

# Risks of Health Effects of Radiation

## Risks


- The magnitude of the influence of damage
- **The possibility** of any damage (**probability**)
- The combination of the magnitude of the influence and **the possibility (probability)**

Quantitatively expressed probability, not focused on the actual existence of damage

In particular, when considering stochastic effects of radiation,

**Risks =**

**The probability (of contracting cancer or dying of cancer)**

Having risks  (Surely) being subject to damage

# Relative Risks and Attributable Risks

Factors	Incidence		Total
	Yes	No	
Exposed group	A	B	A+B
Non-exposed group	C	D	C+D

How many times factor exposure would increase the incidence of an individual:

$$\text{Relative risk} = \frac{\text{Incidence risk among an exposed group}}{\text{Incidence risk among a non-exposed group}} = \frac{\frac{A}{A+B}}{\frac{C}{C+D}}$$

Relative risk larger than 1 represents that risks have increased due to factor exposure.

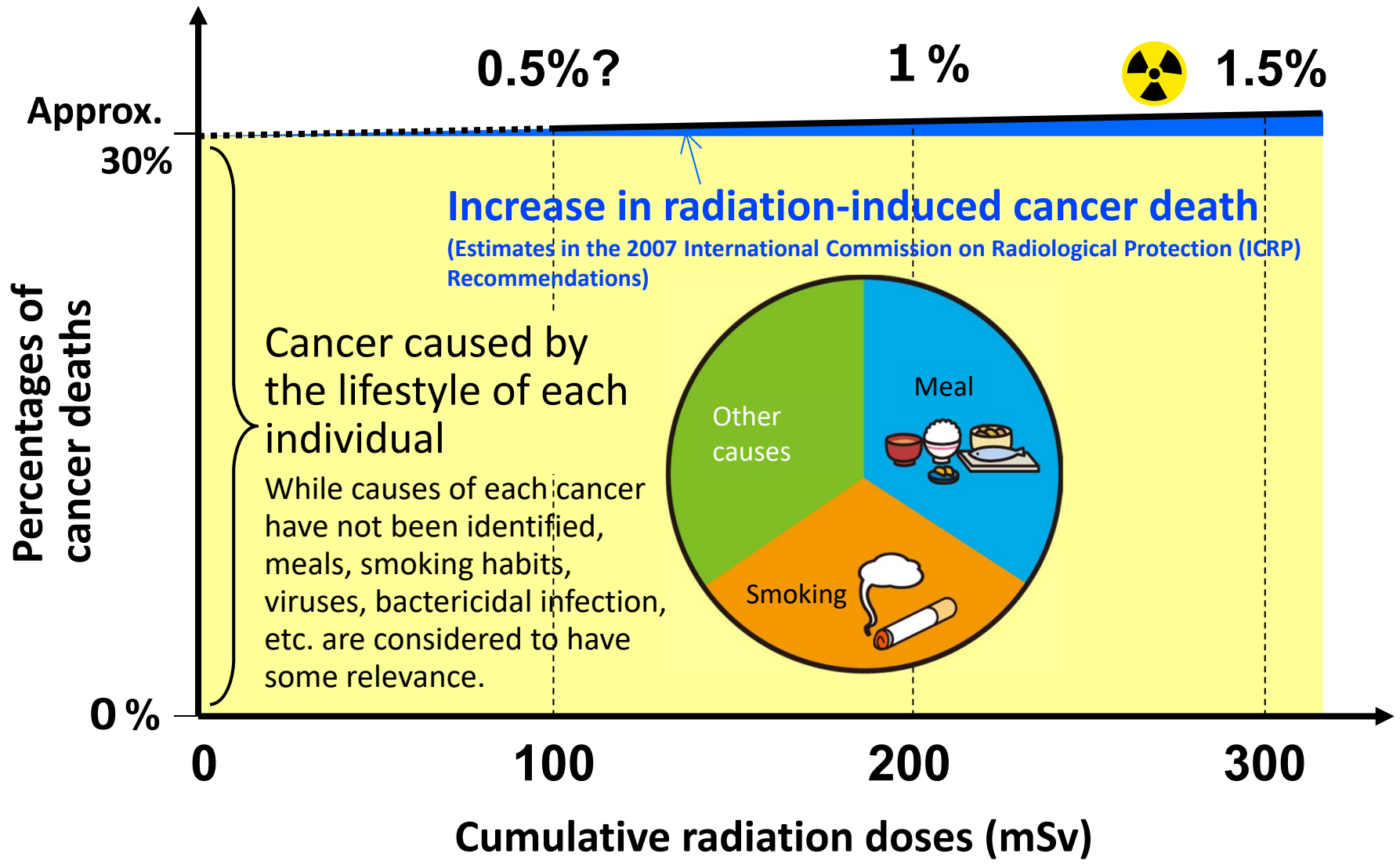
The value obtained by subtracting 1 from the relative risk is an excess relative risk, showing an increased amount of risks.

How many times factor exposure would increase the incidence rate of a group:

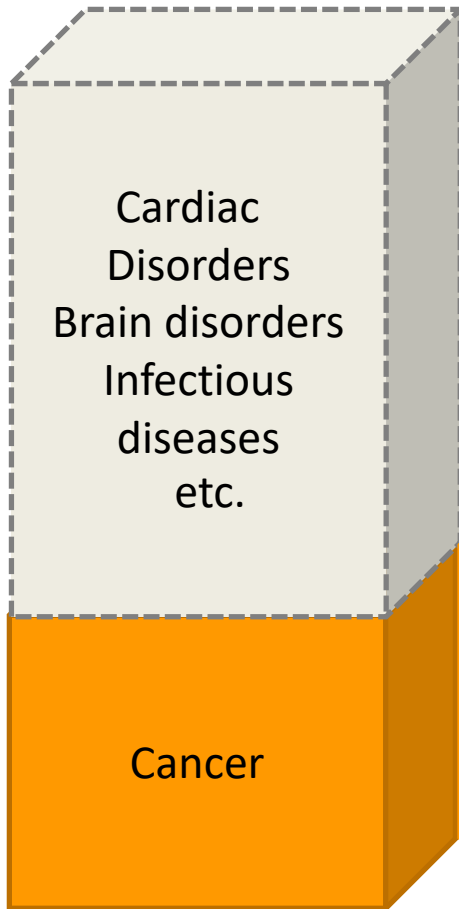
$$\text{Attributable risk} = \text{Incidence risk among an exposed group} - \text{Incidence risk among a non-exposed group}$$

$$= \frac{A}{A+B} - \frac{C}{C+D}$$

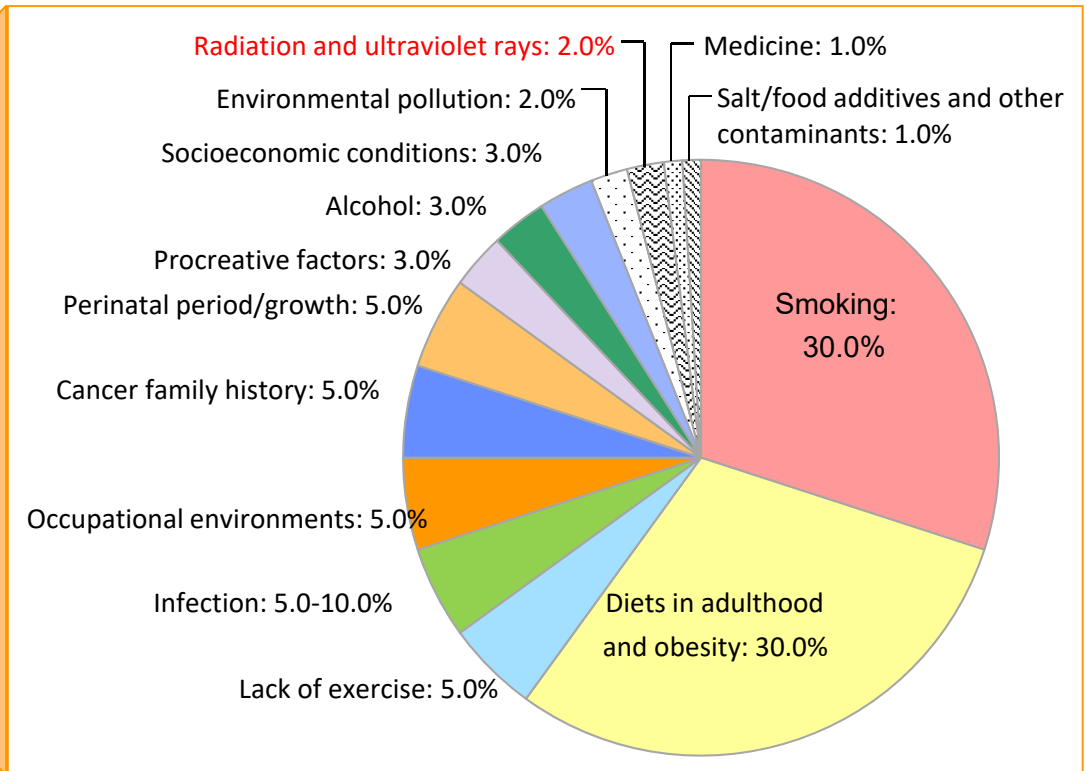
# Risks of Cancer Death from Low-Dose Exposure



# Factors Associated with Carcinogenesis



## Factors associated with human cancer



# Risks of Cancer (Radiation)

Radiation doses (mSv)	Relative risks of cancer*
1,000 ~ 2,000	1.8 [estimated to be 1.5 times per 1,000 mSv]
500 ~ 1,000	1.4
200 ~ 500	1.19
100 ~ 200	1.08
Less than 100	Difficult to detect

Source: Website of the National Cancer Center Japan

\* Risks of developing radiation-induced cancer are based on the data (solid cancers only) obtained from the analysis of instantaneous exposure due to the atomic bombing in Hiroshima and Nagasaki, and are not based on the observation of long-term exposure effects.

\* Relative risks indicate how many times larger the cancer risks are among people exposed to radiation when assuming the risks among non-exposed people as 1.

# Risks of Cancer (Life Habits)

Lifestyle factors	Relative risks of cancer
Smokers	1.6
Heavy drinking (450 g or more/week)*	1.6
Heavy drinking (300 to 449 g or more/week)*	1.4
Obese (BMI $\geq 30$ )	1.22
Underweight (BMI < 19)	1.29
Lack of exercise	1.15 ~ 1.19
High-salt foods	1.11 ~ 1.15
Lack of vegetable intake	1.06
Passive smoking (nonsmoking females)	1.02 ~ 1.03

\* Alcohol consumption is in ethanol equivalent.