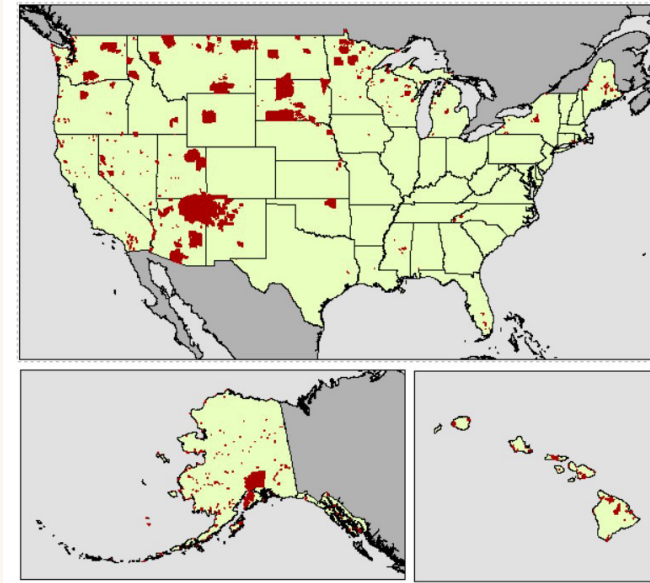




How to Monitor Wastewater Ethically to Benefit Vulnerable Communities

Case Study: WBE in tribal communities

There are 5.4 million American Indians and Alaska Natives in the United States, with 574 distinct tribes communicating in some 130 different languages. Because of historical exploitation and marginalization, public health research among tribal nations can be challenging. Successful application of WBE is possible, however, as an early demonstration study focusing on substance misuse has illustrated (Driver et al. 2022). Unique aspects include tribal autonomy, tribal organization and governance, and unconventional wastewater infrastructure that may necessitate the monitoring of lagoons rather than conventional wastewater treatment plants to assess community health. Tribal buy-in is essential and consent may have to be obtained at multiple levels, e.g., from a Tribal President or Chief as well as from individual Tribal Chapters and Villages, Research Review Boards, and tribal sub-committees.



Notes: Highlighted areas include American Indian reservations, off-reservation trust lands, Alaska Native Villages, and State-designated Tribal areas.

AUTHORS

Rolf U. Halden, Erin M. Driver, Rochelle Holm, and Otakuye Conroy-Ben, Ph.D. *

* Corresponding author information: Sustainable Engineering and the Built Environment Arizona State University otakuye.conroy@asu.edu

During the COVID-19 pandemic, analysis of community wastewater for biomarkers (that is, genetic, chemical, and biological signature compounds) emerged as a powerful public health tool that can save lives. Yet this method of sifting through the human waste communities excrete might appear threatening and invasive to some people and subpopulations (McClary-Gutierrez et al. 2021), particularly those who have been historically exploited by the Western medical and research establishments. Ethical concerns about wastewater-based epidemiology (WBE) include issues of privacy, data sharing, and potential stigmatization of communities or community members (Jacobs et al. 2021; Keeler et al. 2018). Ethical considerations in WBE are particularly important when monitoring the health of vulnerable populations, such as school children; senior citizens; Indigenous people, and communities of color; prisoners; and refugees. Achieving ethical and socially equitable WBE typically requires thoroughly engaging all community leaders and groups with a vested interest in the resulting data and using custom-tailored protocols and reporting procedures. Further, the perspectives of the community being monitored should be considered first and foremost.

Strategies for using WBE to benefit vulnerable populations

When determining whether to implement WBE in a particular setting or among a potentially vulnerable population, visioning exercises and focus groups can be helpful (Keeler et al. 2015). Answering the following questions can help clarify whether to pursue WBE and how to set it up for success:

- / Why are we monitoring wastewater, and who will benefit from it?
- / What are the histories, beliefs, religion, and cultural practices of the communities in which monitoring is envisioned and how can their interests and concerns be acknowledged and addressed?
- / What information will be collect (and what can be considered optional)?
- / Who will have access to the data?
- / Who will be included and excluded in the monitoring given the local infrastructure?

How to Monitor Wastewater Ethically to Benefit Vulnerable Communities

- / Can the information collected potentially lead to marginalization or stigmatization of individuals, groups, or geographic settings?
- / Who are the appropriate entities, diverse communities, and their spokespersons to engage with, and how can a true partnership of equals be created that honors the needs and concerns of all?
- / How will the information be communicated?
- / Can it be delivered in the preferred methods and channels of communication of community members?

Answering these questions is an important first step in engaging and garnering buy-in from key community stakeholders beyond health agencies and public health researchers. Identifying, engaging, and responding to communities and their stakeholders is a time consuming but essential process. The immediacy required from a public health perspective must be carefully weighed and balanced with the need to gain the trust of community members and to fully understand their concerns and motivations. Anticipating and managing these timing issues and other tensions must be understood as an ongoing process that at times will be frustrating to one or more entities engaged in the partnership.

Implementation logistics

Different, marginalized or underserved communities will have varying informational needs and concerns, but the following steps can improve the chances of successfully implementing WBE for vulnerable populations:

- / Determine the interest in and potential benefit of a future WBE campaign. The success and long-term sustainability will be greatest if the community fully supports and demonstrably benefits from the monitoring campaign (Bowes et al. 2022).
- / Secure ample funding to perform the planned activities.
- / Identify and invite stakeholders and spokespersons into a working group to explore the need for focus groups, visioning exercises, and how to avoid or successfully manage potential sensitivities and issues.
- / Determine governance structures and obtain the necessary authorizations (for example, institutional review board review and approval), access to sanitation infrastructure, and data release strategies.

- / Convene a public forum to lay out the project, reporting, and anticipated benefits and risks in plain, accessible language, and invite comments on the planned approaches. Doing so helps to build trust, creates buy-in, and aligns stakeholder expectations.
- / Continuously share updates and documentation on data acquisition, data communication, and public health actions and benefits that might result from WBE activities.
- / List resources and organizations that can help create successful and durable partnerships (for example, the [Centers for Disease Control and Prevention's National Wastewater Surveillance System](#), [OneWaterOneHealth](#), and [AquaVitas](#)).

Avoiding pitfalls

Implementation groups should engage in a constant dialogue with spokespersons from all stakeholder groups to learn about and address potential concerns early on and to enable a sustained, successful public health protection campaign. Challenges to WBE implementation can arise from the following areas:

- / A lack of communication around the intents and purposes of monitoring
- / Biased selection of monitoring sites, resulting in stigmatization of local communities
- / Expanded or increased spatial resolution of the monitoring network and the list of target analytes without explicit consent from stakeholders
- / Lacking, delayed, or selective communication of monitoring data
- / Sharing data with entities that cause community concern (such as law enforcement)
- / Overstating of the informational value of the data collected
- / Lack of effort to translate obtained information into a culturally acceptable and accessible format
- / Lack of strategies and funding to respond to health challenges detected by WBE, leaving communities with threatening information and no way to address it

Conclusion

Implementing a WBE monitoring system for vulnerable communities can be hugely beneficial (Driver et al. 2022) but is not without risk (Jacobs et al 2021; Keeler et al. 2018). Yet, with proper planning, thorough community engagement, and tailored, continuous information exchange between all communities and entities involved, WBE can be implemented and has been demonstrated to protect the health and interests of at-risk populations (Bowes et al. 2021).

References

- Bowes, D.A., E.M. Driver, S. Kraberger, R.S. Fontenele, L.A. Holland, J. Wright, B. Johnston, et al. "Leveraging an established neighbourhood-level, open access wastewater monitoring network to address public health priorities: a population-based study." *The Lancet Microbe*, 2022.
- Driver, E.M., D.A. Bowes, R.U. Halden, and O. Conroy- Ben. "Implementing Wastewater Monitoring on American Indian Reservations to Assess Community Health Indicators." *Science of the Total Environment*, vol. 823, 2022.
- Jacobs, D., T. McDaniel, A. Varsani, R.U. Halden, S. Forrest, and H. Lee. "Wastewater Monitoring Raises Privacy and Ethical Considerations." *IEEE Transactions on Technology and Society*, vol. 2, no. 3, 2021.
- Keeler, L.W., and C. Selin. "The Future of Wastewater Sensing." Tempe, AZ: Center for Nanotechnology in Society, Arizona State University, 2015.
- Keeler, L.W., R.U. Halden, and C. Selin. "The Future of Wastewater Sensing Guide." Tempe, AZ: Center for Nanotechnology in Society, Arizona State University, 2018.
- McClary-Gutierrez, J.S., Z.T. Aanderud, M. Al-faliti, C. Duvallet, R. Gonzalez, J. Guzman, R.H. Holm, et al. "Standardizing Data Reporting in the Research Community to Enhance the Utility of Open Data for SARS-CoV-2 Wastewater Surveillance." *Environmental Science: Water Research & Technology*, vol. 7, 2021, pp. 1545–1551.

Suggested citation: Halden, R.U., E.M. Driver, R. Holm, and O. Conroy- Ben. "How to Monitor Wastewater Ethically to Benefit Vulnerable Communities" Washington, DC: Mathematica, 2022.

Acknowledgements and funding: This brief is based on research funded by The Rockefeller Foundation and was prepared by and with Mathematica. The findings and conclusions contained within are those of the authors and do not necessarily reflect positions or policies of The Rockefeller Foundation.