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Development of a New Framework to Address Public Health Ethical Considerations in Wastewater Surveillance

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Description of need

Wastewater surveillance (WWS) provides valuable information about infectious disease trends in communities. The Centers for Disease Control and Prevention (CDC) created the National Wastewater Surveillance System (NWSS) in 2020 to coordinate and inform WWS programs in state, tribal, local, and territorial (STLT) health departments.¹ As this system grew from eight initial implementing partner jurisdictions to implementers in all 50 states, seven territories, and some tribal communities, so too did ethical questions and a need for clear, shared priorities for the WWS field. Geographic coverage and pathogen testing capabilities expanded quickly over time, emphasizing the need for a standard set of ethical priorities at a national level. These priorities are essential to ensure the responsible use of WWS data for public health action while addressing potential ethical risks. Academic, international, and independent implementers have previously defined ethical priorities and considerations for WWS.^{2–4} This foundation of work also highlighted the need for a practical, applied ethical framework for WWS that incorporates the perspectives of WWS expert groups.

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Framework development

In January 2021, as the program expanded, CDC recognized a need to address ethical concerns raised by WWS, including privacy, stigma, and data stewardship. This recognition, in addition to reports⁴ from a committee of the National Academies of Sciences, Engineering, and Medicine that covered various WWS topics including ethics, informed the development of the framework.

To shape the contents of the framework, from January 2024 to December 2024, ASTHO engaged with the Wastewater Surveillance Centers of Excellence,⁵ the convened Ethical National Wastewater Surveillance-Infectious Disease Workgroup (ENWS-ID Workgroup), and other subject matter experts. As a result of these engagements, the framework includes input from wastewater epidemiologists, infectious disease leaders, academics, utilities and water authorities, tribal health professionals, and individuals from local, state, and federal governments. The framework also incorporates academic literature, technical reports, policy documents, and relevant public health ethics frameworks and guidance. This effort to develop a coordinated, applied ethical framework resulted in a tool that can be used by groups and individuals involved in infectious disease WWS, including utility partners, health departments, academic partners, and policymakers.

Implications and use

Ethical challenges routinely arise in the domain of public health yet public health professionals may not have the tools they need to analyze and address them.⁶ This framework intends to meet that need and to prepare WWS implementers to address ethical challenges as a routine WWS activity. It includes recommendations for strengthening public health ethics infrastructure; it also includes case studies and interactive questioning to help users work through hypothetical problems and apply them to their daily work.

Ethical values central to wastewater surveillance

The Framework for Addressing Ethical Considerations in Infectious Diseases Public Health Wastewater Surveillance⁶ highlights ethical values relevant to WWS shown in Figure 1. The purpose of WWS programs is closely tied to the public health value of WWS, which can include informed public health action, development of WWS tools, representativeness of the system, and integration of WWS with other public health systems. The public health value of WWS may vary geographically and change over time but should remain closely tied to ethical values. These values guide navigation of the routine and more consequential ethical concerns that arise during WWS implementation.

Key areas of ethical concern

Stigma

Stigma occurs when differences or perceived differences between individuals or groups, including disease status, are deemed socially significant and undesirable.⁶ Stigma is an ethical concern in WWS when information is shared that links individuals, groups, or

communities to a socially undesirable disease or condition.⁶ Stigmatized individuals or groups are often marginalized and devalued and can experience discrimination and harm. To mitigate stigma and related harms, WWS program infrastructure should support data protection and bidirectional communication with participating communities. Data and information on WWS efforts can be proactively, positively shared with community members to reduce knowledge gaps that can exacerbate stigma.

Privacy

Privacy is defined as respect for autonomy.⁶ Privacy in WWS is expressed through the protection of contributing communities' sensitive health information.⁶ Wastewater samples and the corresponding data are aggregated, encompassing outputs from multiple sources simultaneously, thereby ensuring that individuals' contributions cannot be discerned at the time of writing. But WWS may be conducted with varying scale (or size of community sampled), including at the facility- or neighborhood-level. At all levels, privacy is an important ethical consideration for WWS, which must be balanced with public health value to ensure that the information collected provides enough detail to inform action.

Data Stewardship

Data stewardship is the responsibility to effectively use and carefully protect data to preserve the interests of a contributing community. Data stewardship in WWS applies to the ethical, regulatory, technical, and practical aspects of data governance and management throughout the data lifecycle.⁶ Data stewardship requires planning and infrastructure (eg, data use agreements) to ensure that data are sufficiently protected and are not used beyond public health purposes. Meaningful and consistent community engagement on data sharing, including with tribal partners, is central to ensuring data stewardship. Proper stewardship of WWS data can ensure privacy and minimize the risk for stigmatization; it can combat function creep and foster trust with communities.

Strengthening an applied public health ethics infrastructure for WWS

This framework offers a tool for WWS implementers to practice applied ethics in public health. Ensuring that ethical values are clear and accessible, while exploring ways to prevent and mitigate issues, can enable every implementer to support a growing public health ethics infrastructure for WWS. Tools such as this framework are only the beginning of ethical infrastructure in WWS. Education for public health ethics expertise, sharing it across disciplines, and research and implementation of applied ethics in WWS will operationalize this framework. Regular revisions and updates to applied ethical tools in WWS will ensure relevance and approachability. Public health ethics approaches can be reviewed by independent ethics advisory groups who can provide additional perspectives over time.

Conclusion

WWS provides critical information that can be used for public health decision making, empowering communities, and informing personal health choices. Public health ethics infrastructure in WWS will help protect privacy, prevent stigma, and ensure proper data

stewardship. Addressing these ethical considerations can help build trust with contributing communities and can facilitate the effective use of wastewater data. Attention to ethical considerations in WWS paired with sustained community engagement throughout the WWS implementation cycle will bolster this growing public health tool. Application of this framework will strengthen the foundation for a public health ethics infrastructure in WWS at the national level.

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FIGURE 1.
Public Health Ethics Values in the Framework for Addressing Ethical Considerations in Infectious Diseases Public Health Wastewater Surveillance.