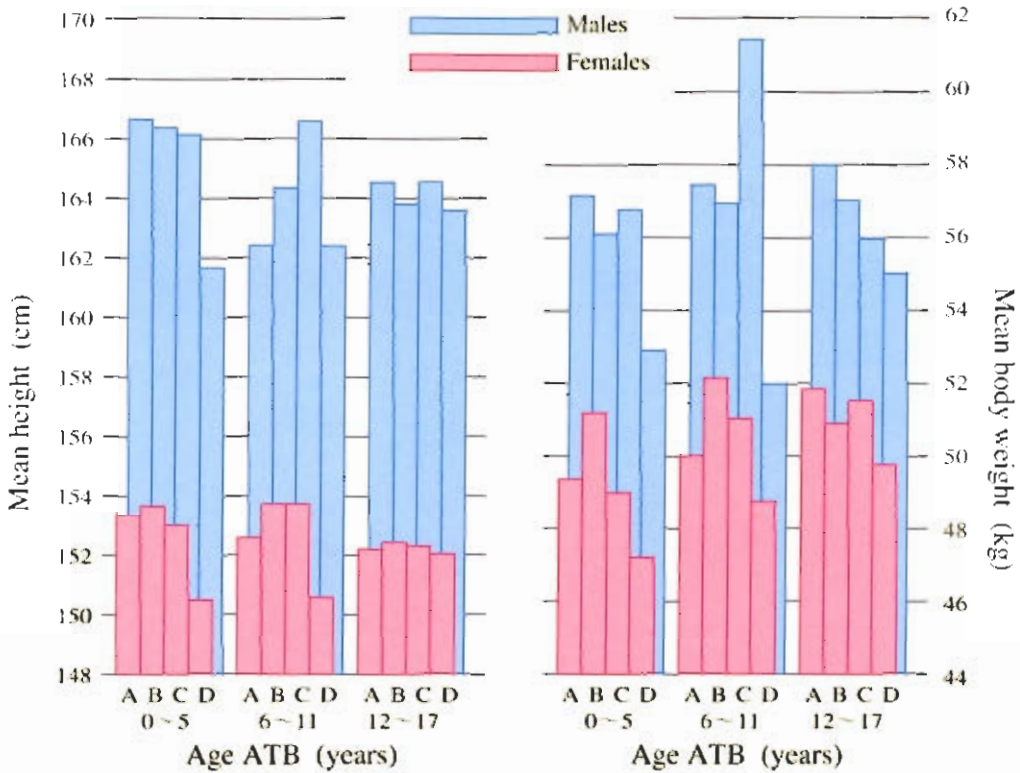


Growth and development of survivors exposed while young



Based on measurements during 1966-1968.

Group A consisted of subjects not in Hiroshima at the time of bombing.

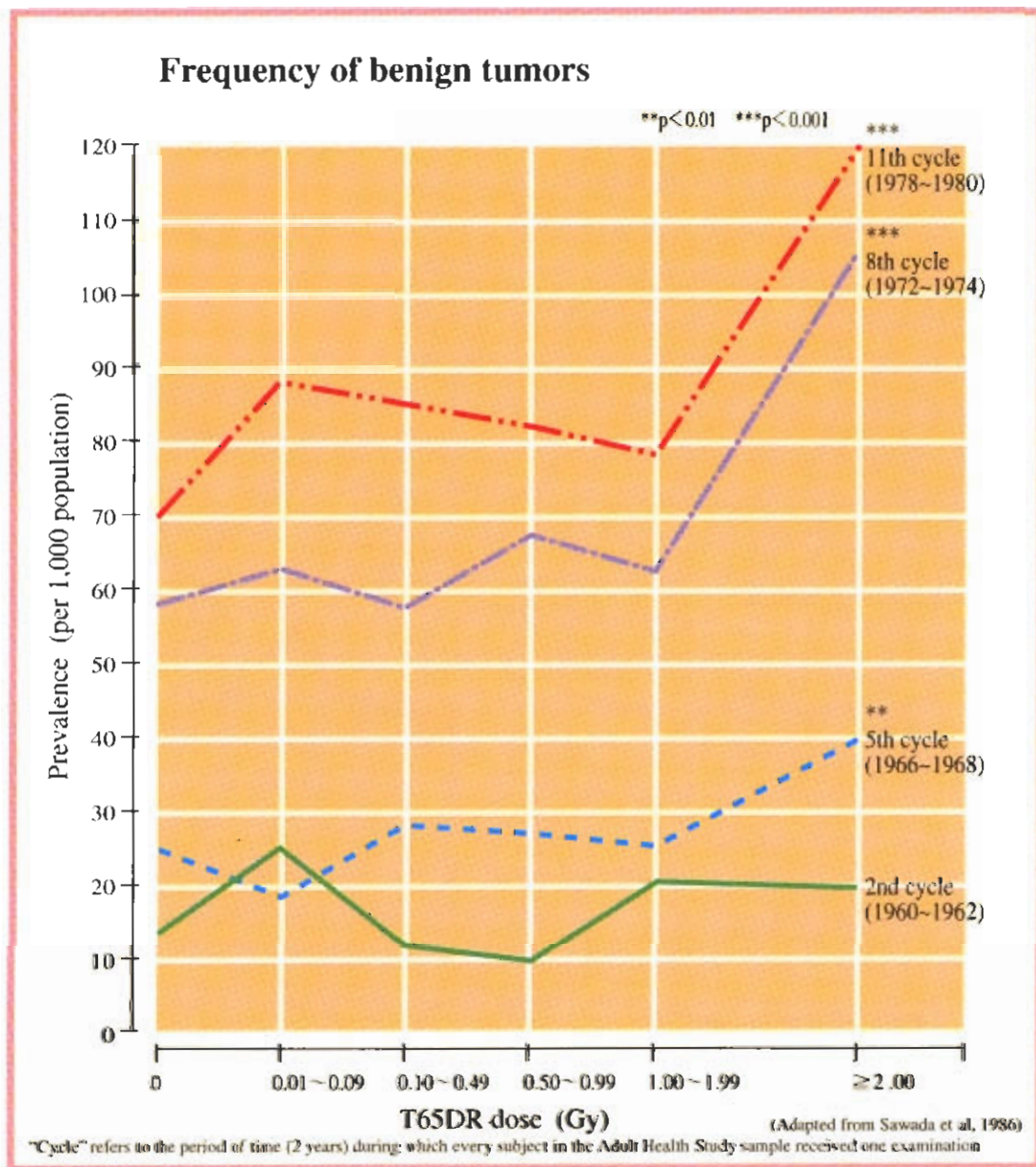
Groups B, C and D were respectively exposed to T65D doses of 0-0.009 Gy, 0.01-0.99 Gy and ≥ 1.00 Gy.

ATB = at the time of bombing.

1. Growth and development of survivors exposed while young

Reduced heights and body weights were observed among individuals heavily exposed as infants, but not among Nagasaki males exposed at ages 12 to 17 years; the same tendencies were also observed among prenatally exposed survivors. The difference appears to

have started not after puberty, but to have been continuous from childhood. The reasons for this have not been clarified, although various mechanisms are conceivable, e.g., radiation effects on bone formation, or changes in systemic hormonal environment.

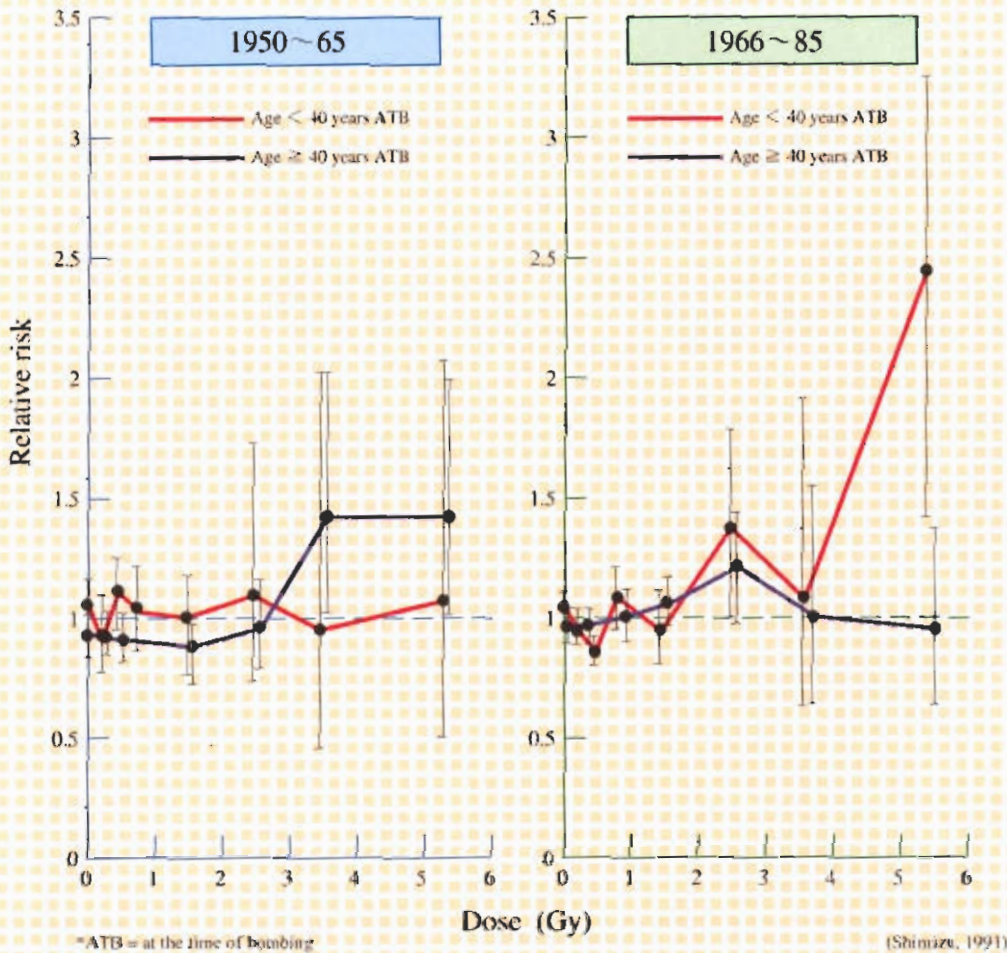


2. Benign tumors

Due to difficulties encountered in studying the relationship between radiation and benign tumors, no clear results have been forthcoming. However, a study on prevalence among the fixed population at the Radiation Effects Research Foundation (the Adult Health Study) found a significant increase in benign tumors

among heavily exposed survivors after 1970, particularly for gastric polyps in Hiroshima. However, other pathological studies have failed to show an association between radiation and polyps of the digestive tract (which include gastric polyps). Of gynecologic diseases, the frequencies of myoma uteri and benign ovarian tumors have suggested a dose-dependent increase. However, no such increase has been observed in benign tumors at other sites.

Mortality risk from non-malignant diseases



3. Life span

A radiation effect on life span due to the development of non-malignant diseases has not been apparent until recent years. As the survivors exposed while young have recently reached the age at which adult diseases such as cardiovascular disease frequently occur, an effect has been suggested amongst the heavily exposed (≥ 2 Gy). However, in comparison with cancer risks, the relative risk is small, and notwithstanding the fact that the natural mortality rate is high, the excess number of deaths is also small.

The radiation-related life shortening is seen as an upward but parallel shift of the straight Gompertz function (the line describing the proportional relationship between age and the logarithm of the mortality rate, which is a good index of life span). In the case of cancer, this tendency is marked. Although slight in comparison with cancer, non-malignant diseases also demonstrate an upward shift among the ≥ 2 Gy population.

Various approaches (particularly clinical techniques) have been used to investigate whether radiation causes accelerated aging, but as yet no clear conclusions have been forthcoming.

4. Liver disease

A comparatively high frequency of liver disease was reported among atomic bomb survivors since immediately after exposure, posing an important medical problem. Various

approaches (including clinical, pathological and immunological methods) have been adopted in vain attempts to clarify the relationship between radiation and liver diseases.

Since liver diseases are known to be caused by many factors, including viruses and nutrition, further studies are necessary.

5. Cardiovascular disease

Recent reports have suggested a slight radiation effect among heavily exposed survivors in the incidence and mortality rates of both ischemic heart disease and cerebrovascular

disease. The prevalence of aortic calcification and some electrocardiographic studies have also suggested a slight effect on ischemic changes.

However, problems remain regarding the accuracy of data and number of subjects, and thus further studies are required in order to confirm a relationship with radiation.