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Exposure Investigations Conducted by the Agency for Toxic Substances and Disease Registry

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Editor's Note:

As part of our continued effort to highlight innovative approaches to improve the health and environment of communities, the *Journal* is pleased to publish regular columns from the Agency for Toxic Substances and Disease Registry (ATSDR) at the Centers for Disease Control and Prevention (CDC). ATSDR serves the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. The purpose of this column is to inform readers of ATSDR's activities and initiatives to better understand the relationship between exposure to hazardous substances in the environment, its impact on human health, and how to protect public health.

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Background

The Agency for Toxic Substances and Disease Registry (ATSDR) protects communities from harmful health effects related to exposure to natural and human-made contaminants in the environment. The Office of Community Health Hazard Assessment within ATSDR provides this protection by working closely with the U.S. Environmental Protection Agency (U.S. EPA), tribal agencies, state partners of the ATSDR Partnership to Promote Localized Efforts to Reduce Environmental Exposure (APPLETREE) Cooperative Agreement Program, and other partners including communities, to conduct public health assessments of hazardous waste sites.

ATSDR relies on environmental data provided by other environmental agencies, including U.S. EPA and state and local agencies, to determine if people living near a hazardous waste site are being exposed to toxic substances and if that exposure is harmful. In some instances,

there are not enough site data available to complete an assessment and make a public health determination, resulting in a data gap. Data gaps can be filled at a site by recommending that other environmental agencies conduct appropriate sampling or, in some instances, by modeling exposure to the contamination. If data gaps cannot be addressed with samples collected by other agencies or exposure modeling, ATSDR will consider conducting an exposure investigation (EI).

Exposure Investigations

An ATSDR EI is a biological (e.g., blood, urine) and/or environmental (e.g., air, water, dust, soil, biota, etc.) sampling effort that is designed to fill a data gap needed to make a public health conclusion at a site. The following four questions are evaluated to determine if it is appropriate to conduct an EI at a site:

1. Can an exposed population be identified?
2. Does a data gap exist that affects the ability to determine if there is a health hazard?
3. Can an EI be designed that will address this data gap?
4. How will the EI results affect the public health decision-making for the site?

The question that is the most difficult to answer is question 4. The results of the EI sampling must be able to impact public health decisions for the site, which can be achieved in various ways:

- Recommend actions to be taken by the regulatory community to reduce exposure (e.g., treating water or providing an alternative water source if water is contaminated).
- Indicate the need for further sampling or enhanced surveillance (e.g., measuring blood lead levels in children near a site).
- Recommend a health study to be conducted to evaluate potential health effects associated with exposure.
- Identify the need for community education (e.g., assisting the community in understanding how to reduce exposure).
- Provide physician education in the form of grand round presentations and/or written clinician guidance.

Methodology

The process for determining whether to conduct an EI is provided in Figure 1. Engaging the community is a critical first step to ensure that conducting an EI will work to address the concerns of the community and allows ATSDR to prepare an appropriate and feasible recruitment strategy for the investigation. ATSDR may hold a kickoff meeting in the community to provide information and begin recruitment. When the EI is complete, ATSDR conducts a public meeting to relay the results of the EI to the community.

Determining an appropriate recruitment strategy is critical to ensure that the results of the EI fill the exposure data gap and meet the concerns and needs of the community. ATSDR engages community leaders and local health agencies to determine the best way to recruit participants. Recruitment can include sending letters or postcards inviting residents to participate, making phone calls, going door-to-door, or using appropriate media (e.g., newspapers, social media) to engage the community.

EIs typically focus on sampling the most highly exposed individuals or environmental locations to determine the worst case for potential exposure in the community. The use of this strategy results in the sampling data only being applicable to the tested individuals and the results not being generalizable to the community.

After an EI request is accepted, ATSDR will prepare a protocol that provides appropriate consent forms, questionnaires, and outreach materials. Prior to collecting either biological or environmental samples, participants must complete consent forms (e.g., adult, parental permission, assent forms for adolescents) to ensure they are granting informed permission to partake in the investigation. Participants may agree in the consent form to allow ATSDR to share de-identified results with other specified entities, as appropriate.

Next, the team in the field administers questionnaires to participants, as needed, to collect exposure data needed to better interpret the results of the sampling. For instance, for an EI where we are measuring blood lead levels, we will ask about the amount of time spent in the yard by a child (if soil contamination is an issue) and hand-to-mouth habits of children. For an EI where we are measuring per- and polyfluoroalkyl substances (PFAS) in environmental samples in homes, we will ask about the participant's use of stain-resistant products and other household items that could contain PFAS.

The administration of a questionnaire prompts the need to first prepare a Paper-work Reduction Act (PRA) package to submit to the Office of Management and Budget to ensure that participation in the EI does not overburden the public and that the time spent participating is appropriate. The PRA package is only applicable if 10 or more participants are included in the EI.

Anaconda Exposure Investigation

In 2018, ATSDR conducted an evaluation of blood lead levels and urine arsenic levels in people living in Anaconda, Montana, a community with past smelting activities. Soils in the city were impacted by the smelting of copper ore in the community. Community members were concerned about exposure to heavy metals as a result of direct contact with impacted soil or exposure to indoor dust.

For lead exposure, ATSDR usually focuses on people who are at the greatest risk for harmful effects: children 6 years, pregnant individuals, and individuals of childbearing age. In Anaconda, older residents also were concerned about exposure because many of them have resided in Anaconda for their entire lives. Therefore, testing for the EI was offered to all Anaconda residents.

A total of 367 residents were tested for lead in blood and arsenic in urine (Figures 2 and 3). Arsenic in urine was speciated to differentiate exposure to inorganic (i.e., might be associated with arsenic in the environment) and organic (i.e., associated with arsenic in seafood) forms of arsenic. ATSDR partnered with U.S. EPA to assist in prioritizing homes for soil remediation as well as remediation inside the home (e.g., attic).

Test results were comparable to the national average reported in the 2015–2016 National Health and Nutrition Examination Survey (Centers for Disease Control and Prevention, 2023). This information was particularly useful to participants, as the results showed no immediate health threats from direct contact with the impacted soil. Additionally, U.S. EPA continued their cleanup efforts to further reduce potential for exposure. A health consultation of the EI was created, which is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, chemical release, or presence of hazardous materials (ATSDR, 2019).

EIs provide ATSDR with data needed to determine how people are exposed to contaminants at a site. Community engagement is critical for planning the EI and for ensuring community concerns are understood and addressed through the EI.

Biography



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References

- Agency for Toxic Substances and Disease Registry. (2019). Health consultation—Exposure investigation: Blood lead and urine arsenic levels, Anaconda Co. Smelter; Anaconda, Montana, https://www.atsdr.cdc.gov/HAC/pha/AnacondaCoSmelter/Anaconda_Co_Smelter_HC-508.pdf
- Centers for Disease Control and Prevention. (2023). National Health and Nutrition Examination Survey, <https://www.cdc.gov/nchs/nhanes/index.htm>



FIGURE 1. The Exposure Investigation (EI) Process

Note. ATSDR = Agency for Toxic Substances and Disease Registry; OMB = Office of Management and Budget.

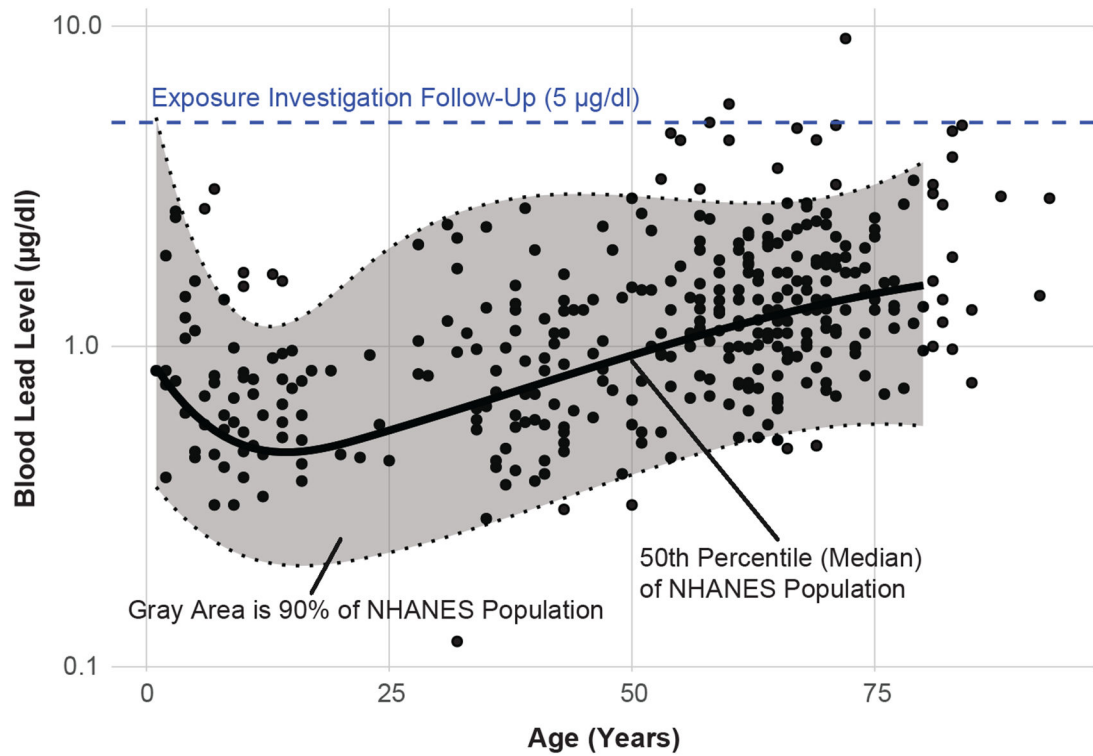


FIGURE 2. Blood Lead Levels by Age in Participants of the 2019 Exposure Investigation in Anaconda, Montana

Source: Agency for Toxic Substances and Disease Registry, 2019.

Note. NHANES = National Health and Nutrition Examination Survey.

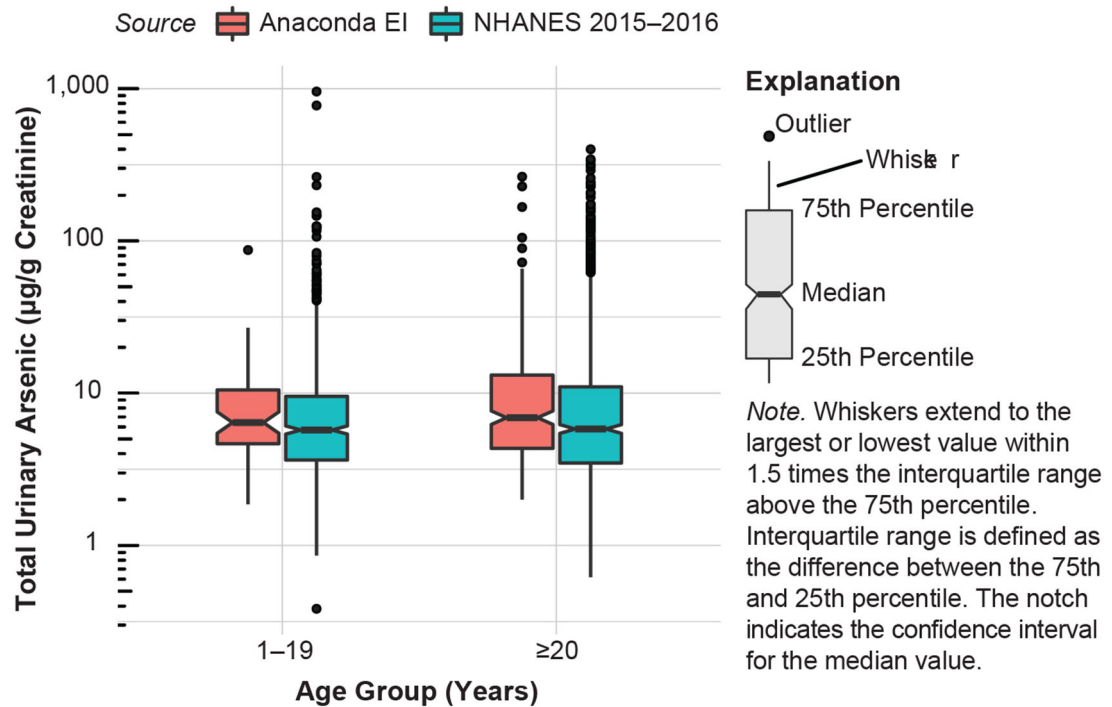


FIGURE 3. Total Urinary Arsenic Levels by Age in Participants of the 2019 Exposure Investigation in Anaconda, Montana

Source: Agency for Toxic Substances and Disease Registry, 2019.

Note. EI = exposure investigation; NHANES = National Health and Nutrition Examination Survey.