The effect of prostate-specific antigen (PSA) test on radiation risk estimate for prostate cancer incidence among atomic-bomb survivors

Based on results from a 2021 report (https://www.rerf.or.jp/uploads/2021/02/RR8-19_e.pdf) investigating the relationship between incidence (occurrence) of prostate cancer and radiation dose in RERF's Life Span Study (LSS)[1] cohort of atomic bomb survivors showed that occurrence of the cancer increased with increased dose. The Adult Health Study (AHS)[2] started PSA[3] testing for its health examinations starting in December 2004, but at the time of the original analysis in 2021, information about whether study participants had undergone PSA testing could not be ascertained. The reanalysis in this new study estimated the effects of radiation exposure with consideration paid to the more detailed information now available about PSA testing.

During the follow-up period of 1958–2009, 851 prostate cancer cases were detected among 41,554 males. As a result of the reanalysis this time, it was found that the occurrence of prostate cancer among the A-bomb survivor participants who underwent PSA testing in the AHS was increased nearly 2.86 times above the baseline rate (occurrence of disease in people unexposed to radiation) in non-AHS participants,(That rate is compared with the increase in the previous 2021 analysis of 2.5 times based only on AHS-participation not PSA-testing data.) In our reanalysis of occurrence of prostate cancer among A-bomb survivors based on those data, it was found that the excess relative risk (ERR)[4] per 1 gray (Gy)[5] of radiation was 0.54 (indicating an increased risk of 1.54 times per 1 Gy), which did not substantially differ from the ERR of 0.57 reported in 2021.

The study's findings reinforce the dose-response estimates for prostate-cancer incidence previously announced in the 2021 LSS report and support the idea that analysis into effects of PSA testing should be used in future epidemiological studies investigating association between radiation and prostate cancer.

Notes

[1] Life Span Study (LSS):

The main aim of the LSS is to investigate the long-term effects of atomic bomb radiation on the cause of death and cancer incidence. At the time of the 1950 national population census in Japan, about 94,000 atomic bomb survivors were selected from among those who were confirmed to be in Hiroshima and/or Nagasaki at the time of the atomic

bombings and about 27,000 who were not in city at the time. This study has tracked about 120,000 subjects.

[2] Adult Health Study (AHS):

AHS is a clinical research program based on biennial health examinations. The study's major objective is to investigate disease incidence and other long-term health effects of A-bomb radiation. About 20,000 participants have been followed since 1958.

[3] Prostate-specific antigen (PSA):

PSA is protein made in the prostate gland that is also contained in the blood in small amounts. Through testing, a PSA value exceeding 4 ng/ml is considered indicative of a possible abnormality such as prostate cancer.

[4] Excess relative risk (ERR):

Excess relative risk is the increase or decrease of a certain health risk in an exposed group compared with a control group. An excess relative risk of 0 means that radiation exposure did not affect risk. An excess relative risk of 1 in the exposed group would indicate a rate of disease that is double the rate in the unexposed, or control, group.

[5] Gray:

Gray (1 gray = 1,000 milligray) is a unit that represents the amount of dose absorbed by a substance when it is exposed to radiation. The average dose for RERF's LSS participants is around 140–200 milligray (0.14–0.2 Gy). As reference, the average annual amount of radiation we are all exposed to in our daily lives, including medically, is estimated to be around 2–6 milligray (0.002–0.006 Gy).

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RERF's objective with this brief outline is to succinctly explain our research for the lay public. Much of the technical content of the original paper has been omitted. For further details about the study, please refer to the full paper published by the journal.