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Effects of measurement error on estimating biological half-life

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Abstract

Direct computation of the observed biological half-life of a toxic compound in a person can lead to an undefined estimate when subsequent concentration measurements are greater than or equal to previous measurements. The likelihood of such an occurrence depends upon the length of time between measurements and the variance (intra-subject biological and inter-sample analytical) associated with the measurements. If the compound is lipophilic the subject's percentage of body fat at the times of measurement can also affect this likelihood. We present formulas for computing a model-predicted half-life estimate and its variance; and we derive expressions for the effect of sample size, measurement error, time between measurements, and any relevant covariates on the variability in model-predicted half-life estimates. We also use statistical modeling to estimate the probability of obtaining an undefined half-life estimate and to compute the expected number of undefined half-life estimates for a sample from a study population. Finally, we illustrate our methods using data from a study of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) exposure among 36 members of Operation Ranch Hand, the Air Force unit responsible for the aerial spraying of Agent Orange in Vietnam.

Related information

PubChem Compound (MeSH Keyword)