

Published in *Radiation Research*[§]

“Radiation Exposure and the Risk of Mortality from Noncancer Respiratory Diseases in the Life Span Study, 1950–2005”

Truong-Minh Pham, Ritsu Sakata, Eric J. Grant, Yukiko Shimizu, Kyoji Furukawa, Ikuno Takahashi, Hiromi Sugiyama, Fumiyoshi Kasagi, Midori Soda, Akihiko Suyama, Roy E. Shore, Kotaro Ozasa.

Radiat Res 2013 (November); 180(5): 539–45 (doi: 10.1667/RR13421.1)

Study Rationale

The Life Span Study (LSS) has found that exposure to A-bomb radiation is associated with mortality from noncancer respiratory diseases (hereinafter, simply called respiratory diseases). However, this relationship may be a secondary association caused by the fact that respiratory diseases that can develop at the terminal stage of illnesses such as cancer and circulatory diseases, which have already been linked to radiation exposure, are designated as the cause of death. Considering that the biological mechanisms behind the association between radiation exposure and respiratory diseases are unclear, further examination was necessary before reaching any conclusion about whether the association between radiation exposure and noncancer respiratory disease mortality was genuine or an artifact disease misclassification.

Explanation

1. Objectives

While the LSS has clarified the association between A-bomb radiation exposure and cancer, attention has also recently been paid to noncancer diseases. The two purposes of the study were (1) to examine the associations of radiation dose with the main subclasses of deaths coded as respiratory diseases on the death certificates; and (2) to determine the degree to which the associations between radiation exposure and respiratory diseases were genuine or were caused by biases due to lifestyle and sociodemographic factors or disease misclassification.

2. Methods

The subjects of the present study were 86,611 people with estimated lung doses from among the 120,321 members of the LSS, which was established on the basis of the Japan 1950 National Census. Based on the International Classification of Diseases, respiratory diseases recorded as causes of death of these subjects were classified into acute respiratory infection, pneumonia/influenza, chronic obstructive lung disease, bronchial asthma, and other respiratory diseases. The present study was based on a follow-up conducted from 1950 through 2005. To determine the degree of association of radiation exposure with mortality from these diseases, excess relative risks (ERR) were estimated using Cox regression analyses.

3. Results

(1) Association between radiation exposure and respiratory diseases

During the study period, 5,515 deaths due to respiratory diseases occurred. The ERR per Gy for all noncancer respiratory diseases was significantly elevated, being 0.17 (95% confidence interval [CI]: 0.08, 0.27). (The ERR of 0.17 here indicates a 17% increase in the risk at 1 Gy of exposure as compared with unexposed subjects, but with a range of uncertainty from 8% to 27%.) The ERR for each of the respective diseases varied, being 0.20 (95% CI: 0.09, 0.34) for pneumonia/influenza, 0.08 (95% CI: –0.14, 0.37) for chronic obstructive lung disease, 0.16 (95% CI: –0.10, 0.52) for bronchial asthma, and –0.16 (95% CI: <0, 0.40) for acute respiratory infection. Adjustments for lifestyle and socioeconomic factors had virtually no impact on the risk estimates. When the study period was divided into shorter intervals (1950–1964, 1965–1979, and 1980–2005), the association between radiation exposure and respiratory diseases was observed to be stronger in the period 1980–2005. Until the 1970s,

most respiratory disease deaths in Japan were from acute infections, but in the 1980s respiratory disease deaths started to be observed primarily as diseases accompanying the terminal stages of cancer and circulatory diseases among the elderly. It was thus plausible that the suggestive association between radiation exposure and respiratory diseases might reflect cancer and circulatory disease in this later period.

(2) Effects of cause-of-death misclassification

Because in the present study information on cause of death was obtained from death certificates, it is important that the underlying cause of death recorded on death certificates be accurate in order to correctly estimate risks. Many patients with cancer or circulatory disease die of respiratory diseases at the terminal stage of such illnesses. Thus, there is a concern that although the actual underlying cause of death is cancer or circulatory diseases, respiratory diseases may be mistakenly recorded as the cause of death. With this in mind, analysis was conducted after excluding subjects with a history of cancer or circulatory diseases from among deaths due to respiratory diseases. As a result, the ERRs decreased by about 35%, and except for pneumonia/influenza, no statistically significant association between radiation exposure and mortality from respiratory diseases was observed.

Care should be taken in interpreting the results of the present study because the study could only partially correct for other causes of death. Some study subjects did not live in Hiroshima or Nagasaki prefectures where our tumor registries could have identified associated cancers, and death certificates often list only one “cause” of death, rather than identifying the important accompanying causes as well, such as cancer or cardiovascular disease. Thus, the apparent associations of radiation with respiratory diseases may have been reduced even more if we had complete ascertainment of the alternative underlying causes. However, the present study indicates that at least part of the apparent association of radiation exposure with noncancer respiratory disease deaths is likely due to reporting artifacts on the death certificates, but not due to sociodemographic or lifestyle biases.

The Radiation Effects Research Foundation has studied A-bomb survivors and their offspring in Hiroshima and Nagasaki for more than 60 years. RERF’s research achievements are considered the principal scientific basis for radiation risk assessment by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and for recommendations regarding radiation protection standards by the International Commission on Radiological Protection (ICRP). RERF expresses its profound gratitude to the A-bomb survivors and survivors’ offspring for their cooperation in our studies.

[§]*Radiation Research*, which is an official monthly journal of the Radiation Research Society, publishes original, peer-reviewed papers and review articles on radiation effects and related issues in the fields of physics, chemistry, biology, and medicine. (Impact factor in 2012: 2.698)