

Evaluation of Statistical Weighting Approaches for a Meta-analysis of Occupational Acrylonitrile Exposure and Lung Cancer Mortality

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Background and Aims: Meta-analysis provides a useful quantitative summary for occupational mortality studies. We conduct a meta-analysis for lung cancer mortality and occupational acrylonitrile exposure comprising all available published studies through the end of the year 2010. In addition, we evaluate weighting methods typically applied by standard meta-analytic approaches for estimating summary standardized mortality ratios (SSMR).

Methods: Results were abstracted from mortality studies for eleven occupational cohorts. National comparisons were reported for eight cohorts while regional comparisons were reported for seven cohorts. The SSMR was calculated by pooled analysis, and by fixed and random effects models following heterogeneity assessment. The relative change in proportional weight for each study-specific SMR was evaluated.

Results: Pooled SSMRs were 0.93 (95%CI: 0.84, 1.02) and 0.84 (95%CI: 0.74, 0.94) for results from the national and regional comparisons, respectively. Due to significant evidence of heterogeneity in the results for both national comparisons ($p=0.01$) and regional comparisons ($p=0.05$), random effects SSMRs were estimated as 1.02 (95%CI: 0.85, 1.22) and 0.96 (95%CI: 0.77, 1.19), respectively. Standard statistical weighting approaches to meta-analysis increased the relative proportional weights assigned to studies reporting SMRs greater than 1.0 while those studies reporting SMRs less than 1.0 had decreased proportional weights.

Conclusions: Consistent with published qualitative reviews, occupational acrylonitrile exposure is not significantly associated with lung cancer mortality. The current meta-analysis weighting approach may introduce bias relative to summary estimates from pooled analyses. This is due to increased proportional weights assigned to studies reporting SMR greater than 1.0 without regard to cohort size or number of observed mortality outcomes.