Bayesian Hierarchical Meta-Regression of Epidemiologic Studies: Dose and Response Pre-Analysis (Poster 6)

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Purpose and Scope
- National Research Council (NRC) has recommended the application of meta-analytical approaches, including Bayesian approaches, to well-studied health outcomes for the development of point estimates of risk and confidence intervals (NRC, 2013; NRC, 2014).
- NRC specifically recommended that EPA conduct dose-response meta-analysis for arsenic-related diseases in the IRIS assessment of inorganic arsenic (NRC, 2013).
- This poster is the first of two (see also Poster 7) that describe a case study highlighting an application of Bayesian hierarchical dose-response meta-regression to the analysis of arsenic exposure and human bladder cancer.

Case Study: Inorganic Arsenic (iAs) & Bladder Cancer

The pre-analysis steps described here employ methods to:
- Address how doses are commonly reported in epidemiological studies
- Calculate a common dose metric across all epidemiological studies
- Calculate "effective counts" from reported effect measures in human studies to facilitate sensitivity analysis of dose that exist across studies

Aim: To determine the degree of correspondence among susceptibility studies conducted in epidemiological studies in the context of dose-response analyses, including:
- Reporting of interval-censored exposure distribution
- Use of divergent measures of dose
- Sensitivity analysis

Methods
The methods described herein were used to account for commonly encountered limitations in epidemiologic studies in the context of dose-response analyses, including:
- Reporting of interval-censored exposure distribution
- Use of divergent measures of dose

Results
- After averaging over all individuals within a dose-group, a Monte Carlo simulation was run with 1,000 iterations to derive a distribution of group-specific dose values.
- The median, 2.5%, and 97.5% percentiles from this distribution were used to characterize the "best", "low-end", and "high-end" estimates of dose (Table 3).

Conclusions
- The methods described herein were used to account for commonly encountered limitations in epidemiologic studies in the context of dose-response analyses, including:
  - Reporting of interval-censored exposure distribution
  - Use of divergent measures of dose

References
- Greenland, S., Longnecker, P. Meta-analysis of epidemiologic studies in the context of dose-response analyses, including:
  - Reporting of interval-censored exposure distribution
  - Use of divergent measures of dose

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