## RELEVANCE AND EXPECTED OUTCOMES

Goals, Outcomes and Impacts

Following the first wave of the COVID-19 outbreak in Canada, provincial authorities are currently relaxing lockdown restrictions of various institutions and types of social gathering. Policies to mitigate the spread of COVID-19 are based on the state and forecast of SARS-CoV-2 infection prevalence, using various models and more or less granular population data. Current models mostly exploit COVID-19 clinical test results, hospital admissions, and deaths. However, the COVID-19 clinical test results only react with a delay of two to five days after a patient is infected and contagious. Moreover, tested people are mostly symptomatic, thus not accounting for the whole population that is known to exhibit a large fraction of asymptomatic SARS-CoV-2 carriers.

SARS-CoV-2 RNA has been proven present in the stool of COVID-19 patients and has been detected successfully in wastewater around the world. In Connecticut, SARS-CoV-2 RNA titers were shown to follow the evolution of positive COVID-19 tests but were preceding those numbers by 7 days[1], which demonstrates the incredible potential that wastewater-based epidemiology (WBE) of COVID-19 offers.

Detection of viral RNA in wastewater has been around for many years, but work remains to translate RNA signals into actual numbers and forecast infection prevalence in the population connected to the wastewater treatment plant (WWTP)[2]. Progress in standardisation of experimental methods is very fast and expected to soon deliver results (Canadian COVID-19 Wastewater Coalition). Thus, excellent viral signal data will become available in the coming months to feed WBE throughout Canada. However, using the results of such surveillance to manage a pandemic is unprecedented and a number of model-methodological hurdles need to be solved first. The goal of this project is to improve current wastewater-based SARS-CoV-2 epidemiology in order to

i) support ongoing efforts to better understand and forecast COVID-19 prevalence in the Canadian population for subsequent waves of the pandemic;
ii) develop new modelling techniques that will benefit from quality-controlled and comparable data and exploit state-of-the-art WBE and machine learning (ML) techniques that through combination will improve and create a new generation of WBE models.
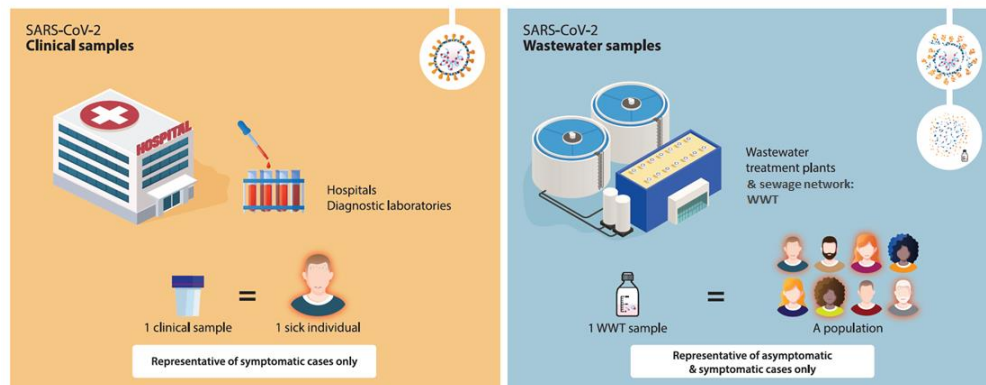
Principle of Wastewater-based Epidemiology (right) to complement traditional epidemiological studies (left).[2]

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[1] Peccia et al. (2020) SARS-CoV-2 RNA concentrations in primary municipal sewage sludge as a leading indicator of COVID-19 outbreak dynamics. medRxiv DOI: 10.1101/2020.05.19.20105999.

[2] Hill et al. (2020) SARS-CoV-2 known and unknowns, implications for the water sector and WBE to support national responses worldwide: Early review of global experiences with the COVID-19 pandemic. DOI: 10.2166/wqrj.2020.100.