Reference material for June 27, 2007 press release

Title of paper: Solid Cancer Incidence in Atomic Bomb Survivors: 1958–1998
Radiation Research 168, July 2007 issue (Refer to Note 1)

Background and objective of research

With the aim of studying health effects of A-bomb radiation, the Radiation Effects Research Foundation (RERF) has conducted a mortality follow-up since 1950 of about 120,000 members of the Life Span Study (LSS) cohort. RERF has also engaged in cancer incidence studies since 1958, based on use of local cancer registries in Hiroshima and Nagasaki.

Comprehensive analyses of radiation effects on solid cancer incidence in the LSS cohort were recently completed, leading to publication of the paper in question. The paper reports on analyses conducted from a new perspective, with use of the new dosimetry system DS02 and after extension of the study period 11 years from the previous 1994 report.

Methods

The analyses were based on 17,448 first primary solid cancers diagnosed from 1958 through 1998 among a total of 105,427 cohort members with individual DS02 dose estimates who were alive and not known to have had cancer prior to 1958. Radiation-associated risks were assessed for all solid cancers as a group, for 19 specific cancer sites and for five histology groups. (Refer to Note 2.) The magnitude of radiation-associated risks was investigated, along with the shape of dose response, how the risks vary with gender and age at exposure, and how such risks differ between cancer sites.

Results

1) Results in principle confirming the 1994 report
   - i) It was estimated that about 850 (about 11%) of the cases among the LSS cohort members with colon dose of 0.005 Gy or greater were associated with atomic bomb radiation exposure.
   - ii) It was shown that the dose-response curve within the 0–2-Gy range was linear.
   - iii) It was estimated that, at attained age of 70 years after exposure at age 30, solid cancer rates increased by about 35% per Gy for men, 58% per women, and 47% for both genders.
   - iv) For all solid cancers as a group, excess relative risk decreased by about 17% per decade increase in age at exposure. Excess absolute risk appeared to increase throughout the study period. (Refer to Note 3.)
   - v) Significant radiation-associated increase in cancer risk was seen for such sites as oral cavity, stomach, colon, liver, lung, skin, breast, ovary, bladder, nervous system and thyroid. There was no indication of a statistically significant increase in risk for cancers of the rectum, gallbladder, pancreas, prostate, or kidney. (See Slides 1, 2, and 3.)

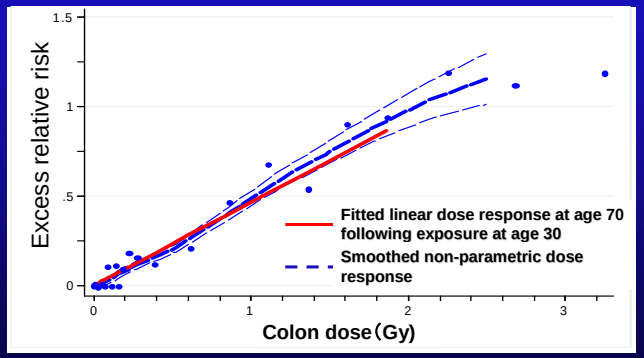
2) New findings
   i) Statistically significant dose response within the 0–0.15-Gy range was also observed.
   ii) Risk of esophagus cancer was found to be significant.
   iii) It was suggested that radiation exposure at ages less than 20 years might increase risk of uterine corpus cancer.
   iv) Observation by histological type of cancer suggested increase in risk for all histological types considered, including sarcoma.

Note 1:
The paper is available on the homepage of Radiation Research, a U.S. scientific journal on health effects of radiation. (URL: http://www.rrjournal.org)

Note 2: Histological types of cancers
Analyses were conducted by classifying tumors into five subgroups on the basis of the tissue from which the malignant neoplasm originated: epithelial carcinoma (1. squamous cell carcinoma, 2. adenocarcinoma, and 3. other epithelial malignancies) and non-epithelial carcinoma (4. sarcoma, and 5. other non-epithelial cancers).

Note 3: Risk index
Excess relative risk: rate (mainly indicated by percentage) of risk increase per unit dose
Excess absolute risk: absolute value of increased incidence per unit dose

Dose-Response Curve of All Solid Cancers (LSS, Incidence Study, DS02, 1958-1998)

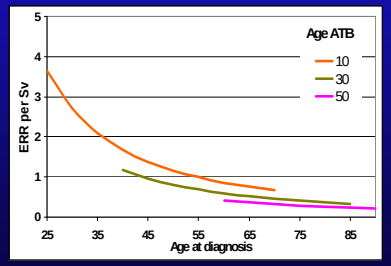


Statistically significant risk increase is observed also in the dose range of 0 - 0.15 Gy.

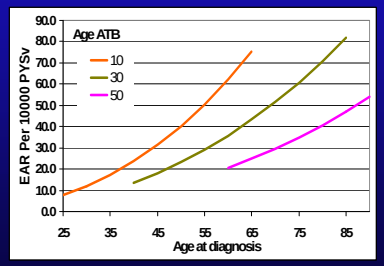
(Preston DL et al: Radiat Res 2007; 168: 1-64.)

Longitudinal Change in Risks
—All Solid Cancers —

Excess Relative Risk (ERR)



Excess Absolute Risk (EAR)



Site-Specific Risks of Solid Cancers

Site	ERR/Gy	EAR/10^4PYGy	Excess cases
All solid	0.47	52.0	853
Bladder	1.23	3.2	35
Female breast	0.87	9.2	147
Lung	0.81	7.5	117
Thyroid	0.57	1.2	63
Colon	0.54	8.0	78
Stomach	0.34	9.5	151
Liver	0.30	4.3	54

* Risks at age 70 following exposure at age 30

Atomic Bomb Radiation Health Effects Study
—Utilization of Results—

- UNSCEAR: United Nations Scientific Committee on the Effects of Atomic Radiation
- BEIR Committee: NAS-NRC Committee on the Biological Effects of Ionizing Radiation
- ICRP: International Commission on Radiological Protection