Canadian Water Network

Canadian Wastewater Surveillance – Where are We Now? COVID-19 Wastewater Coalition

Dr. Steve E. Hrudey
Chair, National Research Advisory Group, CWN
CanCOVID Speaker Series, October 20, 2020

Canada's COVID-19 Wastewater Coalition

Presentation Outline (Note: Dr. Dominic Frigon June 9, 2020 CanCOVID presentation)

- The COVID-19 Wastewater Coalition
- Expert Advisory Groups
- Wastewater surveillance for SARS-CoV-2
- Inter-Lab methods validation
- Some Canadian wastewater monitoring results
- Ethics and communication guidance
- Summary

cwn-rce.ca/covid-19-wastewater-coalition

- The Canadian Coalition seeks to assess **what** is needed and **how** reliable use of wastewater-based epidemiology can inform public health decision-making for dealing with the COVID-19 pandemic
- Researchers, water utility and public heath authority members were invited to sign on to the Principles of the Coalition

Coalition signatories

Participants who have signed on and agreed to abide by the Guiding Principles when conducting activities that relate to the COVID-19 Wastewater Coalition:

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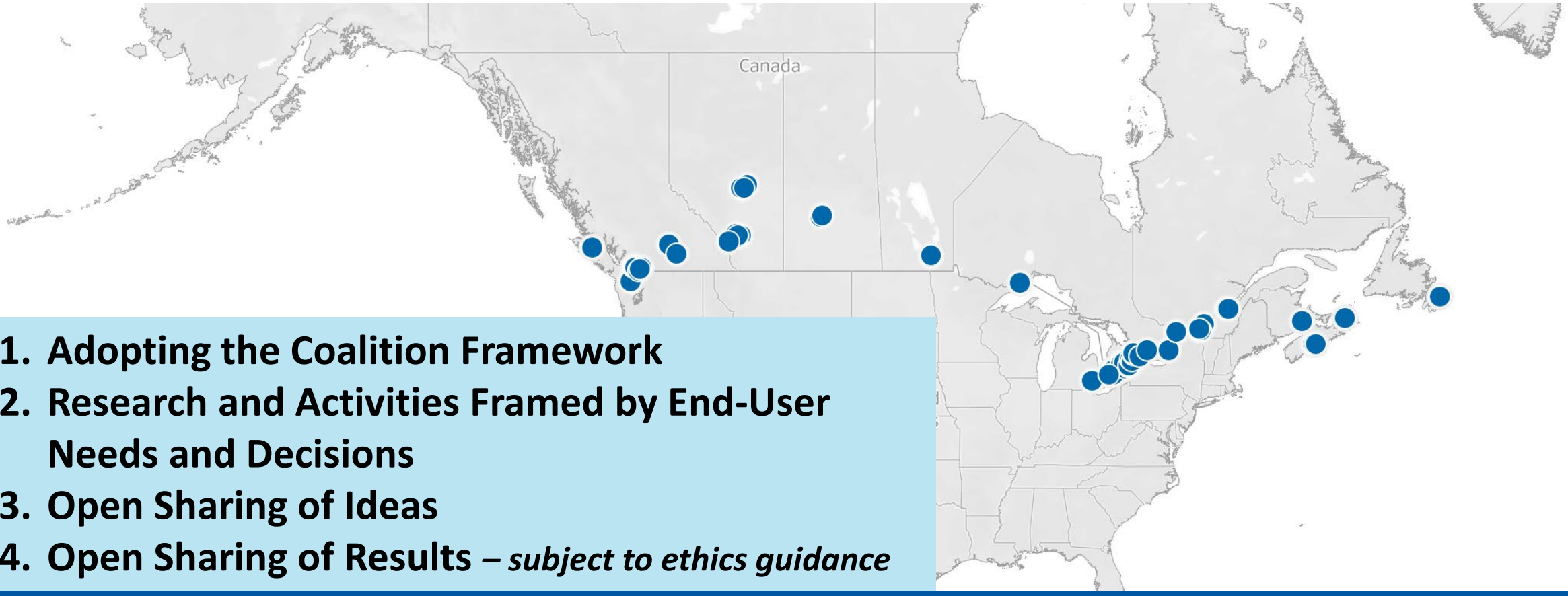


1. **Adopting the Coalition Framework**
2. **Research and Activities Framed by End-User Needs and Decisions**
3. **Open Sharing of Ideas**
4. **Open Sharing of Results** – ***subject to ethics guidance***

National Research Advisory Group

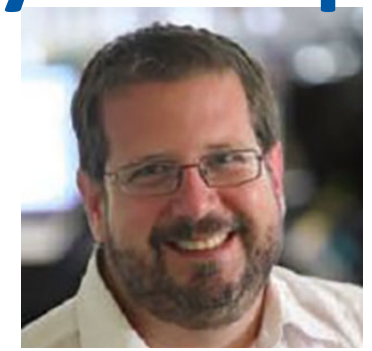
Advisory Group Chair

Dr. Steve E. Hrudey

Dr. Nicholas Ashbolt

Dr. Robert Delatolla

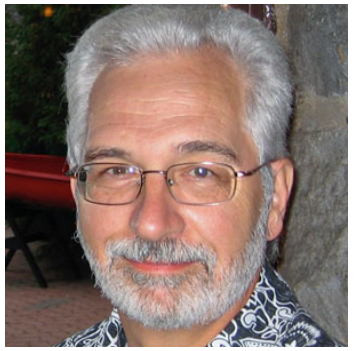
Dr. Sarah Dorner



Dr. Dominic Frigon

Dr. Graham Gagnon

Dr. John Giesy



Dr. Pierre Payment

Dr. Natalie Prystajecky

Dr. Mark Servos

Dr. Peter Vanrolleghem

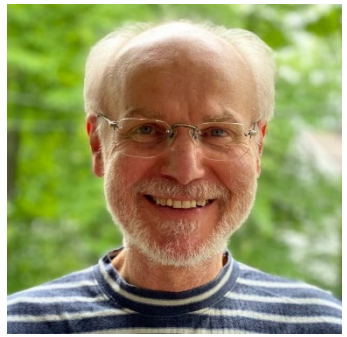
Dr. Viviane Yargeau

Public Health Advisory Group

Dr. André Corriveau

Dr. Steve E. Hrudey

Dr. Judith Isaac-Renton



Dr. Patrick Levallois

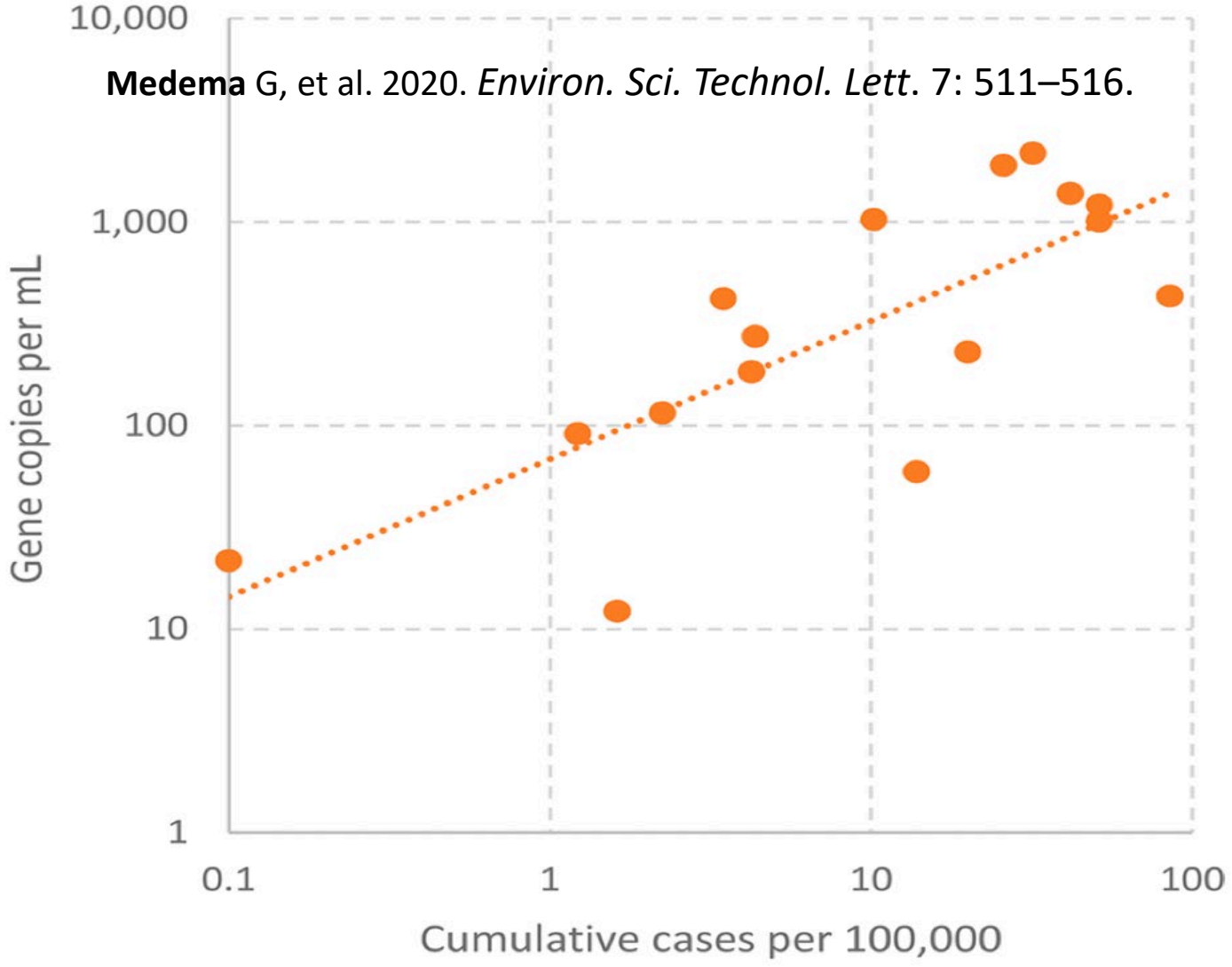
Dr. Wendy Pons

Dr. Jacob Shelley

Dr. Diego Silva

Dr. James Talbot

First Reports of Successful Wastewater Monitoring



Medema G, et al. 2020. *Environ. Sci. Technol. Lett*. 7: 511–516.

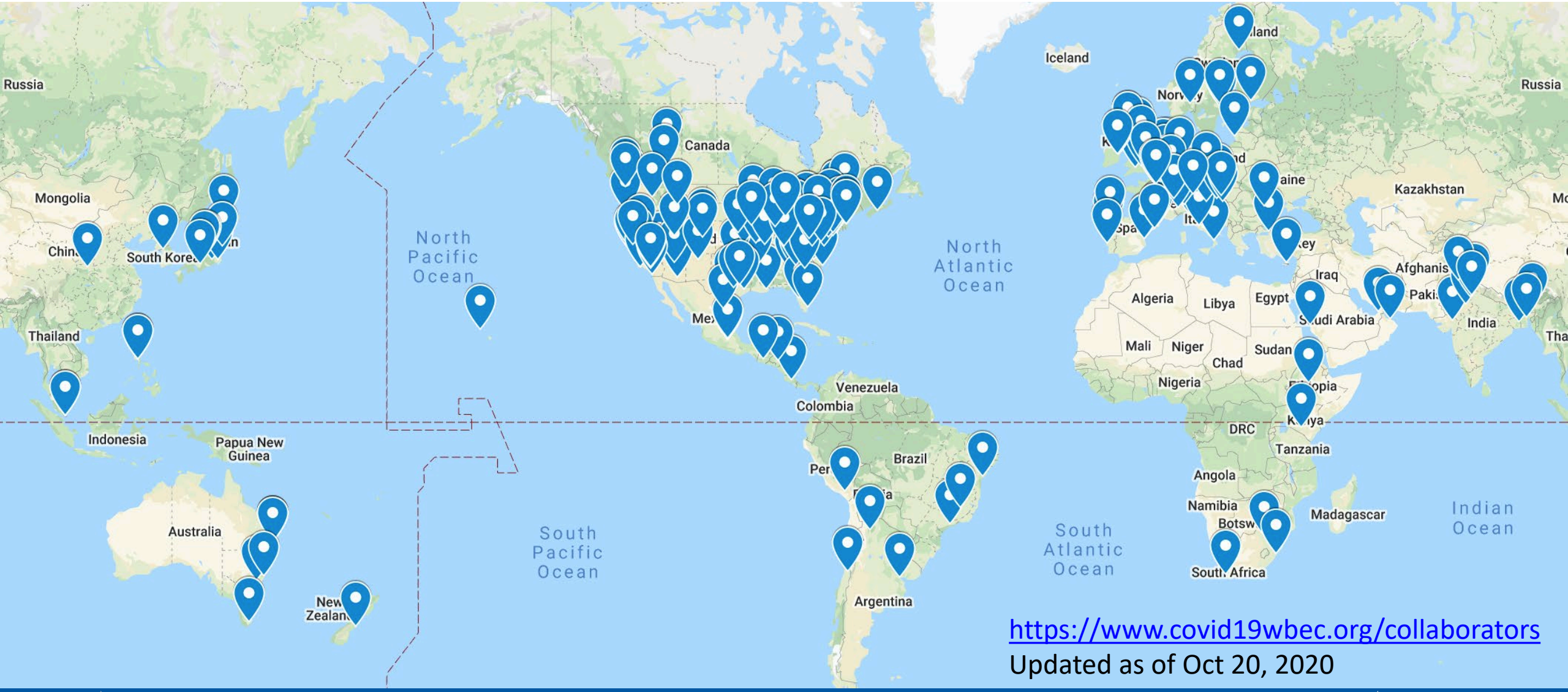
SARS-CoV-2 indicators in sewage appear to:

- Be detectable
- Track COVID cases
- Provide up to a 1 week of advance warning
- Offer considerable promise

Many technical details and questions remain to be answered for confident application to decision-making

Medema G, et al. 2020. *Current Opinion in Environ Sci & Health*, https://doi.org/10.1016/j.coesh.2020.09.006

Proliferation of Wastewater SARS-CoV-2 Monitoring Activities



https://www.covid19wbec.org/collaborators

Updated as of Oct 20, 2020

Potential of SARS-CoV-2 wastewater surveillance

- SARS-CoV-2 is shed in faeces by asymptomatic and symptomatic individuals
- Sewage potentially provides an efficient pooled sample of community or institutional disease prevalence
- Evidence of an ability to detect low levels of community infection (as low as a few cases/100,000) up to a week prior to when clinical cases are detected and reported
- Potential to help support epidemiology / surveillance and potentially improve early-warning that is critical to controlling asymptotic spread
- Focus on “trends” analysis and early warning for higher risk institutions

COVID-19 Wastewater Coalition
Key focus and activities

- Establish and validate a **consensus** sampling and analysis method
- Identify capacity/opportunity in Canada
- Inform how wastewater epidemiology / surveillance programs can effectively inform Public Health Decisions
- **Recognize that bad data is worse than no data – "*under-sell & over-deliver*"**
- Foster collaboration and knowledge exchange
- Identify and encourage promising new approaches

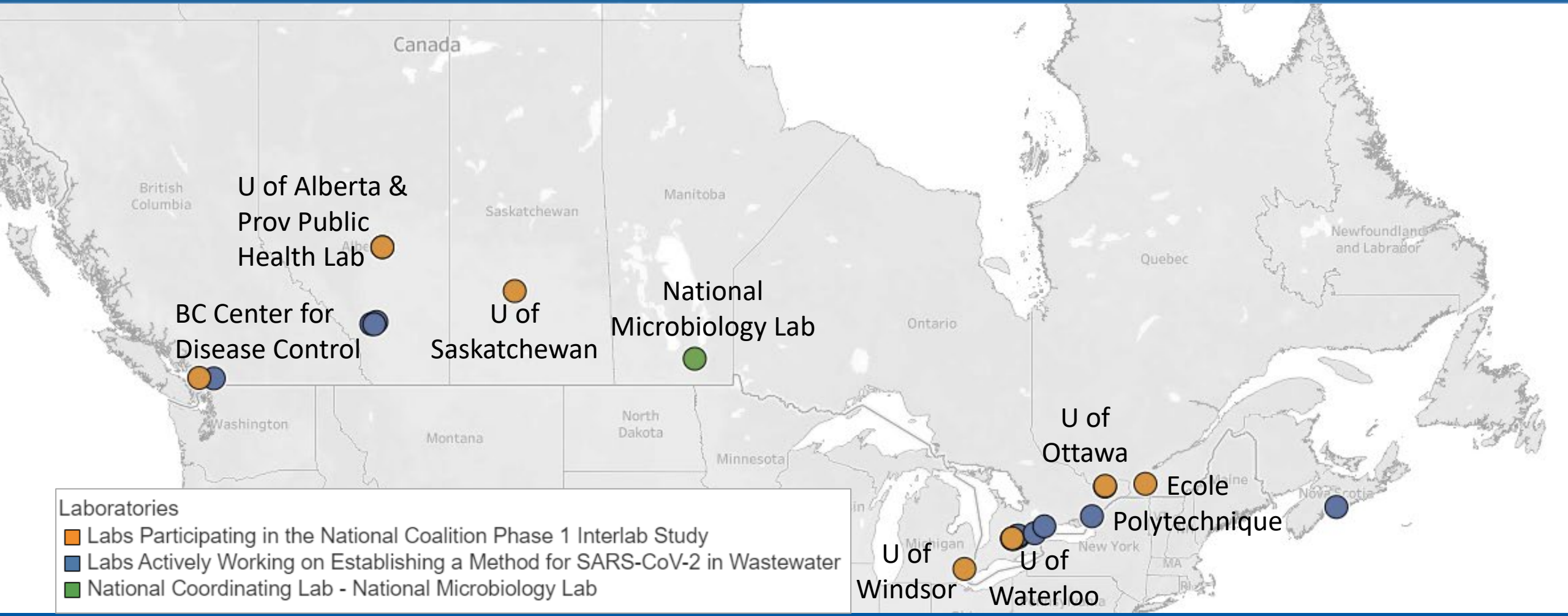
Wastewater Sampling & Analysis for SARS-CoV-2 is Challenging

This is still emerging science / practice

Application is not just a tweak/pivot from clinical or environmental analysis for the application of qPCR (very different from clinical sampling, or even freshwater environmental samples)

- Sample processing – **phase partitioning** – water vs. solids?
- Results must not just be **presence/absence** like most clinical sampling but **needs** to be **quantitative** to detect trends
- Wastewater **matrix is challenging,** making effective QA/QC critical

COVID-19 Wastewater Coalition: Phase 1 Inter-lab Pilot Study and Labs Developing Methods in Canada



Phase 1 Inter-Laboratory Study

- Characterize the inter- and intra- laboratory variability associated with results emanating from the testing of SARS-CoV-2 using RT-qPCR after extraction from a common wastewater matrix.
- **Biases between protocols** are likely attributable to the method of **sample pre-treatment** of the wastewater sample collected, in addition to possible indirect impacts due to the presence of inhibitors during RT-qPCR amplification of targets
- Recognize the diversity of protocols – leverage existing expertise and capacity

Phase 1 Inter-Laboratory Study

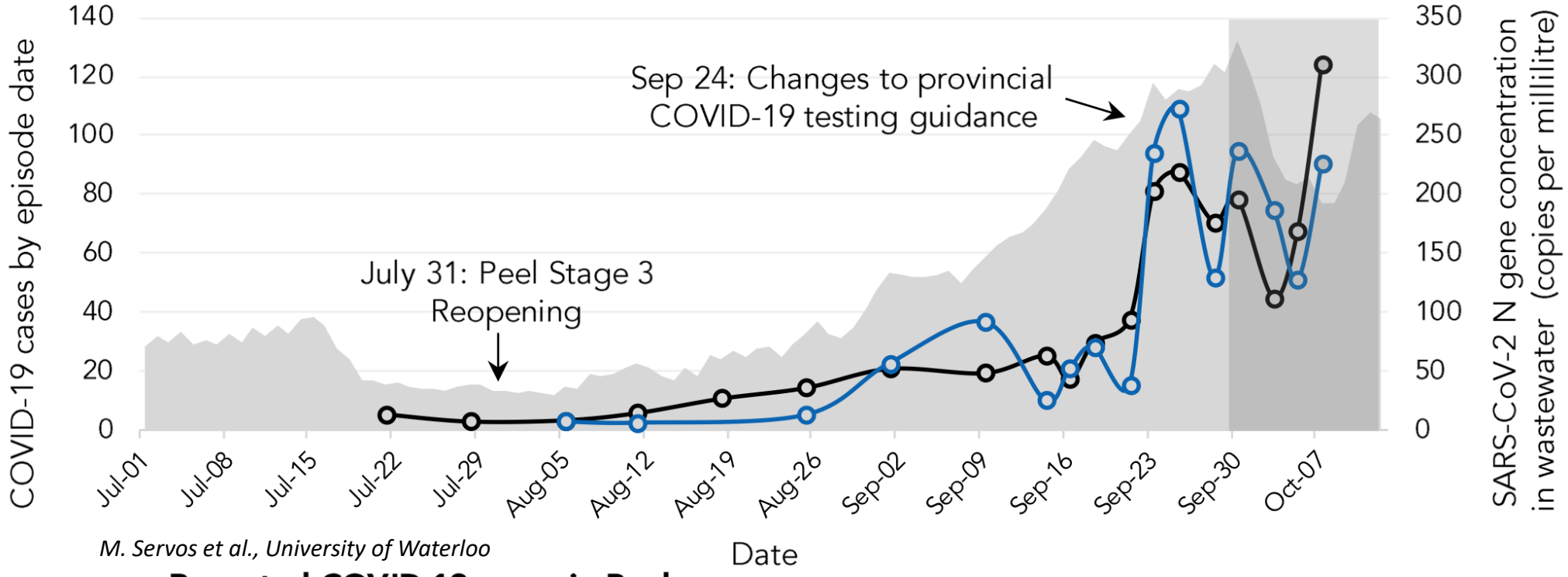
- A national standard method is **not** feasible in the foreseeable future
- Engage a cross-section of public health and research laboratories across Canada
- Most variability believed to be attributable to the method of wastewater sample preparation (concentration step) rather than nucleic acid extraction or PCR detection and quantification steps
- Most approaches currently used in Canada either rely on chemical precipitation **or** ultracentrifugation for wastewater sample preparation
- Seek to answer: **Can the various methods used by laboratories across Canada reliably detect and quantify SARS-CoV-2 in wastewater to support establishing trends?**

Phase 1 Inter-Laboratory Study Preliminary Results

- Concentration estimates for known spikes across labs were generally consistent (at most an order of magnitude different)
- Spiked surrogates detected in both solids and liquid phases (for methods that separated and quantified both, but phase partitioning IS an issue)
- Need to clarify - **IF** and how PCR inhibition was handled / addressed between laboratories should be clear and consistent
- Need to clarify how standard curves are derived when comparing and interpreting results
- **Final study report** is under review and will be forthcoming shortly

Ontario Suburban Community Monitoring

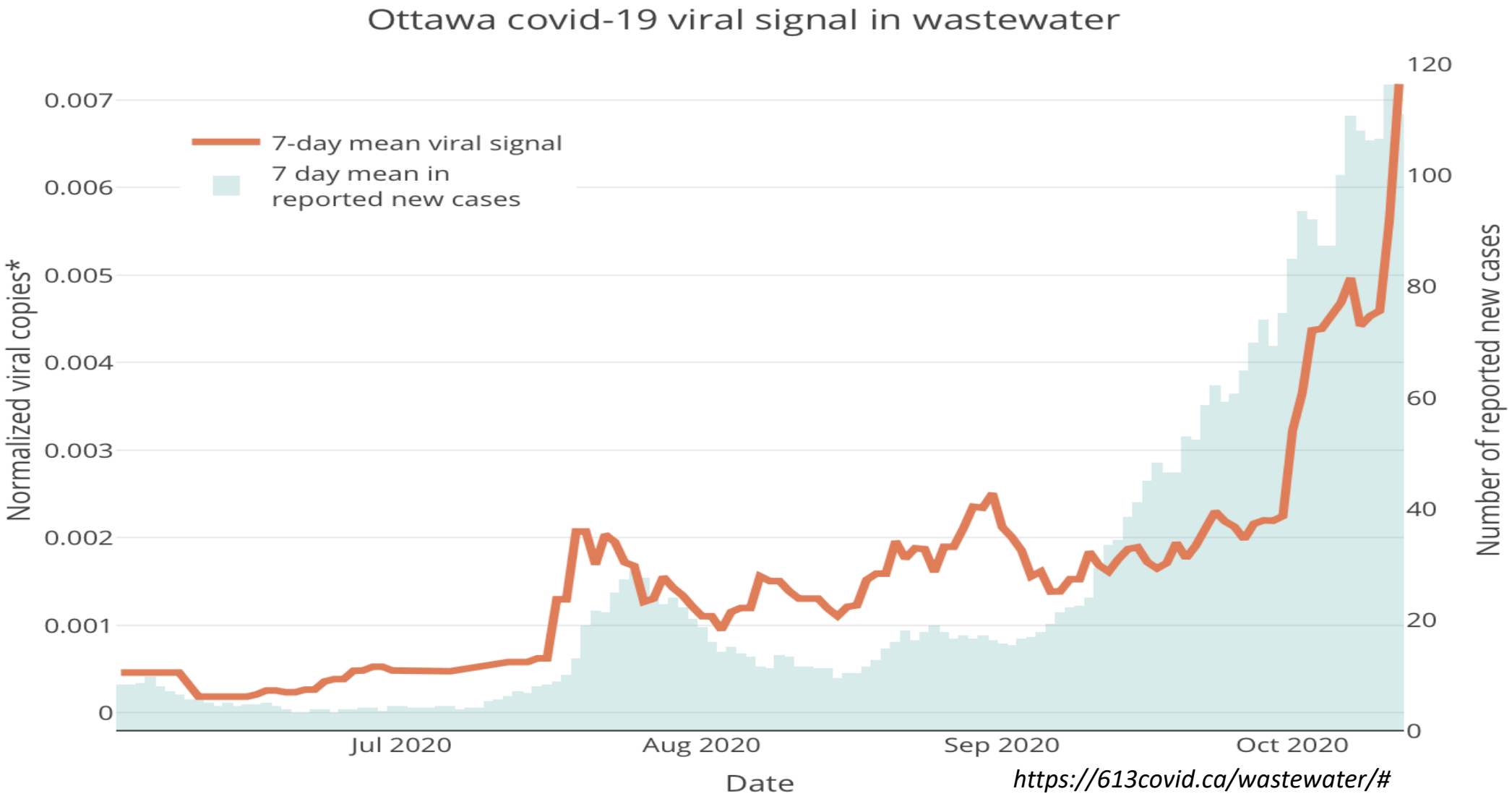
Figure 6. COVID-19 cases in Peel and concentration of SARS-CoV-2 virus detected in untreated wastewater: July 1, 2020 to October 12, 2020



M. Servos et al., University of Waterloo

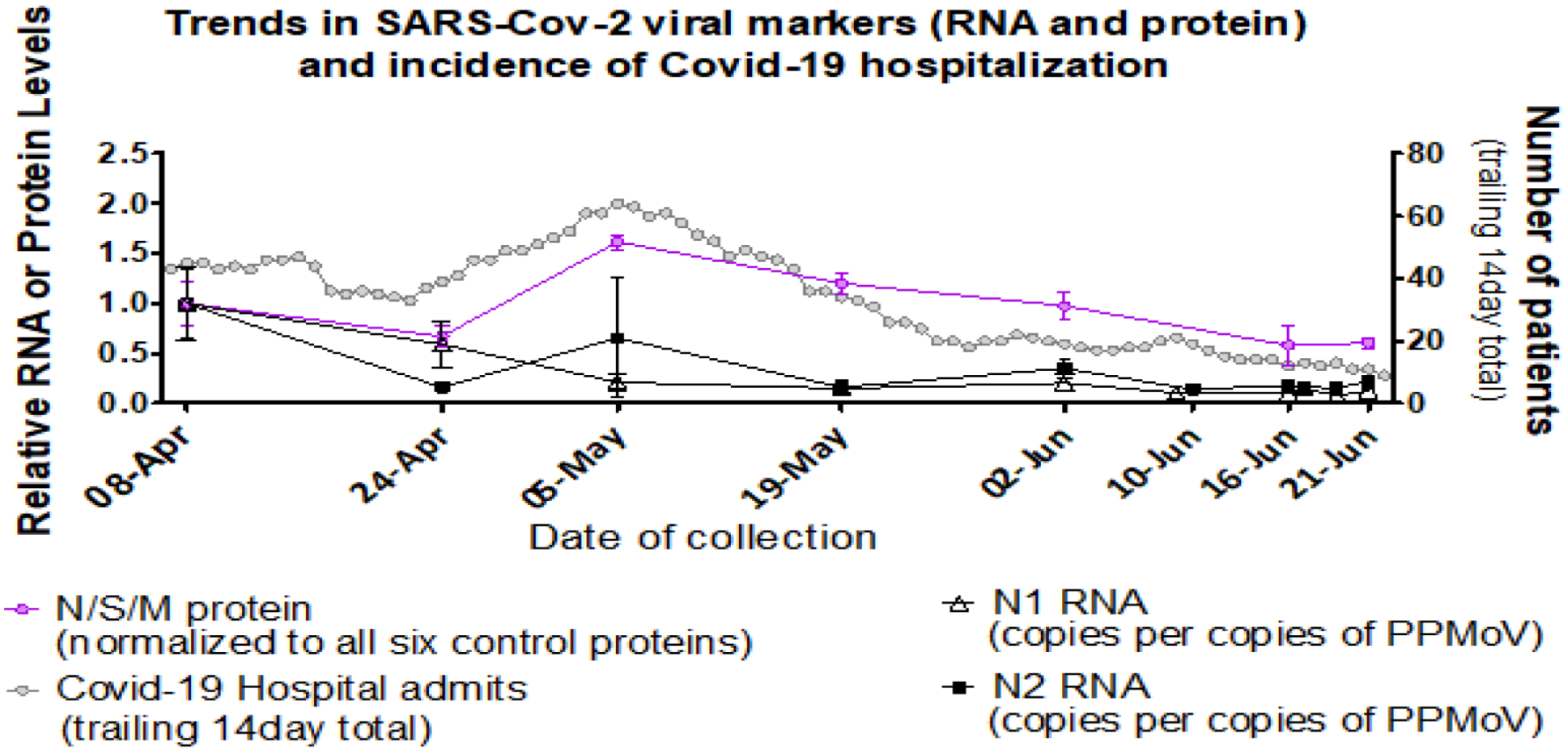
https://www.peelregion.ca/health-professionals/covid-19/pdf/epi-update-2020-10-16.pdf

Ontario Urban Community Monitoring



https://613covid.ca/wastewater/#

SARS-CoV-2 Protein Monitoring



Neault et al. 2020. SARS-CoV-2 Protein in Wastewater Mirrors COVID-19 Prevalence. https://doi.org/10.1101/2020.09.01.20185280doi: *medRxiv*

Ethics and Communications Guidance

- Wastewater monitoring for signals of SARS-CoV-2 is an application of public health surveillance and requires appropriate ethical guidance.

- The purpose is to inform public health decision-making for the protection of public health - that requires **public trust** to be effective and trust can be lost **IF** ethical guidance is not considered.

- This requires collaboration between investigators and public health decision-makers. Most academic investigators may not be familiar with the ethical obligations for such public health evidence

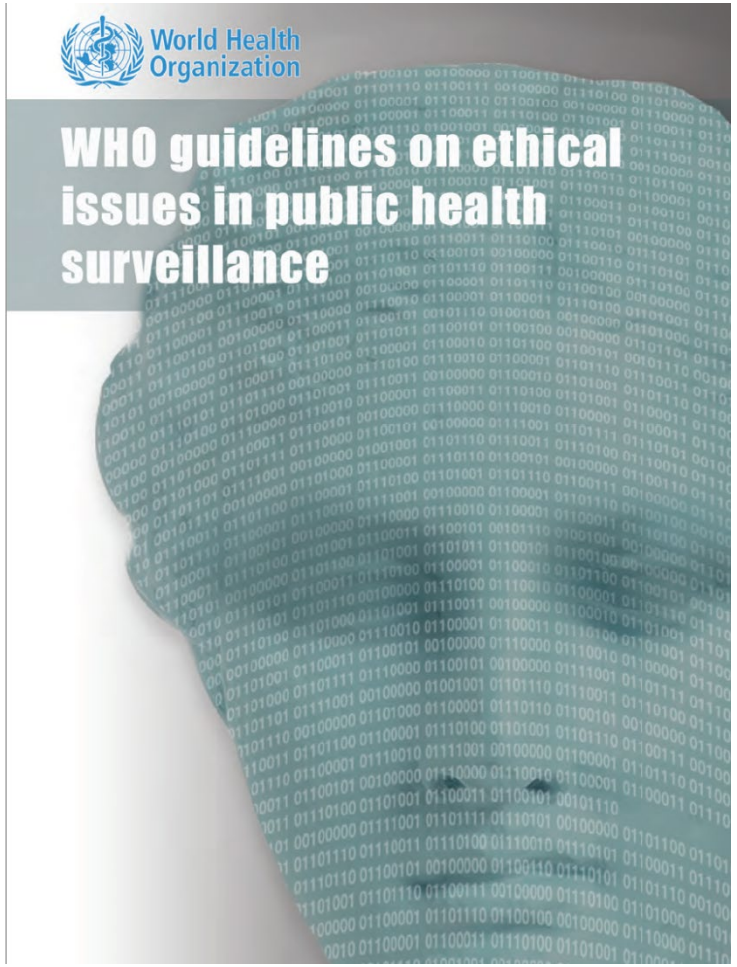
Ethics and Communications Guidance

- Wastewater monitoring has the potential to identify groups of individuals, making it sensitive, human health-related information.
- Public health surveillance involves balancing individual rights and freedoms with population interests requiring difficult choices.
- Articulate what to consider and weigh when making decisions about planning, implementing and using data from wastewater surveillance, and in communicating findings related to public health.

Ethics and Communications Guidance

- WHO (2017) guidelines on ethical issues in public health surveillance
- We found that 12 out of the 17 WHO guidelines applied directly to wastewater surveillance for SARS-CoV-2
- CWN guidance document elaborates how those 12 WHO guidelines apply to wastewater surveillance for SARS-CoV-2

https://cwn-rce.ca/wp-content/uploads/COVID19-Wastewater-Coalition-Ethics-and-Communications-Guidance-v4-Sept-2020.pdf



Summary

- Wastewater surveillance for SARS-CoV-2 offers clear promise as an additional source of insight for informing public health decision-making
- Emphasis on data quality is essential to underpin any reliance on wastewater surveillance data for public health decision-making
- Many aspects of wastewater surveillance quantitative data remain to be clarified and better understood
- Ability of wastewater surveillance to provide effective early warning is a key question is under evaluation

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