

Visitors from the north

Our warming planet will bring more infectious diseases via biting insects, ‘species leaps’ and contaminated food and drinking water. How ready are we for emerging virus outbreaks? **BY SALLY BLUNDELL**

The dull queasiness. The gut cramps. Cold sweat on the forehead, a reeling stagger to the toilet. A “bit of gastro” is a mild euphemism for what can be an efficient but wrenching and potentially dangerous bodily response to unwanted bacteria.

Last September, in the middle of end-of-year exams, more than 150 students at a University of Canterbury hall of residence were floored by *Clostridium perfringens* bacteria after eating a chicken souvlaki dinner.

In December 2023, more than 60 people in Queenstown came down with cryptosporidiosis (“crypto”), caused by a parasite transmitted in the faeces of infected humans and animals.

In Havelock North in 2016, contaminated drinking water caused an outbreak of campylobacteriosis, leading to thousands of gastroenteritis cases, 42 hospitalisations and four deaths. Several people also ended up with serious long-term neuropathies, when the body’s immune system attacks the nerves, says Nigel French, distinguished professor of infectious disease epidemiology at Massey University and former chief science adviser for Te Niwha, the infectious diseases research platform hosted by the University of Otago and Environmental Science and Research (ESR). “It’s often forgotten that these diseases can be fatal and cause very debilitating illnesses.”

At this fishing, picnicking, BBQ-sizzling time of year, care around food handling, cooking and storing is a no-brainer. According to MPI, about 200,000 New Zealanders get food poisoning every year, the most common causes being campylobacter, salmonella, E coli and yersinia. This figure

is likely to be skewed – it includes those infected overseas and ignores those who don’t leave their sick bed to go to a GP clinic or hospital or whose illness falls under the less specific “acute gastro” category.

Climate change, with its volatile tailwind of rising temperatures, increasing humidity, changing rainfall, warmer oceans, drought and extreme weather events, is upping the ante, setting up the right environmental conditions for new and more hardy pests and pathogens around the planet.

AVIRAL FORECAST

Already, increases in land surface temperature globally have been linked to the spread of tick-borne illnesses such as Lyme disease across much of Canada and encephalitis in northern Europe.

Warmer, wetter climates are driving mosquito-borne infections such as zika, malaria and chikungunya virus into higher altitudes. Small outbreaks of dengue have been recorded in Texas and southern France.

Otago University environmental epidemiologist Simon Hales says this is partly because the world is “possibly a degree warmer than [it] used to be. It doesn’t sound a lot, but it is if you are a mosquito.”

Already, yellow fever mosquito (*Aedes aegypti*) and tiger mosquito (*Aedes*

albopictus), the key reservoirs of chikungunya, dengue and zika infections, have been intercepted in New Zealand ports. There are no breeding populations here but temperatures in the northern parts of the country are edging closer to those required by the *Aedes* species to survive the winter.

“So I think we can say these things are going to happen, but where and when is trickier,” says David Hayman, professor of infectious disease ecology at Massey University. “Mosquitos are unlikely to survive a winter in Christchurch but more likely to in Auckland, which is where most people come into the country.”

Te Niwha is supporting research into broad-spectrum antivirals for emerging viruses and a potential vaccine for the mosquito-borne Rift Valley fever virus. It’s not yet in New Zealand but, as Te Niwha’s website states, “with a changing climate, this may change”.

Gastro bugs are also set to increase. Heavy rain can wash *giardia* and *cryptosporidium* cysts and *campylobacter* bacteria into waterways, where they can contaminate drinking water, as was seen in Havelock North.

Te Niwha is funding a project to assess water quality and its impact on the public. The burden of waterborne diseases programme is led by Canterbury University’s Dr Tim Chambers and Connor Redmile of Te Kura Taka Pini, the Ngāi Tahu freshwater group. Chambers says an estimated 18,000-34,000 New Zealanders develop acute gastrointestinal disease each year from contaminated drinking water supplies, but this estimate is 20 years old. The project aims to reassess rates of illness, and identify the most affected parts of the country.

Drought conditions, too, can lead to a

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GETTY IMAGES/ILLUSTRATION

Future plagues

From top, Nigel French and David Hayman of Massey University; Te Niwha director Te Pora Thompson.

greater concentration of *cryptosporidium* cysts in groundwater and surface water. Last month, the UN Convention to Combat Desertification reported that more than three-quarters of Earth's land became permanently drier in the three decades up to 2020 compared with the previous 30 years (22% of land experienced wetter conditions).

According to Massey University-based Environmental Health Intelligence New Zealand, a 1°C increase in monthly average temperature is associated with 15% more salmonella notifications in that month. The average temperature in New Zealand is expected to rise by about 1°C by 2040 compared to a 1995 baseline.

Tropical cyclones have been associated with a 9% rise in hospitalisations for infectious diseases. After Cyclone Gabrielle in February 2023 came an increase in leptospirosis, a serious bacterial infection mostly affecting those working directly with animals, such as farmers and meat workers.

The cyclone hit some of the poorest communities in Tairāwhiti, including Māori and Pacific people from low-income families, “and it is so difficult to mobilise the resources needed to tackle these things”, says Massey’s Nigel French. “Often, certain communities are just off the radar.”

BY AIR & WATER

“As the world changes, the face of disease will change too,” US researchers Colin Carlson and Gregory Albery wrote in a paper published in *Nature* in 2022. Changes in climate and land use would increase opportunities for “zoonotic spillover”, where



viruses transfer from animals to people. At least 10,000 virus species with the ability to infect humans were circulating silently in wild mammals.

Disentangling the effects of climate change from other forms of environmental degradation is not easy. Zoonotic diseases such as Covid 19, Sars and, less commonly, bird flu have been linked to deforestation, lack of biodiversity, human density and closer animal-human proximity. (November’s outbreak of the H7N6 strain of bird flu at an Otago poultry farm is thought to have resulted from laying hens foraging outside being infected by a low-pathogenic virus from wild waterfowl.)

One of the recognised barometers of climate change is *vibrio*, a family of small, comma-shaped micro-organisms thriving in warmish, brackish coastal water. Some strains, such as *V parahaemolyticus*, grow in bivalve molluscs such as oysters, mussels and pipi. Eaten raw or undercooked, these infected shellfish can leave a groaning trail of cramps, diarrhoea, nausea, vomiting and fever, serious enough for some, especially the elderly, young or immune-suppressed, to end up in hospital.

Other *vibrio* strains, such as *V vulnificus*, can enter the bloodstream through open wounds. For those with low immunity or impaired liver function, the infection can lead to sepsis.

Now, as water temperatures rise, *vibrio* is on the move. In the United States, food-borne illness due to *vibrio* infections doubled between 1996 and 2014. ESR senior scientist Lucia Rivas says data from Australia suggests run-off caused by severe storms may be providing extra nutrients for *vibrio* bacteria to thrive. In New Zealand, *V*

“Many of these issues affect small communities much more than big business, so there isn’t the will or financial backing to put money into it.”

parahaemolyticus infections used to be associated with seafood imported privately from the Pacific Islands. Now, locally transmitted infections are climbing. In 2019, about 25 people contracted vibriosis after eating raw or lightly cooked commercially harvested mussels. A recent MPI report says 34 cases were recorded in 2020, 51 in 2021, 52 in 2022 and 21 in 2023. Some were serious. Of the 60 reported cases of *V parahaemolyticus* between November 2021 and May 2022, just over 40% of those infected were hospitalised.

The decrease in 2023 has been put down to a successful public information campaign urging people to cook all shellfish, but there are concerns many *vibrio* cases are falling under the radar.

Apart from the toxigenic *vibrio cholerae* that causes cholera (which is not endemic in New Zealand), *vibrio* infections are non-notifiable, coming under the general category of acute gastroenteritis. What data there is comes from GP or hospital visits, again ignoring those sweating it out at home or being told to “give it a few days”. As with many instances of a gastro outbreak, says French, only those affecting a large community or major industry tend to become big news.

“There is strong industry demand for food safety – if Fonterra or Tegel don’t produce safe food, they can’t sell it – but many of these issues affect small communities much more than they do big business, so there isn’t the political will or financial backing to put money into methods to reduce disease. It’s a terrible trap.”

BLOOMING PAIN

Warmer waters, higher levels of CO₂, changing salinity and intense rainfall have also fuelled the spread of algal blooms, including *cyanobacteria* (or blue-green algae), with a major impact on the seafood industry. In 1989, an algal bloom in Big Glory Bay on Stewart Island caused the loss of an estimated 600 tonnes of farmed chinook salmon. In 2018, more than 100 mussel farms were closed in



the Marlborough Sounds after toxic algae, a species of *dinoflagellates*, infected the region.

Blooms can have a devastating impact on smaller communities. Excess nutrients caused by run-off in Whakakī Lake, near Wairoa, has caused a proliferation of toxic *cyanobacteria* blooms, contaminating the highly valued tuna (eels) and threatening the health of people who eat them. “So it was a loss of taonga and a potential health risk to people eating it,” says French.

French is emeritus director of the New Zealand Food Safety Science and Research Centre, which is now working with the

Whakakī Lake Trust to restore the lake back to health with funding from the Ministry of Business, Innovation and Employment.

With *vibrio*, the risk is particularly relevant to those engaged in traditional, non-commercial seafood harvesting and

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The Hastings District Council was forced to deliver treated water to Havelock North residents after the town’s bore water was contaminated with *E coli* in 2016.

consumption, particularly among Māori, Pacific and Asian communities.

“But Māori tend to be the group that are [identified] the least with gastroenteritis-type diseases like *vibrio*,” says ESR’s Rivas, “not because they are immune to it but because they are not being tested.”

Through the Te Niwha research platform, Rivas and the ESR team are working in Raglan trying to gauge the extent of *vibrio* infections in the community, to recognise barriers to testing and treatment and to identify the environmental indicators “that can put a red flag up or identify some kind of risk”.

“With some of these diseases, you see more people presenting at hospital. Why? Because they can’t get to a doctor? If we can prevent those people from going to hospital or getting sick in the first place we are reducing that burden on the health system. And if we can find the source for many of these infections, we can put some controls in or put some messages out there.”

COMMUNITY DRIVEN

The work hinges on a close working relationship between researchers, community and public health. Rather than one side telling the other side what they should be doing, says Te Niwha director Te Pora Thompson (Ngāti Hauā), “it’s about connecting people, spending time with the community and the marae hauora, giving the mic to good champions then connecting them into all the other forums”.

In the event of an outbreak, she says, the resulting framework can then be used to convey information through existing local infrastructure rather than more bureaucratic notification systems.

“Generally, a public notice goes out but nobody thinks to say, ‘Let’s just hop in the car and drive 40 minutes, let’s call the marae, let’s call the fishing people and the GPs and the local TLA [territorial local authority].’”

“There is a disconnect between public health, primary care and community care ... getting into these communities and seeing what works well for them in terms of communication.”

In Raglan, the ESR team is working with Te Toi Ora ki Whāingaroa, a marae-based initiative launched in 2020 in conjunction with community groups and the medical centre to help whānau struggling with



Environmental epidemiologist Simon Hales is wary of the impact of agricultural contaminants on freshwater sources and biodiversity.

Covid and mandatory isolation. Together, they have organised focus groups to better understand the barriers Māori communities face when confronted with a gastro outbreak. Again, it's about understanding and working with the local population.

To relay health messages in such a community, says Thompson, "you'd put something in the local rag, tell the local district council, tell the marae, the local RSA and the local fish and chip shops because everybody goes there. The word goes out a lot faster than putting it up on your organisation's website." The resulting systems of surveillance, notification and support, she says, can then be used for the next health event, whether it's Covid-19 vaccinations or for other infectious diseases on the horizon.

PANDEMIC LESSONS

This more collaborative approach adopted during the pandemic is underlined in the phase 1 report of the Royal Commission of Inquiry into Covid-19. It found local hubs and networks, including hapū, iwi, NGOs, schools and faith organisations, became "crucial points for community connection, leadership, practical support and resilience building". In using local knowledge and leadership, they often delivered the most effective solutions during the response and helped counter disinformation.

The report says state agencies recognised

the need to leverage local knowledge to identify needs and get funding and support out to communities fast, enabling local providers to deliver services based on needs.

When strong, trusting relationships were already in place before the pandemic, things worked well. "When relationships were patchy, or had to be developed fresh, this often impeded the effectiveness of the response."

As Otago's Simon Hales says, preparing for the next pathogen is not as simple as saying, "Cook things and it will be alright."

"The underlying issue is that humanity is not treating the natural world as if it has some limits. Climate change is one example – we are pushing carbon dioxide into the atmosphere, the living systems are absorbing currently about half of the carbon dioxide we are emitting. If it wasn't for the trees and algae and other living things absorbing carbon dioxide, the rate of increase in the atmosphere would be much faster. We need to be clearer about how we reverse that process."



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But in the protracted wait for any kind of reversal, there are fears our learnings from Covid will be too quickly forgotten.

Writing in the *New Zealand Medical Journal* in October, former director-general of health Sir Ashley Bloomfield and infectious disease clinician Dr David Murdoch said there is a sense of "collective global amnesia" about the pandemic, leaving us at risk of falling into a cycle of "panic and neglect".

All countries, they wrote, should be applying the lessons from Covid-19 to "update their plans to prevent, prepare for and manage the next major infectious diseases risk".

The royal commission report recommends a central agency to co-ordinate "all-of-government preparation and response planning for pandemics and other national risks".

ADAPTATION PLAN

Already, One Health Aotearoa, an alliance of infectious disease researchers, is developing a research programme straddling human, animal and environmental health to prevent infectious diseases, including in relation to climate change.

The Ministry of Health's new Health National Adaptation Plan 2024-27 calls for the establishment of regional climate health action plans to consider local health and community needs, infrastructure and resources in collaboration with iwi, hapū and hapori Māori (community groups) and other communities to ensure they have the resources and autonomy to better "support holistic health and wellbeing".

Thompson has seen these goals before, "but from what I've seen, it always comes down to the ability to bring communities together, to understand what that interface is – people knowing people, researchers working with community, community working with researchers. It's having community, family, marae, this interest group, that fishermen's club, joined up to science that they have had a hand in developing or co-leading.

"It has to be a full, end-to-end process. If we get that interaction right, that becomes the model that provides the framework for other infectious diseases."

Thompson acknowledges the ongoing calls for New Zealand to have its own Centre for Disease Control. "Whether or not we turn into a CDC, the framework and the approach we are using has to be a part of whatever it is going forward." ■