

In the same publication, Rowland (in press) also examined dose-response functions for head carcinomas. As in previous studies, the linear, linear exponential, and dose-squared exponential functions all fitted the data satisfactorily. The reason lies in the scarcity of head carcinomas. With only 19 of these malignancies observed in the cohort examined, the data are insufficient to discriminate between alternate formulations.

The records indicate that bone sarcomas occurred about twice as often as head carcinomas in the radium-exposed populations. The total known population had 85 bone sarcomas and 37 head carcinomas, while the total measured population had 64 bone sarcomas and 32 head carcinomas. Among the female dial workers, considered the best cohort for dose-response analyses, 46 bone sarcomas and 19 head carcinomas were observed. Because the number of head carcinomas is not sufficient to allow unequivocal determination of the best form for a dose-response function, the best predictor of their incidence at a given intake level is the predicted number of bone sarcomas at that level, divided by two.

At the same international seminar in Heidelberg, Thomas (in press) presented work in which he used lognormal data analysis and the newly calculated skeletal dose values (presented in the appendix of this document) to reach the conclusion that a threshold exists for radium-induced malignancies. Thomas calculated threshold values of 390-620 cGy and suggested the adoption of a value of 1,000 cGy as the threshold for radium-induced malignancies in humans, the same value Evans (1974) had derived 20 years earlier.

Among the unanswered questions that remain is the striking paucity of bone tumors in males. Is this a defect in the accumulated data, or is it a real effect? If it is real, it may be indicative of some male-female differences. Another question is whether other malignancies, such as multiple myeloma or breast cancer in females, are induced by radium. Much remains to be learned from radium-exposed humans, but little time remains before they are all gone.