

The lifetime attributable risk estimates from the National Academy of Sciences BEIR VII report have been used by a number of authors to estimate cancer mortality caused by radiation exposure from medical diagnostic radiology exams. This controversial practice assumes that the dose response relationship between radiation and cancer is linear with no threshold (LNT). For purposes of protecting public health, use of the LNT model is widely accepted. But is it appropriate for estimating risk to individuals exposed to low doses of radiation from medical procedures?

Radiation biology research demonstrates that not all biological processes are linear. It also has provided data that support not only LNT but supra linear and sub linear response models. Results from epidemiology studies can also be used to support the use of any of these models, but the confidence intervals are much larger. Since we can't prove which model is correct, for purposes of protecting patients we assume that any exposure has the potential for harm and we use optimization to keep exposures as low as reasonably achievable.

Several areas of research are contributing insight into this dilemma, but they still leave several important questions unanswered:

- How can we accurately extrapolate low-dose biological effects generated in the laboratory to risk in a human?
- Is extrapolation from high dose, high dose rate, acute exposures appropriate when human exposures are primarily chronic low dose exposures.

Epidemiology alone is unlikely to provide information that will resolve this dilemma. The numbers of individuals required in a sample are too large, and the homogeneity among subjects is lacking. Reliance on radiation biology research alone is problematic because the research is focused primarily on mechanisms and not risk. This paper will present an overview of the issues and suggest areas of research that may contribute to our understanding of the level of risk associated with low doses of medical radiation.

Following this paper, attendees will be able to:

- List the current biological mechanisms that are affected by low doses of ionizing radiation.
- Describe the dilemma of risk extrapolation based on current knowledge of biological effects of radiation.
- Discuss the limitations of extrapolating lifetime attributable risk estimates to cancer mortality for low-dose medical procedures.