

Cohort study of thyroid cancer and other thyroid diseases following the Chernobyl accident

Analysis of dose-response

2002 Dosimetry output

- **Stochastic doses - 1,000 simulations per individual**
- **Doses were estimated for each individual by repeated independent sampling of the uncertain parameters from uncertainty distribution for each parameter**
- **Median GSD=1.7; most important parameters accounting for 95% of overall uncertainty for a 'typical' individual:**
 - **Measured radioactivity – 48%**
 - **Thyroid mass – 49%**

Dose-response analyses

- **Uncertainties have not been taken into account explicitly**
 - **Format of doses did not allow us to separate errors**
 - **Lack of consensus on method accounting for both classical and shared Berkson error**
- **We used arithmetic mean of 1,000 simulations as the best estimate of I-131 dose**
- **Awaiting new set of 2009 doses with shared and unshared errors**
- **Attempting to identify reasonable and feasible statistical method**

Studies of environmentally exposed populations that considered uncertainties

- **Hanford Thyroid Disease Study (Stram, Kopecky, 2003)**
 - Made several observations concerning analysis of study power
 - Outlined general approach to analysis of uncertainty in estimating dose-response
- **Nevada Test Site Fallout Study**
 - Mallick, et al. 2002 - considered a combination of classical and Berkson error assuming that these are independent across individuals
 - Li, et al. 2007 – considered a mixture of classical and Berkson errors, in which Berkson errors are correlated
- **Study of thyroid cancer in Bryansk oblast of Russia (Kopecky, 2006)**
 - Model used did not allow for separation of classical and Berkson errors, appropriate for exclusively classical error

Some findings from previous studies

- **Nevada Test Site Fallout Study**
 - Treating all sources of uncertainty explicitly (classical and Berkson shared) increased ERR/Gy and the upper limit of 95% CI by a factor of 2 relative to case where all uncertainty was assumed to be 100% unshared Berkson
 - The effect of accounting for correlation of Berkson uncertainties was modest
- **Study of thyroid cancer in Bryansk oblast of Russia**
 - Adjustment roughly tripled RR/Gy and 95% CI
 - The RR adjusted for classical error could be viewed as upper bound of the RR adjusted for mix of classical and Berkson error

Questions for discussion

- Are these methods appropriate for our study?
- What method is preferred?
- Do these methods need to be modified?
- Would dosimetric 2009 output work with these methods?
- Is it worthwhile to perfect statistical methods given the number of cases identified and somewhat predictable outcome of the adjustment?