

Abstract Title:

Use of Biomonitoring Data to Interpret Attributable Exposures in Public Health Tracking

Keywords: Exposure tracking, biomonitoring, persistent pollutants, volatile chemicals, pesticides

Background/Purpose:

Biomonitoring of chemical concentrations in urine, blood, and lipid tissue, offers an important opportunity to assess exposures to harmful chemicals. But capabilities and limitations must be explored.

Objective:

The objective of this work is to systematically evaluate the capabilities and limitations of biological samples from humans as tools for interpreting environmental concentrations and exposures. Based on three case studies, we evaluate the relative value of biological samples to calculate internal dose as well as source-to-dose relationships.

Methods:

We use biomonitoring data and emissions data to first construct “empirical” models of source-dose relationships and then compare these relationships with results obtained from “mass-balance” models that account for transport, cumulative exposure, and pharmacokinetics. Three cases are considered--(1) dioxin-like compounds, (2) the volatile organic compound trichloroethylene (TCE) and (3) organophosphate pesticides.

Results:

With dioxin-like compounds the “empirical” and regional “mass-balance” models agree quite well. We found it difficult to use biomonitoring data to infer source-to-dose relationships for TCE. For organophosphate pesticides, the important contribution of common pathways of exposure at such as food residue exposures can be inferred from studies of biomarkers in different populations.

Conclusion:

Biomarkers of exposures to chemicals that are stored in fat are much easier to analyze than volatile chemicals such as TCE, which is rapidly removed. With dioxin-like compounds the blood concentrations provide good markers of cumulative dose primarily due to the persistence, regional-scale transport, and lipid-based intake of these compounds. There are apparent but unexplored opportunities for using pesticide metabolites to infer cumulative dose.

Evaluation:

The results illustrate the value of merging field biomonitoring data with empirical and mass-balance models to both interpret internal doses and better understand source-to-dose relationships.

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