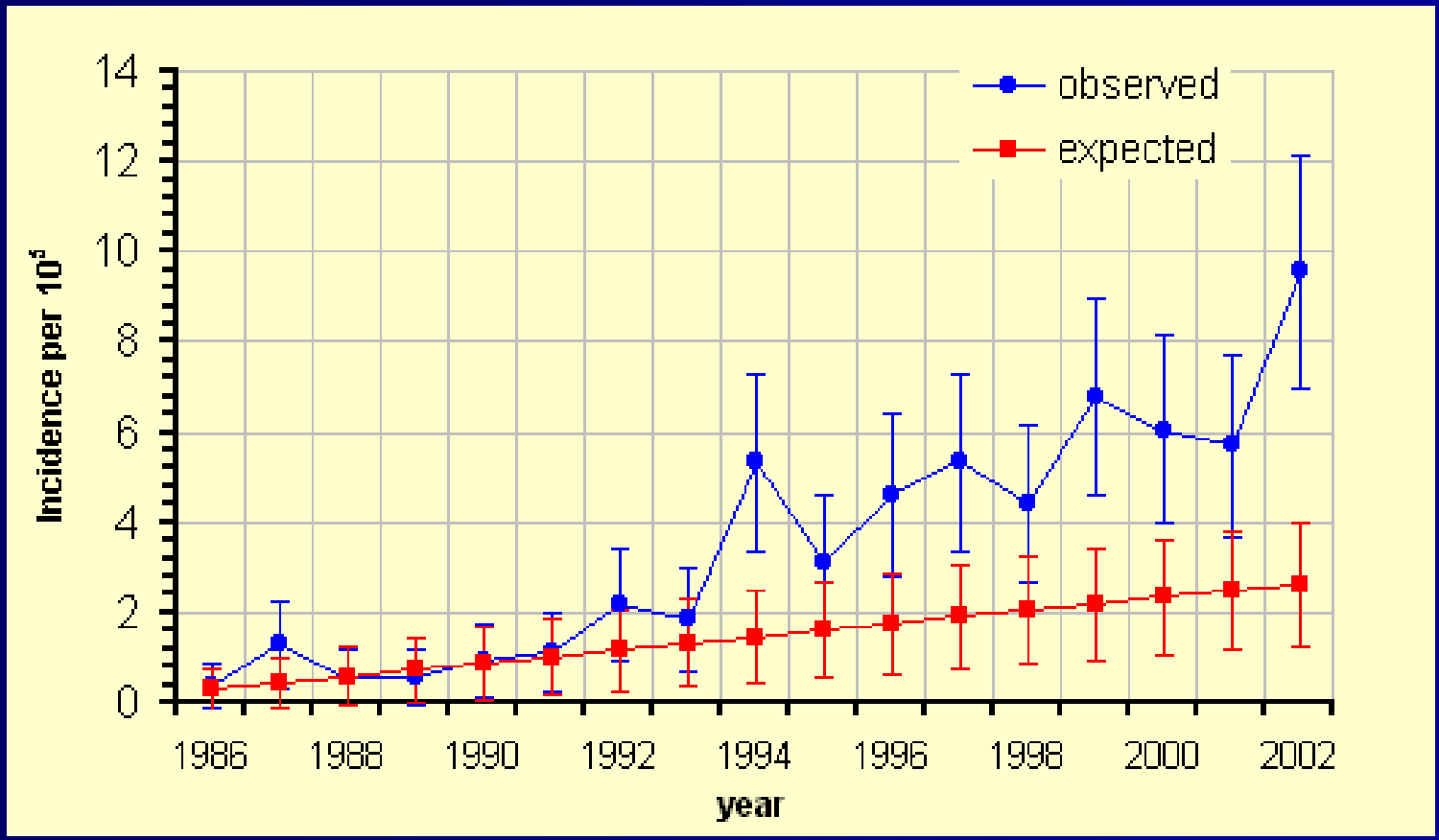
Comparison observed and expected thyroid cancer incidence (0-6 age at time of accident)



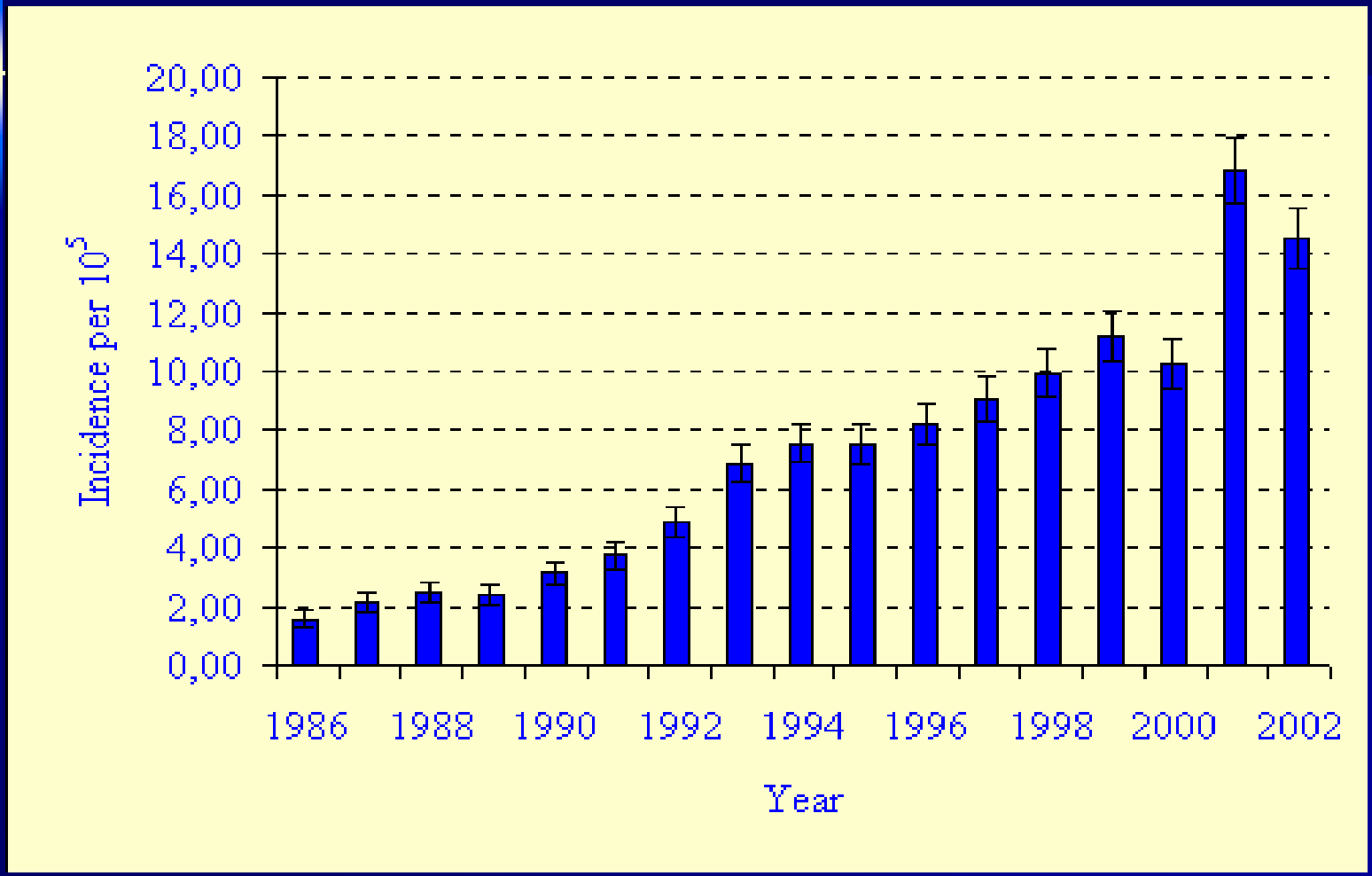
Comparison observed and expected thyroid cancer incidence (7-14 age at time of accident)



Comparison observed and expected thyroid cancer incidence (15-18 age at time of accident)



Thyroid cancer incidence for adults (19+ ATA)



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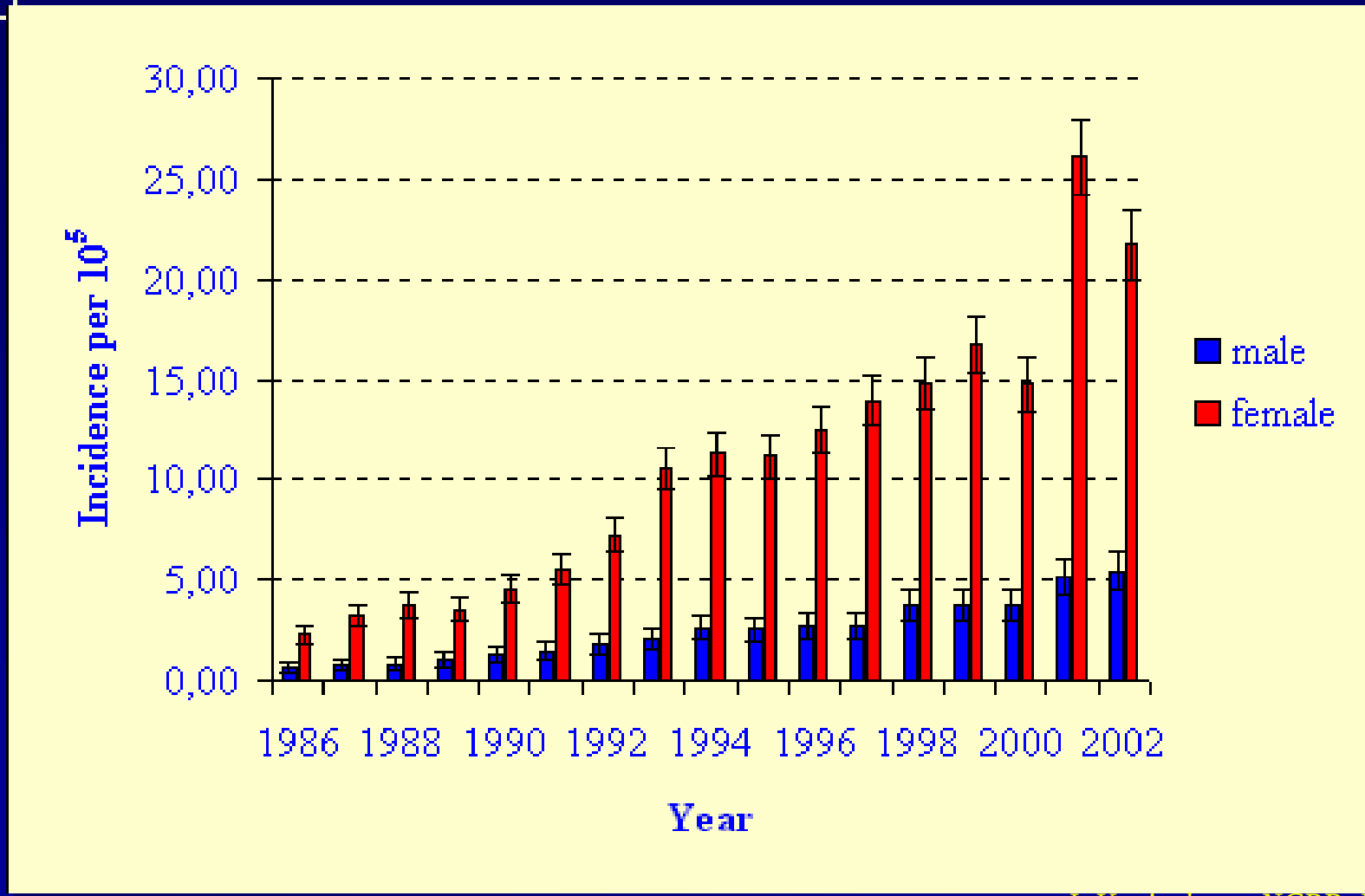
Thyroid cancer incidence for adults (19+ ATA) Separate genders



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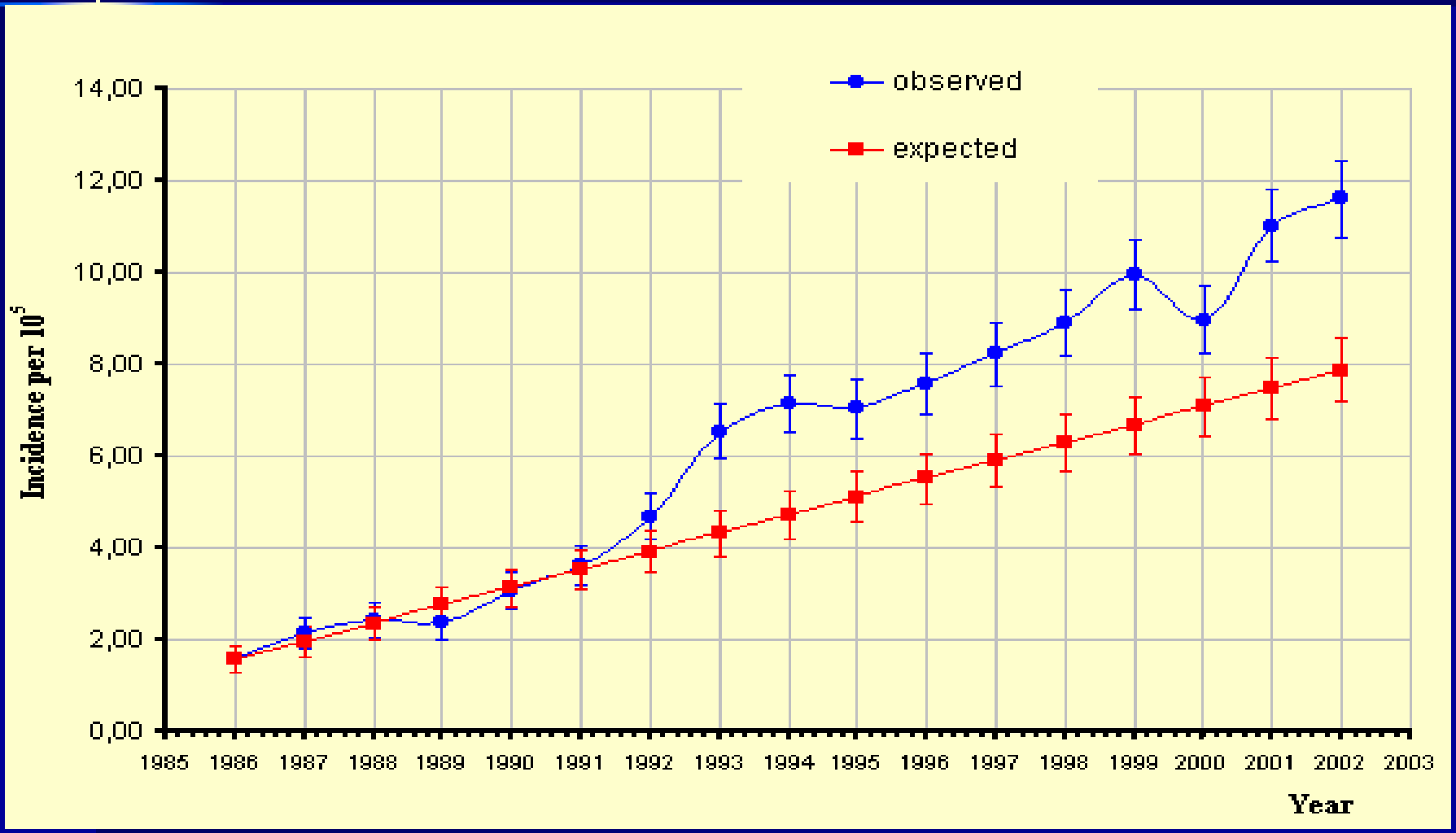
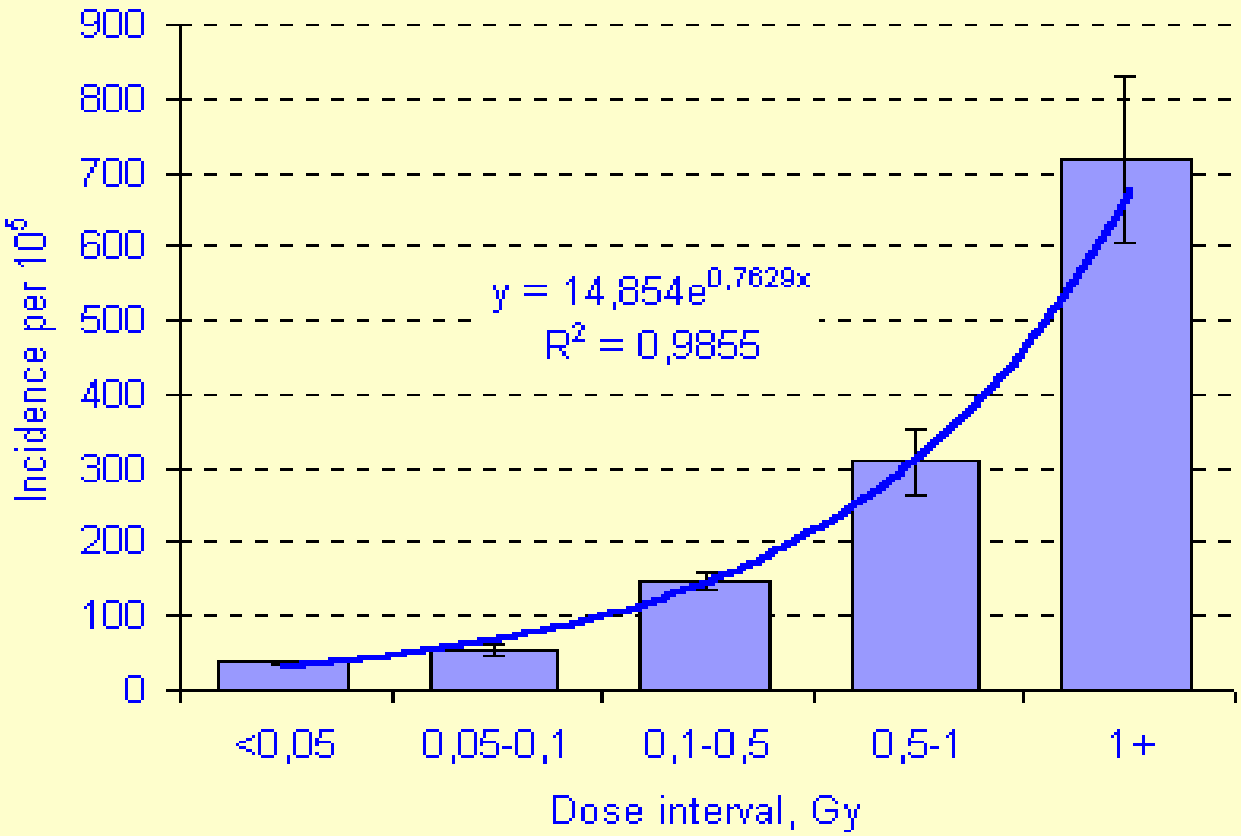
Comparison observed and expected thyroid cancer incidence (19+ age at time of accident)



Cumulative thyroid cancer incidence rate vs dose intervals (1990 – 2002)



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Results of risk analysis of radiation-induced thyroid cancer for children and adolescents exposed to ^{131}I in different age

EAR/ 10^4 person-year-Gy, (95% CI)			ERR / Gy, (95% CI)		
Male	Female	Both	Male	Female	Both
0-6 years of age					
1,5 (1,2; 1,9)	2,6 (1,8; 3,4)	2,1 (1,6; 2,6)	86,4 (67,7; 124,0)	46,2 (33,8; 63,5)	55,9 (43,9; 76,2)
7-14 years of age					
1,0 (0,1; 4,4)	2,3 (0,2; 3,4)	1,7 (1,2; 2,9)	32,9 (0,9; 78,9)	21,5 (1,8; 33,5)	24,2 (16,9; 47,2)
15-18 years of age					
0,8 (-0,1; 1,8)	3,9 (-0,4; 4,9)	2,4 (-0,2; 2,9)	18,3 (-0,4; 26,9)	22,5 (-0,9; 28,4)	21,7 (-0,8; 26,7)

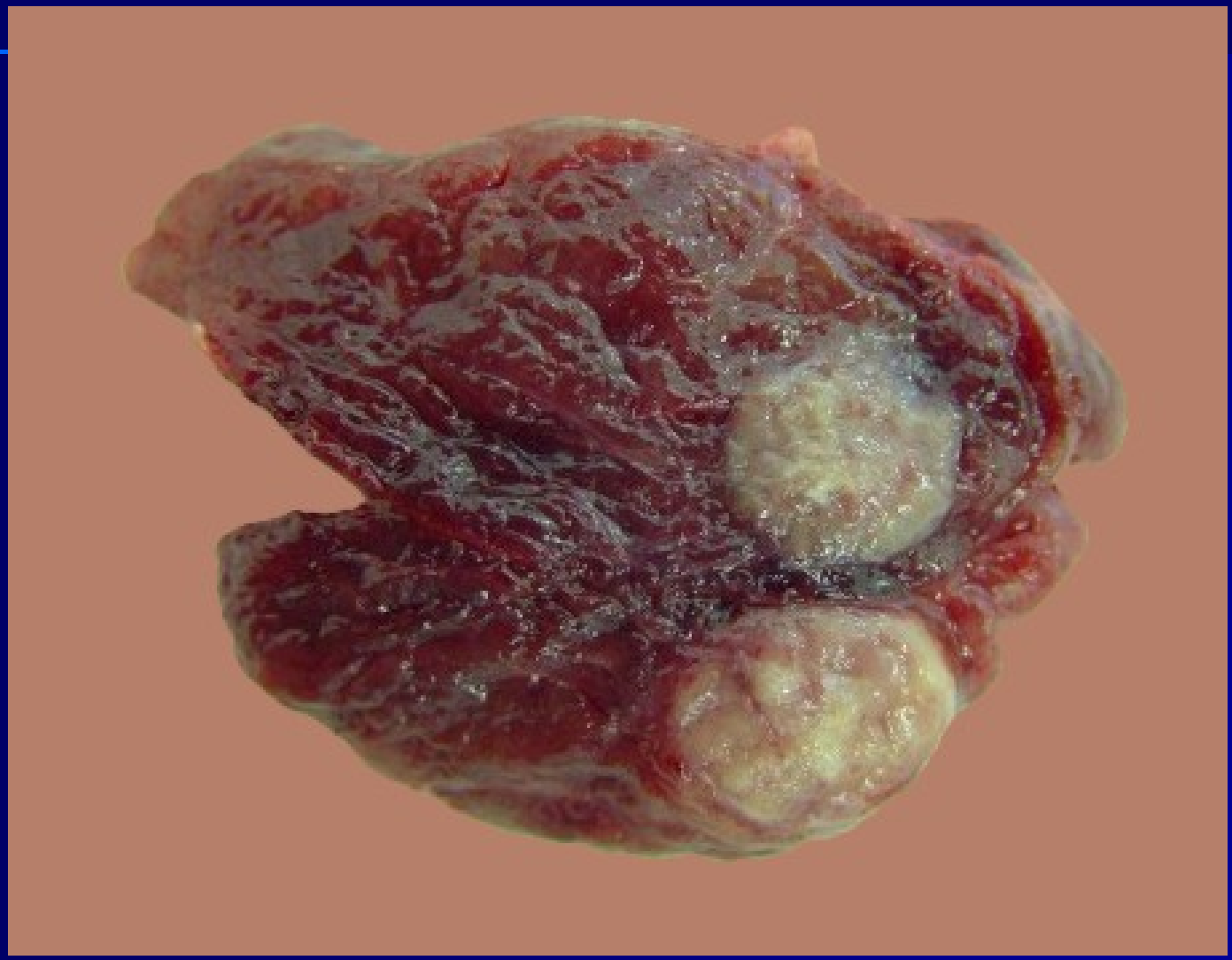
Results of risk analysis of radiation-induced thyroid cancer for Belarus population exposed to ^{131}I in the age of 19 and older

Parameters	Male	Female	Both
EAR/ 10^4 person-year-Gy (95% CI)	0,4 (-0,6; 1,5)	2,5 (1,9; 4,7)	1,7 (0,3; 3,2)
ERR / Gy (95% CI)	3,9 (-0,9; 5,9)	2,4 (0,8; 5,6)	3,8 (0,1; 9,8)

Female patient with advanced papillary thyroid carcinoma (positive neck lymph nodes)

Male patient with advanced papillary thyroid carcinoma (positive neck lymph nodes)

Papillary carcinoma sample



Thyroid cancer
Survival after treatment

Observed 5 years	Observed 10 years
99,3%	98,5%

Prognosis of thyroid cancer cases

Sex	Age in 1986				
	0-14	15-18	0-18	19+	Total
Male	3807	295	4102	230	4332
Female	7862	589	8451	1930	10381
Both	11699	884	12553	2160	14713

Attributive risk

0-18 age – 76.5%

19+ age – 15.6%

Radiation induced thyroid cancer

- Could it be prevented and how?
  - Prevention of consumption of contaminated food
  - Stable iodine prophylaxis
- Could easily be prevented by:
  - Timely warning
  - Effective thyroid blocking
  - Timely restriction of consumption for contaminated food

Implications for protection of thyroid gland

- Children are at highest risk
- Lower risk for adults, but this is still a risk!
- Criteria for stable iodine prophylaxis for all ages
  - 50 mGy proposed by IAEA
- Food restriction may be needed

Prevent cases of thyroid cancer – it's real!!!

From lessons learned to practical application