

# **Dose Uncertainty and A- bomb Survivor Risk Estimates: Possible Improvements**

Dale Preston

Impact of Dose Uncertainties on Dose  
Response

May 8, 2009

# Adjusting for Dose Uncertainty in Risk Estimation

## An Ideal system

- Recognize and characterize sources and types of uncertainty
  - Source-related (yield, transport, shielding)
  - Survivor-related (location, shielding, orientation)
- Distinguish between measurement and grouping errors, shared and unshared errors
- Use relevant latent variables (survival, biodosimetry, ...)
- Easily applicable in routine analyses
  - Addresses both bias and impact on risk uncertainty
- Useful for more detailed investigations when desired

# Dose Error Adjustment at RERF

## What Is Done

- Simple regression calibration system
  - Replace observed dose with  $E(\text{true dose} | \text{observed dose})$  with additional truncation at highest doses
- Used in virtually all analyses
  - Users routinely provided with “adjusted, truncated” doses
  - Requires no modification of standard analytical methods
- Corrects for bias in dose response estimates

# Dose Error Adjustment at RERF

## What Is Not Done (Now)

- Separation of measurement (classical) and averaging (Berkson) errors
- Adjustment of risk estimate confidence intervals to allow for error adjustment
- Use of biodosimetry data
- Accounting for uncertainty information provided with DS02
- Explicit accounting for shared uncertainties (e.g. in yield)
- Allowance for fallout/residual radiation or medical exposures

# Improvements

## Short Term

- Replace current calibration factors with factors based on recent Pierce/Kellerer work
  - Need to decide on measurement / averaging error proportions
- Provide users with information on further adjustments fitting L-Q or (possibly) other non-linear models
  - Simple adjustments should suffice (like  $1.12 * \text{doseadj}^2$  for current system with 35% errors)

# Improvements Looking ahead

- Incorporate biodosimetric data
  - Work to date has been pretty crude
  - Work on latent variable & Bayesian approaches is underway
  - Data generally available for a small portion of LSS
- Investigate impact of moving beyond regression calibration
  - Will more sophisticated / complex methods (e.g. full-likelihood Bayesian methods) lead to marked improvements in risk estimates / inference?
- Investigate of fallout/residual radiation and medical exposure effects
  - Important to address concerns about these issues
  - Little need to incorporate into routine analyses

# Final Thoughts

- Simple calibration approach serves RERF well
  - Routinely used
  - Almost certainly deals with major bias
- Implement with improved adjustment factors
- Explore other issues with primary goals of
  - Improving current system while keeping it simple to use
  - Addressing concerns about impact of other exposures