

CHALLENGES AFFECTING THE INTERPRETATION OF BIOMONITORING DATA IN EPIDEMIOLOGIC STUDIES

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Background and Aims: Biomonitoring (i.e., measurement of chemicals or their metabolites at trace levels in biological tissues) is useful for investigating background exposures to environmental chemicals and has gained importance in environmental epidemiology. However, limitations in biomonitoring measures do exist. For example, although adequate sampling and processing methods are critical for evaluating biomonitoring data, these methods, especially for ubiquitous non-persistent organic chemicals, have not received as much attention as the analytical techniques. Also, the relevance of toxicokinetics on the selection of both biomarkers of exposure and biomonitoring matrices may have been undervalued.

Methods: We use several case studies including phthalates and bisphenol A, among other chemicals, to illustrate the importance of collection, processing and storage strategies for understanding biomonitoring results and their application in etiologic research.

Results: We discuss the relevance of the following aspects: selection of biomarkers of exposure based on toxicokinetics data (e.g., distribution among body compartments, metabolism), selection of the biological matrix, choice of analytical method, collection protocol—including location and timing of specimen collection, and type of specimen (e.g., first morning vs 24-h urine void)—, variability of the biomarker measures over time, storage and transport protocols, and use of quality control materials, including field and laboratory blanks.

Conclusions: Analytical chemistry advances permit measuring multiple environmental chemicals (e.g., analytes) concurrently at trace levels with the specificity and sensitivity required for biomonitoring. However, not all analytes are optimal exposure biomarkers. In addition to state-of-the-art analytical methods, highly trained laboratory personnel, and strict quality control/quality assurance laboratory practices, other often underappreciated factors (e.g., sampling, storage) must be considered to guarantee the valid interpretation of biomonitoring data and their use for environmental epidemiology. Nonetheless, despite its limitations, particularly for non-persistent chemicals which display considerable variability over time, biomonitoring data strengthens the exposure assessment in environmental epidemiology.