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

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Impact of Dose Uncertainties on Dose Response

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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(true dose| 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 * 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