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Some Epidemiologic Studies of Low-Dose-Radiation Cancer Risks Are Misinforming

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Well-designed epidemiologic studies, e.g. some COVID-19 pandemic applications,[1] provide reliable information for society. Poorly-designed epidemiologic studies, as with some that relate to cancer risks for low-dose radiation, employ **mis**informing **pro**cedure**s** (MisPros; singular MisPro; new abbreviations) that can lead to unintended harmful actions related to radiation phobia. This phobia led to enormous societal losses following the Fukushima[2] and Chernobyl[3] nuclear accidents. The phobia is linked to the **l**inear-**n**o-**t**hreshold (LNT) cancer risk model used in many epidemiologic studies.[4] LNT is based on the conjecture that any amount of radiation can cause cancer and cancer risk increases linearly as radiation dose increases; however, extensive radiobiological data related to chemico-biological interactions and their consequences do not support LNT.[5]

This letter focuses on elucidating how some epidemiologic studies of radiation-induced cancer that supposedly support the LNT model were designed to lead to an LNT outcome via using clever MisPros.[6,7] The studies generally focus on the **r**elative **r**isk **e**stimate (RRE; usually misleadingly abbreviated RR) for a specific type of cancer. For the supposedly un-irradiated group (unexposed), RRE = 1, with no uncertainty (MisPro #1; vanishing uncertainty). Some studies also discard some of the radiation dose (called lagging; MisPro #2) allowing epidemiologists to treat radiation doses as being smaller than they were.[6] Another MisPro (#3) is to treat the unexposed group as having never been irradiated (via natural background or other radiation sources). Acknowledging that dose > 0 (eg, in mGy or mSv) for this group forces (as should be the case) LNT advocates to predict radiation risk at absolute zero radiation dose where no measurements can be performed because of unavoidable natural background radiation. This would also force the RRE for the unexposed group (actually irradiated) to be assigned uncertainty > 0 (as should be the case). High-dose data are usually included (MisPro #4) and guarantees a positive slope to the fitted LNT line.[6] Dose groups with a range (sometimes wide) of doses in each group are used (MisPro #5) which hides nonlinearity.[6] In addition, the null hypothesis is usually misassigned to LNT (MisPro #6) rather than to no radiation effect.[7] With the LNT model, preventing all radiation exposures throughout life would be predicted to minimize the overall cancer absolute risk; however, all life forms initially evolved in the presence of higher natural background radiation than now and a slightly elevated radiation level is known to stimulate the body's natural defenses (hormetic benefits) against cancer.[6] Thus, residing in a radiation-free world would likely significantly increases the overall cancer absolute risk, which essentially renders LNT highly implausible.

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