

Power and Uncertainty Analysis of Epidemiological Studies of Radiation-Related Disease Risk in which Dose Estimates are Based on a Complex Dosimetry System: Some Observations

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ABSTRACT

This paper discusses practical effects of dosimetry error relevant to the design and analysis of an epidemiological study of disease risk and exposure. It focuses on shared error in radiation dose estimates for such studies as the Hanford Thyroid Disease Study or the Utah Thyroid Cohort Study, which use complex dosimetry systems that produce multiple replications of possible dose for the cohort. We argue that a simple estimation of shared multiplicative error components through direct examination of the replications of dose for each person provides information useful for estimating the power of a study to detect a radiation effect and illustrate this with an example based on the doses used for the Hanford Thyroid Disease Study. Uncertainty analysis (construction of confidence intervals) can be approached in the same way in simple cases. We also offer some suggestions for Monte Carlo-based confidence intervals.

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