Low-level Radiation Harmed Humans Near Three Mile Island

Wing et al. (*1*) analyze data from the area nearest the Three Mile Island nuclear installation, showing elevated cancer incidence rates 5 years after the 1979 accident. Wing et al. refute earlier assumptions that low-level radioactive emissions from the accident were too minute to produce observable effects (*2*). The critical analysis by Wing et al. (*1*) shows excess cases for all cancers combined, lung cancers, and leukemia.

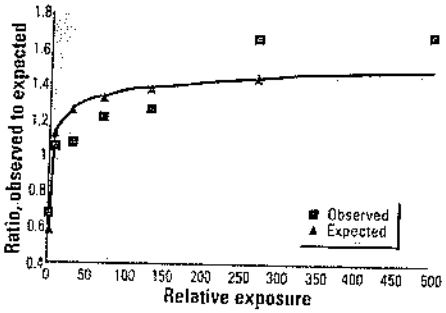

Figure 1. Correlation between the ratio of observed to expected lung cancer cases (1975–1979 versus 1981–1985) and the log values of the dose at Three Mile Island, $r = 0.88$.

Leukemia rates rise with increasing doses, but the small number of cases hamper the significance of the findings. Lung cancer rates also rise, and the larger number of observations make the findings significant. The ratio of observed to expected (O/E) lung cancer cases is three or four times higher at the greatest exposures (still considered low-level) than at the lowest exposures, within 5 years after the accident.

An examination of Wing's data yields a specific finding about effects at low doses. Plotting the O/E ratios by level of exposure shows that the dose response does not conform to a linear model. Rather, a logarithmic or supralinear curve describes the relationship more accurately, as the greatest per-dose effects occur at the very lowest levels of exposure. Perhaps this logarithmic relationship is best seen in lung cancer, where the ratios of the observed to the expected number of cases show a significant rise from 1975 through 1979 to 1981 through 1985. In order to focus on the more rapid rise at low levels of exposure, I demonstrate in Figure 1 the significant correlation between the O/E ratios and the log values of the mean dose, omitting the observations involving the zero mean dose exposure and the highest exposure, the inclusion of which distorts the logarithmic relationship.

The supralinear dose–response scenario carries serious repercussions, not just for accidents like Three Mile Island but for all types of low-level radiation exposure to nuclear workers and the general population. The model has a basis, both in theory and observation. Canadian physician and biophysicist Abram Petkau demonstrated that it took smaller-than-expected amounts of radioactive ^{22}Na added to water to break cell membranes extracted from fresh beef brain (*3*). The supralinear dose response has been illustrated in the medical literature; most recently, such a relationship linking changes in U.S. newborn hypothyroid rates to Chernobyl fallout was reported (*4*).

Future research should not assume that there is a safe threshold for radiation exposure in humans. Because evidence that low levels of radiation exposure can be harmful is surfacing, it is imperative that studies of the biological mechanisms of low-level radiation begin immediately.

Joseph J. Mangano
Consultant
Radiation and Public Health Project
Brooklyn, New York

References

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Phone: (847) 480-9592; Fax: (847) 480-9282