TESTING AND SCREENING KNOWLEDGE EXCHANGE

SESSION: Wastewater Surveillance

September 27, 2021

Summary

High Level Summary

- The Knowledge Exchange session on Monday September 27 focused on wastewater surveillance, was co-chaired by Tim Singer and Anil Nichani (Director One Health Division, National Microbiology Laboratory) and was attended by 150 participants.

- **NWT** provided an overview of their territorial wastewater surveillance program, how it has been actioned by public health, and plans for expansion.

- Academics at **CHEO/Ottawa University** outlined four uses of wastewater surveillance with examples of application: early detection of outbreaks, population wide surveillance, specific population surveillance and variants of concern detection (VOC).

- **Alberta Precision Laboratory** presented experiences, advantages and challenges of implementing wastewater monitoring in long-term care facilities.

- A rich **roundtable discussion** focused on details of implementation including timing of sampling, relative advantages of different sampling technologies, transportation of sampling, and the role of wastewater surveillance for VOC detection.

Detailed Summary

- The forum included 150 participants, was co-chaired by Tim Singer and Anil Nichani (Director One Health Division, National Microbiology Laboratory) and focused on Wastewater Surveillance. Representatives from the Northwest Territories, University of Ottawa, Children's Hospital of Eastern Ontario Research Institute and Alberta Precision Laboratory provided insights.

- **The Northwest Territories (NWT)** has a large and diverse area of 33 communities with only one mechanical treatment plant in Fort Simpson. The vast majority of their wastewater treatment is lagoon wetland with smaller communities relying on trucked collection. NWT started their wastewater surveillance over a year ago and has experimented with different sampling approaches to fit their diverse wastewater systems including grab samples (initial approach in lagoons and trucks), auto samplers, and passive samples using tampon dumps and COSCa balls (used for trucks and manholes outside schools and shoots discharged into lagoons). NWT collected samples in nine different communities, which represents approximately 68% of the NWT population. Initial analysis of samples was performed by NML with a time lag of ~6-7 days from collection. NWT engaged Taiga Lab (NWT owned environmental lab) which created a biology lab space in Fall 2020. In March 2021, Taiga Lab began wastewater sampling analysis with GeneExpert. They are able to run 5 samples within a two-hour timeframe. Taiga Lab currently processes ~50 samples/week on GeneXpert and ~40 on qPCR machines. Positive results are sent to NML for validation. NWT has a public facing dashboard that is updated daily.

  NWT provided three case studies where the territory acted on wastewater surveillance results that covered a high proportion of the population: Yellowknife, Normal Wells and Behchoq. In

Summary

Yellowknife, a wastewater signal resulted in a request for recent travellers to test and the identification of a 6-person cluster. In both Normal Wells and Behchoq, wastewater surveillance did not identify an outbreak but was used to inform when to ramp up and down case finding. Wastewater signals in all three cases allowed for informed ongoing case findings but missed early outbreak detection.

The NWT emphasized the importance of working collaboratively with their partners and remaining flexible in order to be responsive to new information.

- Presenters from **Ottawa University and The Children's Hospital of Eastern Ontario Research Institute** were one of the first groups to establish wastewater surveillance in Canada. They identified an ongoing wastewater surveillance challenge as the impact of variation in wastewater infrastructure and related variables (e.g. weather) on results. Other challenges include developing standards (including what is a representative sample) and understanding the impact of viral shedding and demographics on results.

  Presenters identified four uses for wastewater surveillance:
  - **Early detection of outbreaks:** In one example, the University of Windsor identified asymptomatic individuals living in residence that were relocated and quarantined thereby averting transmission. In another example, a long-term care facility in Hamilton was able to detect an elevated signal ten days prior to a declared outbreak.
  - **Population-wide surveillance:** the Ottawa group collected 14 months of data in Ottawa from 910,000 people connected to one wastewater treatment plan. They observed good correlation between wastewater signals and clinical test results with the wastewater signal acting as an early warning signal. In December, wastewater surveillance data was cited by the province as a reason to implement a shutdown.
  - **Specific population surveillance and early detection of surges in vulnerable neighborhoods** (not discussed in detail due to time constraints)
  - **Variants of concern**: The group has been able to detect 99% of variants in Ottawa's wastewater and the city uses wastewater and clinical data for triangulation purposes to provide a comprehensive picture of COVID-19 in the city. In addition, wastewater variant of concern data is available with a shorter turnaround time than clinical data, providing an earlier warning signal (e.g. when Delta was on the rise in July). Existing assays can quantify the proportion of a variant of concern in the wastewater signal. The Ottawa group was able to identify both the Alpha and Delta variants early on. Metagenomic variant of concern data is shared frequently with the group and can be used to help detect new and emerging variants.

- **Alberta Precision Laboratory** presented their lessons learned, experiences and challenges from the implementation of monitoring COVID-19 in sewage collected from long-term care facility (LTCF) manholes in Edmonton. Several groups have collaborated on this work including Alberta Health, Alberta Environment, and the Canada Water Network.

Summary

Alberta Precision Laboratory received an order to study early warning to prevent COVID outbreaks in LTCF by monitoring in the sewage. The study focused on two major components: the utility and feasibility of the site-specific sewage surveillance of COVID-19 as an early warning system for outbreaks in LTCF's in Edmonton and the antibody response to COVID-19 among the staff and residents of the LTCF's by history, infection and vaccination (not discussed in this presentation). The study involves 10 LTCF in Edmonton, started in January 2021 and is ongoing. Recruitment was based on several criteria including single point of sewage access and history of confirmed COVID-19 outbreaks (sites selected for variety). During the study, seven out of the ten facilities experienced outbreaks, each with a different positivity rate.

A protocol for the study is publicly available. It used real time qPCR analysis based on grab samples. Wastewater was sampled for each site twice weekly. Positive results connected to no known recent or active COVID-19 cases caused the Ministry of Health to initiate an outbreak investigation. Positive results during an outbreak were used to increase investigations in the case of an increasing signal. Positive signals correlated relatively well with COVID-19 waves in Edmonton. Not all positive wastewater signals led to the identification of a COVID-19 case in residents (may have been a visitor).

Some advantages of this wastewater surveillance study was the identification of asymptomatic infections and the monitoring outbreaks. Surveillance ensured there was no interruption to routine work and the approach is non-invasive.

Limitations included discrepancies between clinical and wastewater surveillance results. Potential causes included less frequent sampling, a high percentage of diapered individuals, and visitors contributing to a positive sample. In addition, technical challenges to sample collection were observed, particularly in the winter. Communication challenges occasionally occurred with LTC staff that would have aided in triangulation of clinical and wastewater results.

- A rich **roundtable discussion** focused on details of implementation including timing of sampling, relative advantages of different sampling technologies, transportation of sampling, and the role of wastewater surveillance for VOC detection.