

Science of The Total Environment

Volume 689, 1 November 2019, Pages 1125-1132



Wastewater-based epidemiology as a novel assessment approach for population-level metal exposure

Author links open overlay panel [Christopher Markosian](#)¹ [Natella Mirzoyan](#)

Acopian Center for the Environment, American University of Armenia, 40 Marshal Baghramyan Avenue, Yerevan 0019, Republic of Armenia

Received 10 May 2019, Revised 25 June 2019, Accepted 25 June 2019, Available online 27 June 2019, Version of Record 8 July 2019.

Editor: Thomas Kevin V

[Show less](#)

[Add to Mendeley](#)

[Share](#)

[Cite](#)

<https://doi.org/10.1016/j.scitotenv.2019.06.419> [Get rights and content](#)

Highlights

•

Human biomonitoring (HBM) is not ideal for assessing population-level metal exposure.

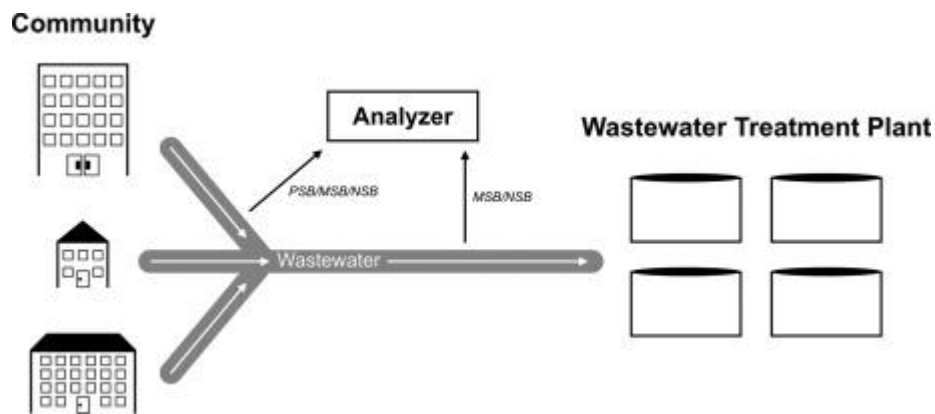
- Wastewater-based epidemiology (WBE) can be used as a novel assessment approach.
- Various biomarkers for metals are available for consideration in wastewater analysis.
- Potential biomarkers of 10 common metals for WBE are discussed.

Abstract

Pollution by heavy metals and metalloids is detrimental to human health due to their toxic, genotoxic, and carcinogenic effects. The traditional approach to assess the extent of environmental and occupational exposures of metals is human biomonitoring (HBM). This method has several limitations, including invasiveness, sampling bias, cost- and time-intensiveness, and ethical issues. This suggests the need for a more robust, non-invasive, epidemiological tool for assessment of exposure to metals and their public health effects. Recently, wastewater-based epidemiology (WBE) has been suggested and utilized as a novel approach to accurately determine the extent of exposure to multiple substances on the population level. We suggest the potential application of WBE to the study of metal exposure on the population level, including possible biomarkers for wastewater analysis of 10 metals belonging to three categories according to health effects and nutritional benefits, and its public health implications. Similar to previous studies of exposure to regulated or illegal drugs, unregulated legal substances, and pesticides, WBE can be applied to the study of metal exposure in a given community. Parental substance biomarkers (PSBs), metabolic substance biomarkers (MSBs), and non-substance biomarkers (NSBs) of 10 common metals are available for consideration in wastewater analysis. The use of WBE would allow for the interpretation of the relationship between metal exposure

and population health, reveal synergistic effects of different health factors, and model public health risks under different scenarios.

Graphical abstract



1. [Download : Download high-res image \(114KB\)](#)
2. [Download : Download full-size image](#)

Abbreviations

HBM

human biomonitoring

WBE

wastewater-based epidemiology

WWTP

wastewater treatment plant

PSB

parental substance biomarker

MSB

metabolic substance biomarker

NSB

non-substance biomarker

Keywords

Wastewater

Epidemiology

Metal

Biomarker