Te Niwha

Research Project Impact Case Study

Making use of wastewater from aircraft and individual buildings for better infectious disease epidemiology and response

Wastewater Testing at the Border & Building

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Introduction

Testing of sewage for the presence of infectious disease, known as wastewater-based epidemiology (WBE), is a powerful tool for assessing disease burden in communities without the need for individualised testing. It allows for cost-effective, non-invasive and unbiased disease screening of whole communities, and can be deployed in areas traditionally underserved by healthcare surveillance. New Zealand has been conducting wastewater-based surveillance for the presence of COVID-19 since early 2020 and have recently extended this work to detect other pathogens such as polio virus, respiratory syncytial virus (RSV) and influenza virus. While the implementation of WBE in large communities, in Aotearoa and internationally, has been well established in the last three years, much less focus has been placed on local-scale WBE, such as at the level of sampling individual buildings or aircraft arriving at the border. This is a key gap in our pandemic preparedness because it is now well established that wastewater testing can play a hugely important role in monitoring for current and emerging disease threats. This impact case study describes the establishment of methodology for testing of aircraft, and for buildings such as hospitals.

Results

Methodology has been established for sampling of individual aircraft, and for the collection of wastewater at the scale of the airport precinct. For aircraft a specially designed sampler is attached to the aircraft at the point of wastewater discharge to the toilet truck. Toilet truck operators are able to collect samples during routine emptying of the aircraft. Within a single morning 20 aircraft could be sampled. Analysis was performed on composite samples representing aircraft from a particular region, or all aircraft on a particular day, as well as individual aircraft. For hospitals small battery operated autosamplers were deployed into manholes, together with a low-cost flow monitoring device. Passive samplers were also deployed, and 24-hour composite samples collected.

SARS-CoV-2 could not only be detected, but variants sequenced. In addition a range of bacteria, viruses and fungi were identified in the wastewater using quantitative PCR and sequencing. Sampling on smaller scales is more sensitive and allows separation of inputs from environmental and industrial sources.

Impact

During COVID there were a number of calls for testing of aircraft and of building such as hospitals. These requests were not able to be meet due to a lack of any mechanism for collecting samples, and uncertainty over how these samples should be processed, and what organisms could be detected. We have solved those problems, demonstrating that wastewater can be used to detect a wide range of bacteria, protozoa, viruses and fungi of potential health concern.