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See also the articles by Cameron and Wagner in this issue.

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The Weight of Evidence Does Not Support the Suggestion that Exposure to Low Doses of X Rays Increases Longevity¹

Wouldn't it be wonderful if low doses of x rays really did increase longevity (1)? X rays would be the elixir of life, as was radium in the 1920s (2). Unfortunately one has to pick and choose the data carefully to reach such a conclusion. In particular, while much attention has been given to a study by Berrington et al (3) of British radiologists, authors of the corresponding larger study of U.S. radiologists (4) come to exactly the opposite conclusion. Neither does a more detailed study of British radiologists (5) support the suggestion that they live longer than other physicians.

To be specific, for overall mortality, the standard mortality ratio relative to other physicians in the study of British radiologists of Berrington et al (3) is 0.91 (after 1920) and is statistically significant. Hence, the claim that low doses of radiation increase longevity (1). However, the corresponding standard mortality ratio for U.S. radiologists is 1.20 (4) and is also statistically significant, but in the other direction. Are we to conclude that radiation is beneficial or harmful depending on one's nationality?

In reference to the British radiologists, a more detailed analysis of causes of death has been published by Carpenter et al (5) in a cohort of 20,000 British national health service consultants employed between 1962 and 1979. For the 1,600 radiologists and radiation therapists in this cohort, their risk of dying from any cause (from 1962 to 1992) was 1.03 (95% CI: 0.92, 1.15) compared with that of all medical consultants. No sign of increased longevity here.

Why are the results of the British study of Berrington et al (3) apparently at odds with those of both the British study of Carpenter et al (5) and with those of the U.S. study (4)? After all, largely the same radiologists were part of the study in the recent time period (1955–1979) of the two British studies (6). The answer is probably in the controls—always a thorny issue in low-dose studies. In both the British study of Carpenter et al (5) and the U.S. study (4), direct comparisons with other physicians were used; by contrast, in the Berrington study (3), on which the claims of increased longevity are based (1), death rates of the general population were used and were supplemented with census-based standard mortality ratio data for medical practitioners versus the general population. However, as Berrington et al (3) point out, census data are often unreliable for identifying medical practitioners among retirees, who will contribute most to the death rates; perhaps this explains why Berrington and colleagues did not conclude that radiologists exhibit increased longevity (3).

One might also ask if there is evidence of increased longevity among the more intensively studied atomic bomb survivors, where the control populations are well defined. The mean life expectancy for city residents who were not in the city at the time of the explosion was 81 years 155 days, while the mean life expectancy for survivors with doses in the range of 5–250 mGy (mean, 60 mGy) was 81 years 9 days (7). Again, there is no evidence that low doses of radiation increase longevity.

Estimation of the effects of low doses of radiation on a human population is extraordinarily difficult, because the standard mortality ratios are close to unity. In such a situation, most studies would be expected to show no statistically significant effects; however, occasionally one study will show an effect in one direction and another will show an effect in the other direction—exactly the case here. It is important to look carefully at all the available evidence before reaching a measured conclusion; when this is done, we conclude there is little credible evidence that a low dose of x rays increases longevity.

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