

Working Meeting on Applications and Methods for Processing Wastewater Surveillance

July 29-30, 2024

UVA Biocomplexity Institute, Charlottesville, VA

Wastewater-based epidemiology (WBE) has shown potential for improving public health decision making during the COVID-19 pandemic. Various states and private entities have developed sampling and sequencing methods to generate robust surveillance streams. Multiple methodological advances have been made to extract relevant information for situation assessment, forecasting, and for informing epidemiological models. Researchers from UVA Biocomplexity Institute (UVA-BI) hosted a two-day working meeting on the current state-of-the-art in WBE with an aim of creating a roadmap of collaborative activities between academics and public health agencies. The workshop was jointly supported by the Council of State and Territorial Epidemiologists (CSTE) and the Virginia Pathogen Genomics Center of Excellence (VA-PGCoE). It was attended by public health epidemiologists from the states of Washington, Delaware, and Tennessee, and researchers at UVA-BI and UVA School of Medicine (UVA-SoM).

The meeting on Day 1 began with a series of presentations from wastewater epidemiologists from the various states, summarizing their ongoing activities and outlining their analytical needs. These included methods for short-term forecasting, scenario projections, as well as for resource allocation. Multiple speakers highlighted the need to think beyond COVID-19, and to port methods for other respiratory illnesses such as seasonal influenza, RSV, for emerging threats such as antimicrobial resistance and HPAI. This was followed by a guided discussion on the use of metagenomics to track evolution of antimicrobial resistance in the UVA hospital and neighboring communities. UVA researchers also presented a complementary study that summarized the relationships between COVID-19 case data and wastewater surveillance from university dorms, highlighting the need to combine clinical, epidemiological, and environmental surveillance streams at high resolutions.

Discussions on Day 2 continued the methodological deep dive into extracting epidemiologically relevant signals from wastewater surveillance. UVA-BI team presented its work with the Virginia Department of Health using statistical correlation and forecasting techniques for WBE. This was followed by overview presentations on using mechanistic models for simulating pathogen shedding and their implications for interpretation, as well as agent-based models and digital twins for predicting outbreaks and creating synthetic datasets. The session concluded with a discussion on optimal design for robust and sustainable wastewater surveillance systems.

Across the sessions, the presentations highlighted success stories from COVID-19 experience, in providing early warning and for tracking variant emergence to informing public health interventions. Participants also acknowledged various challenges including: (a) the need for standardized protocols for sample collection and processing, (b) methodological gaps in advanced analytics and integration with clinical and epidemiological data, and (c) ensuring ethical data collection and analysis, respecting individual privacy.

Overall, the meeting successfully brought together epidemiologists and wastewater researchers to discuss the present and future of wastewater surveillance and facilitated an exchange of knowledge, needs, and potential collaborations. It highlighted the immense potential of wastewater surveillance as a valuable tool for public health beyond COVID-19. Addressing challenges like standardization, data interpretation, and privacy is essential for widespread adoption and impactful application. Open dialogue and collaboration between researchers and public health officials are crucial for developing effective and sustainable wastewater surveillance systems.

Attendees: Ryan Hollingshead (Delaware Health and Social Services), Russell Owens (Tennessee Department of Health), Ian Painter (Washington State Department of Health), Shireen Kotay (UVA-SoM), Amy Mathers (UVA-SoM); UVA-BI participants: Aniruddha Adiga, Jiangzhuo Chen, Baltazar Espinoza, Qijun He, Gursharn Kaur, Bryan Lewis, Srinivas Venkatramanan, Anil Vullikanti, Andrew Warren.

