Te Niwha Scholarship Summary for Final Report

Investigating the impact of water outages on enteric disease in Aotearoa.

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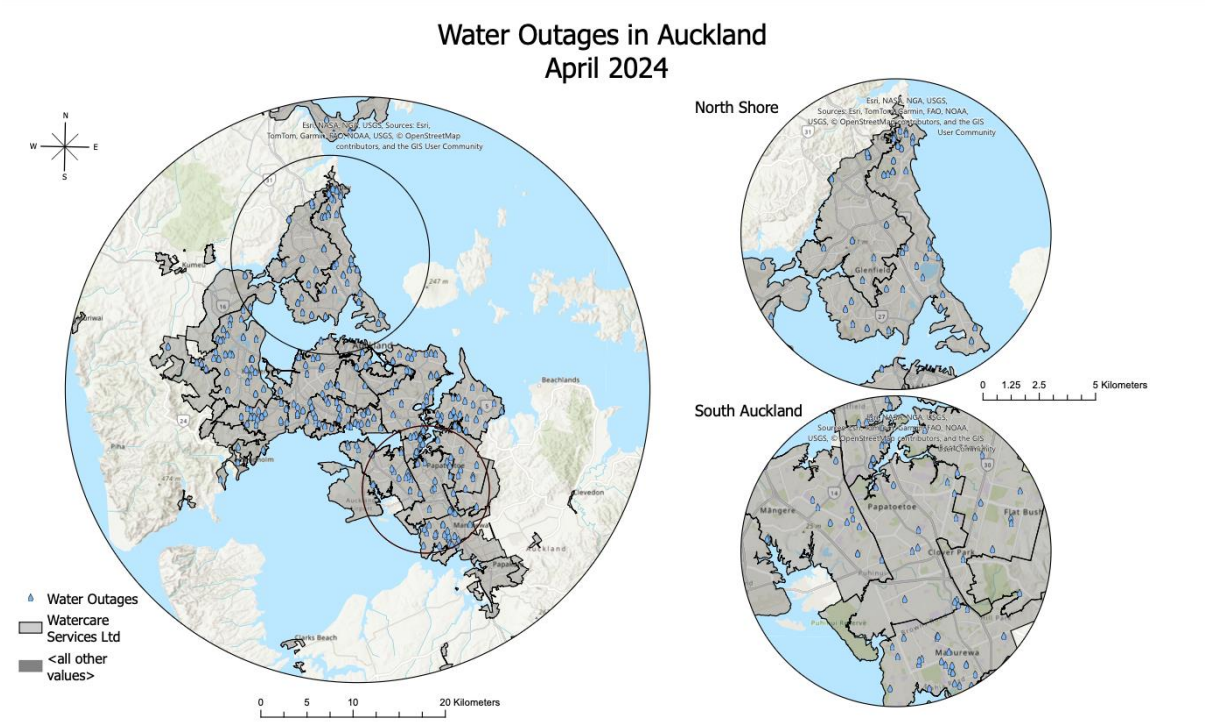
Access to safe drinking water is one of the cornerstones of public health, yet in Aotearoa New Zealand our drinking water networks face increasing challenges[1]. Ageing pipes, frequent outages, and a large infrastructure deficit all raise the risk that microbes can enter the system and cause illness[2] [3]. International studies have shown that interruptions in water supply can allow bacteria and viruses to intrude into the network, but until now there has been little evidence on how often this happens in New Zealand, and what it means for community health[4]. This project set out to address that gap.

The focus of the research has been on enteric diseases, illnesses that affect the gut such as campylobacteriosis, salmonellosis, giardiasis, and cryptosporidiosis. These conditions are common, can cause severe symptoms, and are often linked to contaminated food or water. The project aimed to investigate whether drinking water outages increase the risk of such diseases. We did this by combining two large data sources: water outage records from councils and the national disease notifications from the Institute of Environmental Science and Research (ESR) now PHF.

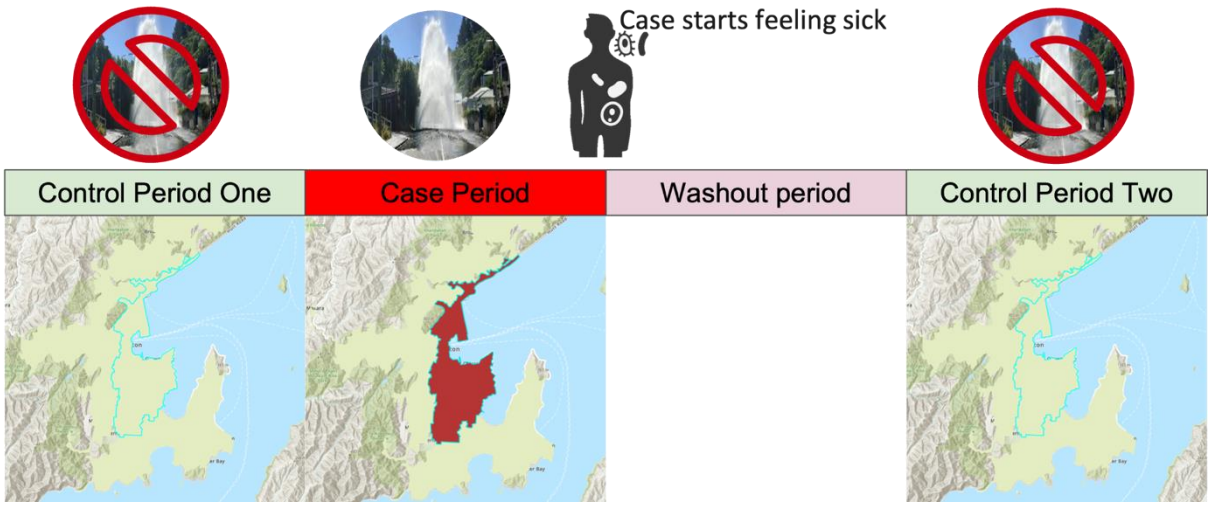
Collecting the outage data was a major undertaking. Through official information requests, records were obtained from 55 of the 67 councils across the country, amounting to more than 110,000 individual outages covering nearly six years on average per council, which required substantial data cleansing due to heterogeneity in council records. In parallel, 25 years of enteric disease notification data was received and linked to a water distribution zone[5].

[1] United Nations General Assembly., 2015
[2] Water Industry Commission for Scotland., 2021
[3] Ball et al., 2006
[4] Ercumen et al., 2014
[5] Puente-Sierra et al., 2023



Water Distribution Zone data created by Geo Health Lab, University of Canterbury. Water Outage data and Map created by Brittany Meafou September 2025

Given the scale of data cleaning required, the project initially focused on seven metropolitan councils where records were most complete. This provided a robust starting point while still capturing a large share of the population. The next step has been to prepare the data for analysis using a case-crossover design[6]. This approach compares a "case period", two weeks before a person becomes sick, with other "control periods" when they did not become ill[7] (see image below). If outages are more common in the case periods, it suggests a likely link between the outages and disease. While this analysis is still underway, the groundwork of cleaning and aligning the data has been a critical achievement.



Partnerships have played an important role in the project's success. Taumata Arowai, the national water regulator, has been a strong supporter, providing feedback, advice, and opportunities to present at their Science Forum. PHF have been a key partner in supplying and helping interpret disease notification data. Engagement with councils through the LGOIMA process has created a nationwide network of contacts in the water sector. Presentations at conferences such as the Apōpō Infrastructure Conference and the International Water Association have further extended these links, connecting the research to both national and international audiences.

[6] Maclure, 1991
[7] Rothenberg et al., 2023

The project has already produced several important insights. The dataset shows that communities connected to pipes rated as poor or very poor are more likely to experience outages[5]. Because Māori and Pacific households are more often located in areas with such infrastructure, these communities may face greater risks of water-related illness. This highlights an important equity issue[8].

The potential impacts for New Zealand are wide-ranging. Economically, preventing illness reduces health care costs and lost productivity. Environmentally, understanding where networks are failing helps councils prioritise sustainable upgrades. Socially and culturally, addressing inequities in exposure protects vulnerable groups and upholds Te Tiriti o Waitangi by supporting Māori rights to safe water. By providing robust evidence on where risks are greatest, the project helps ensure that limited resources for infrastructure upgrades are targeted where they will do the most good.

Looking ahead, we are in the process of applying to upgrade the project to a PhD. If approved, this would expand the analysis from seven metropolitan councils to the full national dataset. It would also allow integration with the Integrated Data Infrastructure (IDI), a secure research database managed by Statistics New Zealand. Using the IDI would enable us to capture a fuller picture of illness, including hospitalisations and pharmaceutical use, and to assess whether recent regulatory upgrades, such as the addition of disinfectant residuals or protozoa barriers have already improved health outcomes. The updated PhD project proposal has written support from the Chief Science Advisor of Taumata Arowai.

In conclusion, this project has created a strong foundation for understanding the health risks of failing water infrastructure in Aotearoa. It has built valuable partnerships, generated a lot of interest, and highlighted important equity concerns. With further development, the research has the potential to deliver lasting benefits: safer water, reduced illness, and more resilient communities across New Zealand.

[5] Puente-Sierra et al., 2023
[8] Taumata Arowai., 2024

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