Triangulation-based adjustment factors for combined cancer risk of chrysotile asbestos

Thomas F. Bateson and Leonid Kopylev
Center for Public Health and Environmental Assessment, Office of Research and Development, U.S. Environmental Protection Agency, Washington, DC

Introduction

The 2020 EPA Risk Evaluation for Chrysotile Asbestos derived an inhalation unit risk (IUR) based on lung cancer, mesothelioma, laryngeal cancer and ovarian cancer. This poster highlights the decisions relevant to triangulation.

Ideally, unit risks for each cancer would be combined to represent the total cancer risk. However, quantitative data for dose-response were insufficient for three of four cancers. Failing to account for those risks in the IUR underestimates the total cancer risk associated with chrysotile asbestos.

- Until 1999, mesothelioma deaths were coded to other causes. Under-ascertainment of cases exerted a downward bias on the dose-response function in an absolute risk model.
- No published asbestos studies reported dose-response results for laryngeal or ovarian cancers.

Figure Legend

Direct effect

External information

Indirect effect using external information

Methods

USEPA (2020) cited the Kopylev et al. (2011) review of quantitative information on mesothelioma under-ascertainment and the calculation that multiplying the unit risk from available data by an adjustment factor of 1.39 would address under-ascertainment of cases (on average) [Fig. 1].

An indirect estimate of additional cancer risk from laryngeal and ovarian cancers was determined using adjustment factors based on a comparison of the excess deaths from lung cancer with the number of excess deaths from ovarian and laryngeal cancers based on published asbestos studies. Details are available in Appendix M of USEPA (2020).

An adjustment factor for laryngeal cancer was based on studies which reported SMRs for the same exposure and both outcomes [Fig. 2]:

≈ 1 + (excess deaths from laryngeal cancer / excess deaths from lung cancer) = 1.02

An adjustment factor for ovarian cancer was based on studies which reported SMRs for the same exposure and both outcomes [Fig. 3]:

≈ 1 + (excess deaths from ovarian cancer / excess deaths from lung cancer) = 1.04

Results

USEPA (2020) derived the lung cancer unit risk directly from available dose-response data and multiplied this value by adjustment factors for laryngeal and ovarian cancer and then combined this lung-larynx-ovarian unit risk with the adjusted mesothelioma unit risk yielding the combined cancer IUR of 0.16 $(f/cc)^{-1}$.

- Without the adjustments, the IUR would have been 0.12 $(f/cc)^{-1}$.

Conclusion

Estimation of cancer-specific adjustment factors to support the derivation of a chrysotile asbestos IUR for all cancers in USEPA (2020) is an example of triangulation.

References

- U.S. EPA. Office of Chemical Safety and Pollution Prevention. Risk Evaluation for Asbestos Part I: Chrysotile Asbestos. U.S. EPA, Washington, DC, EPA/740/R-1-8012, 2020.
- Kopylev L, Sullivan PA, Vinikoor LC, Bateson TF. Monte Carlo analysis of impact of underascertainment of mesothelioma cases on underestimation of risk. The Open Epidemiology Journal 2011;3:98-106.

Figure 1

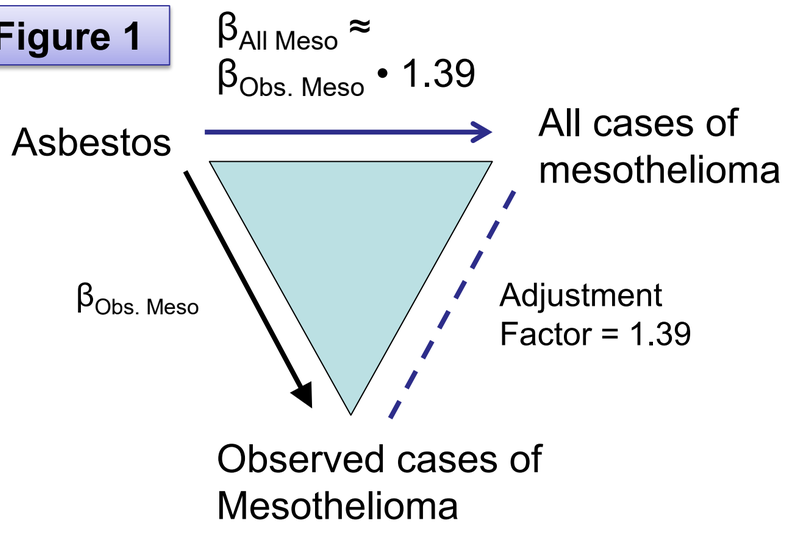


Figure 2

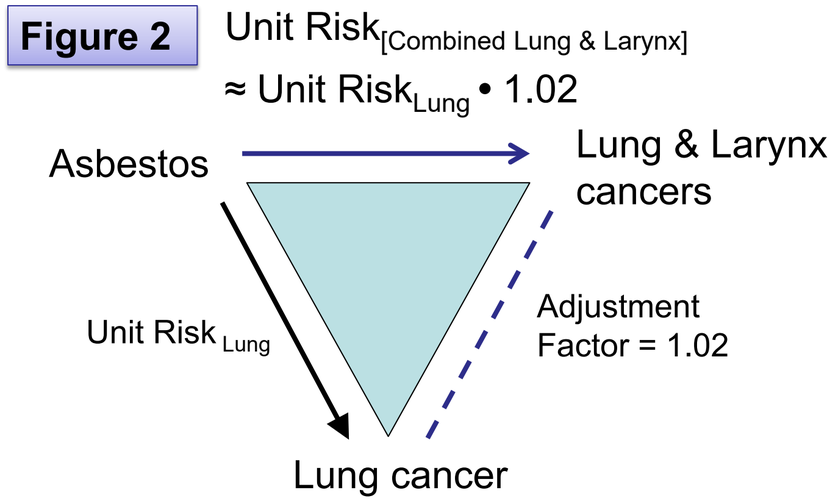
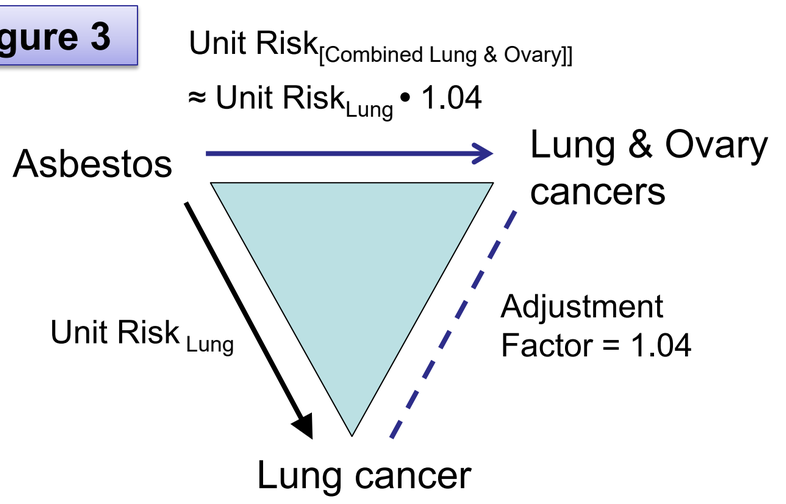


Figure 3



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