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.

The objectives of this project were to establish methodology for testing of aircraft, and for buildings such as hospitals, and to explore Māori views on wastewater testing and investigating the ethical, social, and practical risks and benefits of WBE at various scales, fostering a true tūhonotanga (connection/ relationship) around its future use.

Results

Researchers engaged with Te Kei o te Waka o Tainui to understand views of local iwi regarding wastewater analysis. During wananga key issues identified included the need to build trust, need for consent, sharing of knowledge, Māori as health communicators, and appropriate tikanga. When wastewater is tested it becomes knowledge which should be treated as if that knowledge has been gained directly from the community.

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. 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 collected at various scales in Aotearoa and used to detect a wide range of bacteria, protozoa, viruses and fungi of potential health concern. We have also established a framework for the use of wastewater testing that is not only respectful of indigenous views, but is able to leverage Māori networks to ensure maximum benefits and appropriate use of the knowledge generated.