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Vanishing by Design of Cancer Risk Uncertainty for Low Radiation Doses Is Misleading and Unscientific

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The main basis for cancer risk quantification for humans exposed to low radiation doses is epidemiologic studies. Findings from such studies have influenced the development of the current *system of radiological protection* along with the related radiation-dose-reducing concept[1] "As Low As Reasonably Achievable (ALARA)." Cancer risk quantification for low radiation doses is mainly based on the controversial[2] linear-no-threshold (LNT) model which is unsupported[3] by modern radiation biology. There are uncertainties with any cancer risk assessment related to radiation exposure. With use of the LNT model to *estimate* relative risk (or excess relative risk) for low radiation doses, the uncertainty in the risk estimate is strangely modeled as progressively vanishing as radiation dose decreases to assigned dose zero (e.g., "0 mGy"); an oddity of contemporary epidemiologic studies such as conducted by Leuraud et al.[4] This is problematic because there is no actual zero-radiation exposure since everyone is continuously exposed to natural background radiation and cancer absolute risk in the absence of any radiation exposure throughout life is uncertain. Thus, *epidemiologist when employing the LNT model to radiation-dose-response data for cancer-relative-risk estimation can predict the absolute risk (estimated as "A{U}" with uncertainty U) for the type of cancer of interest for a radiation-free world*. The estimated absolute risk A{U} can then be used in generating the relative risk estimate and related uncertainty for a given dose-group studied. In this case, the zero-radiation relative risk estimate "A{U}/A{U}," with central estimate "1," also has nonvanishing uncertainty because of *uncertainty propagation*.[5] The indicated approach would help in preventing the inappropriate vanishing by design of risk uncertainty for decreasing low radiation doses.

Uncertainty about the correct risk model (other models are possible, including threshold and hormetic) also needs careful consideration and there are reliable ways[5] to address this. The indicted uncertainty becomes quite important when predicting relative risk (or excess relative risk) for cancer at below normal natural background radiation levels because *LNT and hormetic models lead to very different risk predictions*. Below-natural-background-radiation radiobiological studies deep underground that used various organisms have produced results that do not support the LNT model as applied to radiation-induced stochastic effects (e.g., mutations).[6] Additionally, neoplastic transformation in cultured cells was reduced rather than increased by above-natural-background-radiation, gamma-ray doses of 1 to 100 mGy.[7] Given the information provided in this publication, *vanishing by design of cancer risk uncertainty for decreasing low radiation doses is misleading and unscientific.*

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