Dose-Response:
An International Journal
October-December 2021:1–2

DOI: 10.1177/15593258211063982
journals.sagepub.com/home/dos
SAGE

The Linear-No-Threshold Line for Cancer Excess Relative Risk Based on Lagging Low Radiation Doses is Misleading

Bobby R. Scott[1]

Keywords
radiation, cancer, risk assessment, LNT, hormesis, threshold

The linear-no-threshold (LNT) model[1] is currently used in low-dose-radiation cancer risk assessment and this practice is supported by organizations that include the Environmental Protection Agency and the Nuclear Regulatory Commission. Lagging low radiation doses has been used in epidemiologic studies[2] and this helps to justify reliance on an LNT function for excess relative risk (ERR) for cancer incidence. Some of the low dose is discarded (lagging of dose) with the remaining even smaller dose then treated as relevant for cancer induction.[2] This presumed-relevant smaller dose can be expressed mathematically as D-L where D is the assigned total absorbed dose and L (<D) is the discarded amount. Excess relative risk (evaluated as the product k[D-L], with the lagged dose D-L treated as the independent variable) is then the positive-slope (k used here) LNT function to be generated in the epidemiologic study for a given cancer type. The predetermined conclusion of such studies is that any amount of radiation no matter how small is carcinogenic. Interestingly, for a future group exposed to a low dose D of the same type of radiation under similar circumstances, ERR (evaluated as the product kD with slope k based on lagged dose) is then used in *predicting cancer risk*. This leads to inflation of LNT-based ERR by a factor 1/(1-f) where f is the fraction of D that was discarded when previously estimating k. The ERR inflation promotes radiation phobia and this can lead to detrimental outcomes including the loss of many lives as occurred among evacuees after the Fukushima nuclear accident in March 2011.[3] The phobia can also lead to refusals by millions of individuals worldwide of potentially lifesaving and health-enhancing, low-dose-radiation therapy[4] for health problems that may include cancer, Alzheimer's disease, and COVID-19-related pneumonia.

Because a low dose (eg, 10 mGy) is highly unlikely to cause cancer but may with high probability stimulate the body's natural anticancer defenses,[5] there is no well-founded scientific justification for radiation dose lagging in epidemiologic studies of cancer risk after exposure to low-dose radiation or for use of an LNT risk model. Lagging low doses and using other misinforming procedures (MisPros) in epidemiologic studies to make the LNT model appear acceptable is misleading.[6] *For low radiation doses and an appropriate null hypothesis of no radiation-induced cancers,*[7] *blaming all observed cancers on very small doses (a dose-lagging consequence) rather than other risk factors is unscientific.*

ORCID iD

Bobby R. Scott https://orcid.org/0000-0002-6806-3847

References

1. Weber W, Zanzonico P. The controversial linear no-threshold model. *J Nucl Med*. 2017;58(1):7-8. DOI: 10.2967/jnumed.116.182667.
2. Boice JD, Cohen SS, Mumma MT, et al. Mortality among workers at the Los Alamos National Laboratory, 1943-2017. *Int J Radiat Biol*. 2021:1-28. doi:10.1080/09553002.2021.1917784.
3. Siegel JA, et al. *J Nuc Med*. 2021;62(11):17N-18N.

[1]Lovelace Biomedical Research Institute, Albuquerque, NM, USA

Received 13 November 2021; accepted 15 November 2021

Corresponding Author:
Bobby R. Scott, Lovelace Biomedical Research Institute, 2425 Ridgecrest Drive SE, Albuquerque, NM 87108, USA.
Email: bscott@lovelacebiomedical.org

4. Cuttler JM, Abdellah E, Goldberg Y, et al. Low doses of ionizing radiation as a treatment for Alzheimer's disease: a pilot study. *J Alzheim Dis*. 2021;80(3):1119-1128. doi:10.3233/JAD-200620.
5. Scott BR, Tharmalingam S. The LNT model for cancer induction is not supported by radiobiological data. *Chem Biol Interact*. 2019;301:34-53. doi:10.1016/j.cbi.2019.01.013.
6. Scott BR. Some epidemiologic studies of low-dose-radiation cancer risks are misinforming. *Dose-Response* 2021;19. doi:10.1177/15593258211024499.
7. Ulsh BA. The new radiobiology: returning to our roots. *Dose-Response*. 2012;10(4):593-609. doi:10.2203/dose-response.12-021.Ulsh.