

The  
New Zealand  
**Medical Journal**

Te ara tika o te hauora hapori

Journal of the New Zealand Medical Association

Vol 135 | No 1552 | 2022 Apr 1

# The New Zealand Illicit Drug Harms Index: how can it inform a health- based approach to drug use?

A close-up photograph of a person's hands holding a lit cigarette. The hands are positioned as if about to take a drag. The background is dark and out of focus.

Vaccine mandates  
in the time of Omicron

Whānau experiences of patients'  
deaths in Wellington Hospital during  
2020 COVID-19 pandemic Levels 3 & 4

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**Publication information**  
published by the New Zealand Medical Association

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## **Whānau experiences of patients' deaths in Wellington Hospital during 2020 COVID-19 pandemic Levels 3 & 4**

*Sinead Donnelly, Fiona McDonald, Cheryl Goodyer*

Next of kin for 22 patients who had died in Wellington Hospital during Levels 3 & 4 of the 2020 COVID-19 pandemic (16/22 under General Medicine with an additional 6/22 who identified as Māori) from a total of 70 hospital deaths were interviewed. Whānau were asked to describe their experience of a relative dying. Whānau provided poignant and heartbreaking accounts of their experiences. The findings underscore the importance of whānau accompanying the dying patient, and non-abandonment. Pandemic policies should prioritise the needs of whānau and hospitalised patients who are dying of any illness, including: daily telephone/Zoom updates by doctors and/or nurses with whānau; having a bereavement whānau coordinator keeping in touch with relatives of patients who are dying; making follow-up telephone calls to whānau after the death; ensuring availability of Māori healthcare staff to support Māori patients and whānau; and observation of Māori tikanga around dying and death for Māori and their whānau.

## **A Delphi exercise with rheumatologists to identify consensus on essential components of a rheumatology service in district health boards of Aotearoa New Zealand**

*Hamish Nigel Gibbs, Rebecca Grainger*

Rheumatology care is required to get good health outcomes for people with both common (rheumatoid arthritis, gout) and uncommon (vasculitis, Systemic Lupus erythematosus) rheumatic diseases. Surprisingly, there is no agreed description of what DHB rheumatology services should provide or do. There is evidence to suggest rheumatology care varies in different DHBs in Aotearoa New Zealand. This study identified 16 statements about best practice for a rheumatology service that rheumatologists in Aotearoa New Zealand agreed should be in all DHB rheumatology services. There were some statements that rheumatologists did not reach agreement on which included statements about use of telehealth, is some non-inflammatory diseases should be seen in rheumatology services and if some patients can be discharged back to their GP for ongoing care. Further work is needed to understand what patients want from rheumatology services and what rheumatology services at DHB in Aotearoa New Zealand actually provide.

## **Update on Canterbury Charity Hospital Trust activities 2013 to end of 2020: adapting to changing unmet secondary elective healthcare need.**

*Philip Bagshaw, Lynne Briggs, Susan Bagshaw, Vivienne Levy, Carl Shaw, Averill Williamson, Anita Tuck, Alice Brown*

This article outlines the updates that occurred to services and facilities at the Canterbury Charity Hospital Trust during the period 2013 until the end of 2020. It particularly focuses on the development of the endoscopy and dental services, the counselling service provided after the February 2011 Christchurch terror attacks and the effects on services due to the COVID-19 pandemic. It also lists the main clinical research activities undertaken by the staff and volunteers at the Trust.

## **X-ray misinterpretation in urgent care: where does it occur, why does it occur, and does it matter?**

*Crispian Wilson*

This study analysed how commonly errors were made when interpreting X-rays in the urgent care clinic, and why these errors occurred. The results demonstrated that errors were uncommon, often did not affect how patients were treated, and rarely resulted in serious harm to the patient. Doctors with less urgent care training were more likely to make an error, and mistakes were more common when interpreting childrens' X-rays.

## **Simulating the impact of vaccination rates on the initial stages of a COVID-19 outbreak in Aotearoa New Zealand with a stochastic model**

*Leighton M Watson*

I use a mathematic model to simulate the spread of COVID-19 for a range of vaccination rates. The results clearly illustrate that high vaccination rates greatly reduce the spread of COVID-19 and limit the number of hospitalisations. The model was calibrated for the Delta variant and shows that unvaccinated individuals are 3.3x more likely to be infected and 25x more likely to be hospitalised. This work builds upon our existing knowledge to illustrate the importance of getting vaccinated. While the work was focused on Delta, vaccination (and boosters) remain the best tool to protect from Omicron.

## **Hospitalisation during lockdown—patients' beds-eye views**

*Kyu Hyun Lee, Bernard Wong, Seif El-Jack, Guy Armstrong, Ruth Newcombe, Li Ma, John Ramos*

It has been reported that patterns of hospital presentations for various illnesses changed during the COVID-19 pandemic, and many have tried to explain this phenomenon with different hypotheses. In our study, we have found evidence that the COVID-19 and lockdowns directly delayed and affected patient's decision to present to hospital, likely due to perceived risk of the hospital environment during the pandemic. This was more likely to be the case in people under 70 years old. However once in hospital, majority of patients felt safe to stay in to receive necessary care.

## **Insulin pump special eligibility criteria in New Zealand: a survey of prescriber opinion and practice**

*Michaela Groves, Sara Styles, Martin de Bock*

Currently, people with diabetes in New Zealand can only receive funded access to continuous infusion of insulin pumps (CSII) via PHARMAC. The special authority criteria allowing access to CSII has not been updated in the last ten years despite an increasing body of evidence showing their benefits both in terms of blood sugar control and quality of life. We surveyed all the CSII prescribers in New Zealand to gauge their opinion of the current criteria and their current prescribing practice. 88% of respondents believed the current criteria should be updated; only 33% of respondents strictly adhere to the current criteria and 60% of respondents do not believe the current special authority criteria promote health equity for Maori and Pasifika. We believe the current special authority criteria need to be updated to better reflect the evidence, improve patient outcomes and improve health equity for Maori and Pasifika in Aotearoa.

## **Likelihood of infecting or getting infected with COVID-19 as a function of vaccination status, as investigated with a stochastic model for Aotearoa New Zealand for Delta and Omicron variants**

*Leighton M Watson*

I use a mathematical model to simulate the spread of COVID-19 and track the vaccination status of who causes each infection and who is infected. This provides useful information that cannot be determined from real-world data because, as the numbers of cases has increased, contact tracers are overwhelmed. Most new infections are caused by unvaccinated individuals (when normalised by population). For Delta, unvaccinated individuals cause 87% of all new infections whereas transmission between vaccinated individuals (two doses) makes up only 3% of infections. For Omicron, unvaccinated individuals cause 45% of all new infections, vaccinated (two doses) cause 39%, and boosted (three doses) cause only 15%. Transmission between boosted individuals is only 3%, indicating that three doses of the vaccine are effective at preventing infection and transmission.

## **Perioperative leaders' experience of COVID-19 in Aotearoa: a qualitative interview study**

*Professor Jennifer Weller, Vanessa Beavis, Kim Jamieson, Mataroria Lyndon, Jennifer Long*

Undertaking surgical operations in the context of large-scale community spread of Covid-19 poses risks for staff and patients. In 2020 New Zealand's perioperative services developed plans to contain viral spread, keep staff safe and maintain patient care. We interviewed perioperative leaders around the country to understand their experiences, reflections and the lessons learnt from this time. Participants described planning and managing staff in an environment of uncertainty, limited preparedness, information overload and high levels of staff stress and anxiety. They reflected on the importance of communication, caring for staff, collaboration, downtime to enable preparation, and the value of external resources to facilitate planning. Whilst each crisis is unique, these lessons may be applicable to future pandemic or disaster response efforts.

## **Reducing healthcare inequities for Māori using Telehealth during COVID-19**

*Erena Wikaire, Matire Harwood, Kayla Wikaire-Mackey, Sue Crengle, Rachel Brown, Anneka Anderson, Rawiri McKree Jansen, Rawiri Keenan*

This Kaupapa Māori study looked at the experiences of Māori with Telehealth during the 2020 COVID-19 lockdown. We interviewed Māori whānau and primary health care providers about accessing healthcare during the lockdown, and whether they had used Telehealth. Participants told us that Telehealth was useful when it removed common barriers – such as lack of transport, consultation costs and having to take time off work/school – and in general improved access to healthcare. However, they also raised issues with Telehealth, and suggested ways to address these. Solutions focused on improved internet coverage, access to suitable Telehealth and health-monitoring equipment and support for Telehealth literacy.

## **Clinical features of patients hospitalised with COVID-19 from February to October 2020, during the early waves of the pandemic in New Zealand**

*Aliya Bryce, Lydia Foley, Juliette Phillipson, Sandy Slow, Malina Storer, Jonathan Williman, Richard Beasley, Hasan Bhally, Cat L Chang, Jack Dummer, Michael Epton, Mary Furniss, Kathryn Gracie, Robert J Hancox, Thomas Hills, Stephen Hogg, Sandra Hotu, Nethmi Kearns, Susan Morpeth, David Murdoch, Nigel Raymond, Stephen Ritchie, Conroy Wong, and Michael J Maze*

This study reviewed the records of people admitted to hospitals in New Zealand with COVID-19 in 2020, to determine risk factors for severe illness and use of key hospital resources. We reviewed the records of 84 patients at 8 District Health Boards. We found that half of those admitted were discharged within four days, but some required hospital care for up to 44 days. More than half of patients experienced a complication such as shock, delirium, kidney injury or heart arrhythmias. Nearly one in four died or were admitted to an intensive care unit.

# The New Zealand Illicit Drug Harms Index: how can it inform a health-based approach to drug use?

Rose Crossin, Joseph M Boden, Chris Wilkins, Simon Adamson

Sychoactive drugs are widely available in Aotearoa New Zealand, and their use, has potential to cause harm; either to the person using the drug, or to others. Drug harm is multi-factorial, and forms a complex health, equity, and public health issue. The New Zealand Drug Harms Index was first published in 2008<sup>1</sup> and revised in 2016<sup>2</sup> to guide drug policy and resource allocation. An updated report, renamed the New Zealand *Illicit* Drug Harm Index (NZIDHI; referred to as the ‘Index’), was released in February 2022.<sup>3</sup> The updated Index incorporates a number of improved data sources (ie national wastewater estimates, coronial services, hospital admissions), and provides an updated cost estimate of drug harm to New Zealanders of \$1,904 million per year; differentiated into personal harm (\$813 million) and community harm (\$1,091 million). In this editorial we discuss the scope and methodology of the Index, and relate these to the utility of the Index for informing health-based drug policy.

The first key consideration is that the Index’s scope is limited to illegal (‘illicit’) drugs, thus excluding alcohol and tobacco, two widely used substances with substantial health and social harms. For example, the most recent estimate of the cost of alcohol-related harm in New Zealand is \$7 billion per annum;<sup>4</sup> more than triple of all illegal drugs included in the Index. This scope reflects the historic purpose and origins of the Index, which was predominantly law enforcement focused. However, drug harm ranking studies using multi-criteria decision analysis in the United Kingdom,<sup>5</sup> Europe,<sup>6</sup> and Australia<sup>7</sup> have identified alcohol and tobacco among the most harmful drugs (including overall harm and prevalence-weighted harm). By only quantifying harms from illegal drugs, the Index perpetuates the misconception that only illegal drugs are harmful.

A second important issue is that the stated aim of the Index is to evaluate the “costs of harmful illicit drug use”. However, “harmfulness” is not a fixed property of a drug, and can be mitigated

or compounded by the social and policy context in which drug-use occurs. In this Index, a significant proportion of community harm is attributed to either reinvestment of drug trafficking profits into other crime (\$61 million 6% of community harm) or foregone tax revenue (\$240 million, 24% of community harm). Therefore, 30% of the community harm estimates were not attributable to the harmful use of drugs, but rather to the current prohibition framework in which drug use has occurred. This is also likely to be a substantial underestimate, as there are other types of drug-related harm arising from illegality (eg loss of employment, loss of reputation). The inclusion of foregone tax revenue as a harm creates a counterfactual state of affairs that is policy-dependent. In the Practical Guideline accompanying the Index, an example is provided on reduction of harm based on the seizure of X kg of a drug, multiplied by harm per kg. However, if reductions in community harms are calculated for drug seizures, foregone tax revenue cannot be included as avoided harm. Any tax that could have been collected was foregone whether the drugs were seized or not, because they cannot be sold legally. We are not advocating that these estimates of harm be removed; in fact, we think their inclusion in the updated Index is a strength, and reflects the impacts of current drug policy. However, the Index would benefit from clearly separating *drug harms* from *drug policy harms*.

The most important consideration is how the updated Index will inform policy evaluation and resource allocation. The NZ Drug Strategy (2015–2020) (yet to be updated) has an overarching goal of “reducing drug-related harm”.<sup>8</sup> Given that drug-use remains relatively high despite prohibition,<sup>9</sup> we argue that legislation should move more towards a harm reduction and health-based approach. It is important to acknowledge that not all drug use is associated with harm, and there is a broad spectrum of use patterns from sporadic or casual, through to dependent and problematic

use. In contrast with the 2016 edition,<sup>2</sup> the current Index does not enable differentiation by use patterns, effectively attributing harm equally across those who use a drug. In reality however, there are a large proportion of individuals experiencing no, or very little, harm from their drug use, alongside a smaller proportion of individuals and their significant others experiencing substantial harm. This distribution of harm will differ by drug type. The current Index does not provide a cost estimate per “dependent user”, unlike the 2016 iteration.<sup>2</sup> Considering the results of the Index from a resource allocation perspective (consistent with a harm reduction goal) would prioritise resourcing interventions such as needle exchanges, naloxone access and drug checking, as well as drug treatment services. By targeting efforts more directly on reducing drug-related harm, rather than drug-use, we can move closer to a health-based approach to drugs in New Zealand, and focus resources toward those experiencing harm.

A health-based approach must also address the established health and social inequities for drug harm in New Zealand. The Wai 2575 claim reinforces that substantial health inequities exist for drug harms and treatment for Māori.<sup>10</sup> A prohibition-focused drug policy reinforces stigma, creates barriers to help-seeking, and can directly contribute to harm through biased policing and prosecution. The Index does not attempt to quantify harms to Māori relative to the total population; however, we know from current evidence of inequity that this will be greater than would be attributable simply by population proportion. Future iterations of the Index should consider how drug harms are spread across population groups.

The updated Index presents an opportunity to evaluate New Zealand's current drug policy and how effective it has been in reducing drug-related

harm. Drug use can be associated with harm, but equating use with harm misrepresents this relationship, and may lead to poor policy-making. We see this conflation between use and harm within the Misuse of Drugs Act 1975, whereby any possession or use is considered misuse—the current Act fully conflates use with harm. Independent reviews have highlighted that our current drug policy approach requires reform,<sup>11</sup> and the Misuse of Drugs Act, at 47 years old, is beyond the point where it can be coherently amended. We argue that drug policy should reflect the relative harmfulness of drug types, and current classifications need evidence-based revision. We maintain that drug policy should be coherent and proportionate, and that would include considering the harmfulness of alcohol and tobacco alongside currently illegal drugs.

New legislation that genuinely enshrines a harm reduction and health-based approach to *all* drugs (regardless of legal status) is required. Such legislation could then be supported by a re-designed “Substance Harms Index” with a broader scope and definition of harm, and which differentiates harm associated with drug use from harm associated with drug policy. Like any analysis, the accuracy of the Index is reflective of the quality of available data. The authors of the Index highlight, and we concur, that there are methodological constraints and limitations attributable to issues with New Zealand data quality. Therefore, an investment in improved data is also required. After more than 50 years of a prohibition approach during which drug supply and use has increased globally,<sup>12</sup> it is time for our legislation in Aotearoa New Zealand to be reformed, centered on human rights, equity, and health.

**COMPETING INTERESTS**

Nil.

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[www.nzma.org.nz/journal-articles/the-new-zealand-illicit-drug-harms-index-how-can-it-inform-a-health-based-approach-to-drug-use-open-access](http://www.nzma.org.nz/journal-articles/the-new-zealand-illicit-drug-harms-index-how-can-it-inform-a-health-based-approach-to-drug-use-open-access)

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# Vaccine mandates in the time of Omicron

David C G Skegg, Maia Brewerton, Philip C Hill, Ella Iosua, David R Murdoch, Nikki Turner

Our group was asked to give independent advice to the New Zealand Government on the place of vaccine mandates in the current strategy for minimising harms caused by the COVID-19 pandemic, to health, society and the economy. As we had not previously reported on this subject, we were able to take a fresh view of the evidence, without any temptation to defend previous positions.

There is often confusion about the term “vaccine mandate”. In the late 19th and early 20th centuries, vaccination of children against smallpox was compulsory in New Zealand, as in many other countries, but the mandate was not rigorously enforced. Vaccination of citizens against SARS-CoV-2 has been mandated in some parts of China, and a proposal to require this in Germany will be debated in the Bundestag within the next few weeks. In Italy and Greece, vaccination is mandatory for people in older age groups. Compulsory vaccination against SARS-CoV-2 has never been proposed in New Zealand.

In New Zealand the term vaccine mandate has mainly been used, during this pandemic, to describe Government orders for people in certain occupational groups, such as healthcare workers, to be vaccinated in order to continue working in those roles. Apart from the Health and Disability sector, vaccine orders currently apply to at least some workers at the Borders and in Education, Corrections, Fire and Emergency, the Police, and the Defence Force.

Employers can also require vaccination against various diseases as a condition of employment. This has been common for many years in certain sectors, such as healthcare providers and armed forces. Since the advent of COVID-19, some employers have required vaccination against the virus, either to ensure continuity of their business or to protect other staff or customers who may be vulnerable. Government regulations introduced in December 2021 provided an assessment tool that an employer may (but is not required to) use to assess whether it is reasonable to require that workers be vaccinated.

The term “vaccine mandate” is also sometimes

used loosely to refer to the requirement that people show a vaccination certificate (“My Vaccine Pass”), in order to attend places such as hospitality venues that are using these. Under the COVID-19 Protection Framework (CPF), limits on the numbers of people who can attend hospitality venues or gatherings, such as church services or marae, depend on whether or not vaccination certificates are used. There is a legal requirement that businesses that have to use vaccine passes to operate, or to operate with fewer restrictions, must ensure that their own employees are vaccinated. The CPF is being revised, so the role of vaccination passes is not discussed here. We will use the term “vaccine mandates” to refer to the occupational mandates imposed by the Government.

## Diverse benefits of vaccination

Vaccination against any disease is often seen as a step that people take to protect themselves from illness. Such *individual protection* is important, but there are also other benefits. Vaccination may reduce the risk that a person will infect *other people around them*, who may be particularly vulnerable (and who may not themselves be able to derive as strong protection from vaccination). Vaccination can also provide *community protection*, helping to control the spread of illness in the whole population.

In the case of COVID-19, vaccines have been shown to be especially effective at preventing severe illness and death. This benefits not only the sick person and their family and friends, but also the whole community—because health services are less likely to become overloaded. In places like the United Kingdom, where there have been very large outbreaks of COVID-19 over the last two years, many people with unrelated diseases (such as cancers) have had difficulty in accessing healthcare. Consequently, there are now unprecedented numbers of patients waiting for delayed treatment or elective surgery.

Evidence is mounting about delayed effects of infection with SARS-CoV-2, including the condition known as “long COVID”. By reducing the risk

of such complications, vaccination benefits both the individual and the community.

Control of COVID-19 also helps to protect public and private enterprises. In many countries, large outbreaks have led to massive absenteeism and temporary collapse of some public services and commercial businesses. This has been less of a problem in highly vaccinated populations.

Experience has shown that the protection provided by vaccines wanes after a few months, although it lasts for longer against severe disease. For most vaccines against SARS-CoV-2, the primary course for adults involved two doses, but it is now clear that a booster dose is highly desirable—especially for people who are at risk of severe disease. It might be better if we talked about a “vaccination course”, as the term “booster” is interpreted by some as implying an optional extra. A full vaccination course now involves three doses for the majority of adults, and two doses for most children. Immunocompromised people need three or four doses, depending on their age and the severity of their condition.

## Experience with vaccine mandates in New Zealand

Most of the occupational vaccine mandates in New Zealand were introduced in the latter part of 2021, as the country was battling with the Delta outbreak. The main purpose of these mandates has been to reduce the risk of workers becoming infected and transmitting the virus to groups of people who may be either unable to be vaccinated themselves (eg young children), particularly vulnerable to infection (eg sick patients or residents in aged care), or at risk of large outbreaks (eg inmates in prisons).

Encouraging vaccination in the general population was not one of the specific objectives of vaccine mandates. Nevertheless, the fairly wide application of mandates probably was one of the factors contributing to the achievement of New Zealand’s excellent overall vaccination coverage. Along with other public health measures, this averted what could have been a disastrous wave of disease caused by the Delta variant. As we now deal with a large Omicron outbreak, vaccination is undoubtedly reducing the numbers of people who are becoming seriously ill and requiring hospital treatment.

As in other countries, people are becoming fed up with restrictions needed to control a pandemic

that has gone on for longer than anyone envisaged. Vaccine mandates have attracted particular criticism. A small minority of the population harbour strong objections to vaccination, and some have been prepared to accept redeployment or redundancy, rather than agree to be vaccinated. Some others feel that the imposition of occupational mandates, even for sound public health reasons, involves an unjustified infringement of personal liberty. There are also legal debates about the relevance of the New Zealand Bill of Rights Act.

Clearly, we are not qualified to comment on the legal issues. As public health and medical professionals, however, we are vitally concerned about the wider effects of preventive measures on societal wellbeing—and not just on numbers of illnesses and deaths. In developing our recommendations, we have taken account of the particular challenges associated with the use of vaccine mandates.

## An evolving pandemic

Vaccine mandates were never intended to be permanent, and it was assumed they would be reviewed periodically. Such a review is appropriate now, for several reasons. First, there is high overall vaccination coverage in the community, although it is disappointing that the uptake of the third (booster) dose of the vaccine has not been higher. Second, the proportion of people with some immunity from natural infection will be increasing greatly during the current outbreak. Third, although some infections with the Delta variant are probably still occurring (and we need better surveillance), there has been a shift to the Omicron variant which now accounts for the vast majority of infections.

Individuals infected with the Omicron variant are less likely to require hospitalisation, and especially intensive care, than people infected with Delta. Nevertheless, Omicron is so infectious that in many countries it has caused more hospital admissions and deaths than those which occurred during Delta outbreaks. That will also be the case in New Zealand.

One of the reasons why Omicron is so infectious is that it is more capable than Delta of evading immunity conferred by vaccination or previous infection. Evidence about the effectiveness of vaccination against Omicron is still accruing, but we summarise here what is known at present.

While current vaccines provide less protection against symptomatic infection with Omicron than with Delta, there is good protection against severe illness, particularly after a third (booster) dose. It is unclear how quickly the immunity provided by the third dose against symptomatic infection will wane, but protection against severe disease will last longer. Key observations for the current discussion are that adults who have received three vaccine doses are (1) less likely than unvaccinated people to get infected with Omicron, and (2) less likely to pass the infection on to others. The differences are smaller than in the case of Delta, but still appreciable.

It must be remembered that a new variant of the virus may displace Omicron in the months ahead. Such a new variant could be more or less virulent in causing human disease. Experience with previous variants suggests that current vaccines would be likely to retain at least some of their effectiveness. It is also possible that new vaccine formulations would be developed that further reduce the risk of infection and transmission, particularly in the case of a dangerous new variant.

## Use of mandates in other countries

Internationally, there has been wide variation in the use of occupational vaccine mandates. It is perhaps most instructive to consider experience in countries with which we share a similar constitutional background. The United Kingdom requires aged care workers to be vaccinated. Legislation was amended, with the intention to extend the mandate to frontline health and social care workers, but in January 2022 this decision was reversed at the last moment. It is believed that this was because of a fear that the National Health Service, already critically overloaded, would not be able to cope with the withdrawal of large numbers of workers. Vaccine hesitancy among such groups appears to be much commoner than in New Zealand.

The United States Government introduced vaccine mandates for federal employees and contractors in July 2021, but this has been challenged in the courts. Most measures for controlling COVID-19 are the responsibility of state and local governments. There is wide variation in the use of vaccine mandates in different states. Some states have imposed no occupational mandates, while others require vaccination of public employees, as well as health workers and other groups.

Australia, like the United States, has a range of public health measures because of its federal system. The country is now well past its peak of Omicron cases. Yet while most public health restrictions have been lifted, Australian states have largely maintained occupational vaccine mandates. In New South Wales, employees in education, health, and aged care services are required to be vaccinated. In Victoria, vaccine mandates, requiring two doses, apply to a very wide range of public and private sector employees. Third doses are required for those in health care, education, aged care, custodial settings, emergency services, food processing and distribution, and quarantine accommodation.

## Conclusions

The case for or against retaining occupational vaccine mandates is now more finely balanced, because of our relatively high vaccination coverage and increasing natural immunity, as well as the apparent lowering of vaccine effectiveness against transmission of the Omicron variant. We also recognise that the Government needs to consider factors other than those discussed here, such as legal considerations and political assessment of the “social licence” for retaining this component of our public health strategy.

For a few occupational groups, we believe that vaccine mandates should be retained for the time being. These groups are: healthcare workers, care givers in the disability sector, aged care workers, workers in Corrections, and border workers along with those in managed isolation and quarantine (MIQ) facilities.

Health workers are more likely to be exposed to COVID-19, and are also liable to transmit the virus to highly vulnerable patients in their care. Aged care facilities and prisons are also places where vulnerable people may be exposed to large outbreaks.

Border and MIQ workers are likely to be the first people in our community to be exposed to new variants of SARS-CoV-2. It is important to minimise their risk of becoming infected, and passing the infection on to others.

Most of these groups have already been required to obtain a full vaccination course (including a booster dose), and this requirement for a booster dose should be extended to any who have not yet been included.

While vaccination remains critically important in protecting New Zealanders from COVID-19, we believe that several of the vaccine mandates could

be dropped once the Omicron peak has passed. These include the mandates for workers in Education, Fire and Emergency, the Police, and the Defence Force. Mandates for these occupational groups need to be replaced by national advice as to how the leaders of the services should protect their staff and reduce the spread of disease to others. Such measures should include clear recommendations for vaccinations and other public health measures that reduce the transmission of respiratory infections. In some cases, it would be appropriate for vaccination to be a condition for new employment. New Zealand has been slow to develop occupational vaccination policies for a whole variety of infectious diseases, and we hope that experience of the current pandemic will lead to new initiatives in this area.

Although vaccination is now available for children over 4 years of age, this is not the case for those in early childhood education centres and kōhanga

reo. We are also conscious that, while COVID-19 is generally less severe in children than in adults, some children suffer serious early and longer-term effects. Outbreaks of COVID-19 in schools also have significant social consequences for many children. Hence there needs to be a comprehensive plan for protecting children from COVID-19. This could be incorporated into a broader plan for protection against respiratory disease, recognising the importance of influenza and other respiratory illnesses such as RSV.

Occupational vaccine mandates should be reviewed within six months. It is possible that a review will be needed earlier, if there is a new surge of Omicron cases or emergence of a dangerous new variant. In such circumstances, administration of a fourth vaccine dose might need to be considered. It is always possible that some vaccine mandates might need to be reinstated in the future.

*The authors are members of the Strategic COVID-19 Public Health Advisory Group.  
This advice was commissioned by Hon Dr Ayesha Verrall, Associate Minister of Health (Public Health).*

**COMPETING INTERESTS**

Nil.

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[www.nzma.org.nz/journal-articles/vaccine-mandates-in-the-time-of-omicron-open-access](http://www.nzma.org.nz/journal-articles/vaccine-mandates-in-the-time-of-omicron-open-access)

# Whānau experiences of patients' deaths in Wellington Hospital during 2020 COVID-19 pandemic Levels 3 & 4

Sinead Donnelly, Fiona McDonald, Cheryl Goodyer

## ABSTRACT

**AIM:** A qualitative exploration of the experience of whānau whose relatives died in an acute hospital setting during Levels 3 & 4 of the 2020 COVID-19 pandemic in Aotearoa New Zealand.

**METHODS:** Next of kin for 22 patients who had died in Wellington Hospital during Levels 3 & 4 of the 2020 COVID-19 pandemic (16/22 under General Medicine with an additional 6/22 who identified as Māori) from a total of 70 hospital deaths were interviewed by phone in August 2020. Whānau were asked to describe their experience of a relative dying. Following transcription, thematic content analysis was undertaken by the researchers.

**RESULTS:** Whānau provided poignant and heartbreaking accounts of their experiences. Researchers broadly categorised their feedback as positive or negative. The dominant factors that contributed to positive experiences for whānau were excellence in nursing and medical care. Māori whānau benefitted from hospital staff understanding the importance of tikanga Māori relating to dying and death practices, and incorporating these into the care of the patient. Factors that contributed to negative experiences for whānau included separation from loved ones at the time of death. The findings underscore the importance of whānau accompanying the dying patient, and non-abandonment. Other negative experiences were not having time to say goodbye, and insufficient communication with medical personnel. There were also misunderstandings and uncertainty about the changing hospital rules around isolation with great variability in interpretation by different staff.

**CONCLUSIONS:** Pandemic policies should prioritise the needs of whānau and hospitalised patients who are dying of any illness, including: daily telephone/Zoom updates by doctors and/or nurses with whānau; emailing photos to whānau of doctors/nurses/patient's room; having a bereavement whānau coordinator keeping in touch with relatives of patients who are dying; making follow-up telephone calls to whānau after the death; prioritisation of fast COVID-19 testing if there is a possibility that the patient will die; ensuring availability of Māori healthcare staff to support Māori patients and whānau; and observation of Māori tikanga around dying and death for Māori and their whānau.

**O**n 30 January 2020, the World Health Organisation (WHO) declared the novel coronavirus a public health emergency of international concern. On 11 March 2020 the WHO recognised its pandemic status. New Zealand had its first reported case of COVID-19 on 28 February 2020, one month after the first cases were reported in Europe.

Similar to other hospitals throughout New Zealand, Capital and Coast District Health Board (CCDHB) introduced a restricted visitors policy (RVP) to Wellington Hospital during COVID-19 Alert Levels 3 & 4, from 22 March to 27 April 2020. The restrictions included whānau wanting to visit dying patients. This study explored whānau bereavement experiences when patients died of COVID-19 (1 patient) and non-COVID-19 (21 patients) illnesses in Wellington Hospital during

this time. The principal investigator (SD) has a strong background in qualitative research on the experience of deaths in hospitals.<sup>1-4</sup> This paper provides a unique contribution to the literature by incorporating a Māori cultural lens. It is anticipated that this research will inform policy for future emergencies, on the care of patients who are dying in hospitals.

The CCDHB RVP stated that no visitors were allowed under Level 4 except on compassionate grounds determined by a senior doctor and ward clinical nurse manager. Under Level 3, one nominated visitor from the patient's bubble was allowed provided they had no COVID-19 contacts or symptoms. CCDHB Whānau Care Service, aware of the potential and likely impact of RVP on all whānau, extended their support services to all patients and families.

As Wallace et al<sup>5</sup> have written: “The COVID-19 pandemic has disrupted usual experiences of grief.” They refer to the impact on the grieving process for the prohibited visitors of hospitalised patients regardless of COVID-19 diagnosis. As death occurs, the physical, mental and social consequences of social distancing may impact the potential for complicated grief. Disenfranchised grief can also occur when families are unable to grieve in traditional ways, such as a vigil at the bedside as the person is dying, accompanying the body to the hospital mortuary and viewing the body there. Wynne et al<sup>6</sup> offer very pertinent advice to countries like New Zealand: “In parts of the world where an opportunity for preparation still exists and as countries emerge from COVID-19, planners must consider care of the dying”.

When starting this study in August 2020, there was little bereavement data from COVID-19 and previous pandemics.<sup>7</sup> Now, there is research on bereavement interventions, eg clinical psychologists,<sup>8</sup> nurse-led bereavement services,<sup>9</sup> ICU senior doctor telephone and video conferences to families<sup>10</sup> and the creation of virtual bereavement groups<sup>11</sup> as well as research on healthcare workers experiences of RVPs for dying patients and their families.

Katz<sup>12</sup> aptly summarises the situation: “This is a bad time to die,” and explains that “death and bereavement are a natural part of life but global pandemics are not. Bereavement is a natural part of life but it can negatively impact on physical and psychological health”. Several other authors also refer to the fact that RVPs have profound effects on the dying and their family members.<sup>7,8,12,13</sup> Capozza<sup>14</sup> makes an emotional plea that “no one deserves to die alone”, and that “dying alone is not justifiable even in times of infection with a pandemic virus”. Mercadante<sup>15</sup> states that during COVID-19, “we are grieving in isolation—something that comes close to an oxymoron in many cultures where mourning is a shared social practice”.

Emerging literature<sup>12</sup> on the psychological effects of COVID-19 on death, dying, grief and bereavement reminds us that restrictions to family centred care (FCC) do not only affect those diagnosed with COVID-19. The very restrictions designed to protect against COVID-19 infections are themselves contributing to additional distress and suffering for both the person who is hospitalised as well as their whānau. There is, therefore, a need to prepare for a steep rise in traumatic, disenfranchised and chronic grief.<sup>7</sup> There are compelling reasons to expand access of family members to

their loved ones as they near the end of life, despite the risk of infection. Separation from the patient, absence of normal death rites and the disruption of social support networks are all risk factors for poor bereavement outcomes. Experiencing a loss, and sometimes multiple losses, in a condition of isolation can be extremely difficult for family members.<sup>8,13</sup>

The threats of COVID-19 must be placed in the context of other threats to health including those that are harder to appreciate in the short term.<sup>7</sup> It may be too early to know the burden of complex grief for family members who endure the loss of a loved one during the pandemic.<sup>16</sup> However, recent studies suggest that COVID-19 bereavement yields much higher grief disorders than natural bereavement—similar to bereavement after suicide or homicide.<sup>8,13</sup> In this new era of “e-mourning” and “unmarked deaths”, we are reminded that a spike in COVID-prolonged- and-complicated grief is itself a potential public health crisis. Downar et al<sup>7</sup> ask a valuable question: “How much psycho-morbidity is justified by the prevention of a single COVID-19 infection?” RVPs reduce the harm from infection, but increase the chance of harm from isolation or separation. Tate<sup>17</sup> and Wiener,<sup>18</sup> writing from the perspective of paediatric palliative care, identify tangible limitations of RVPs and write of “the pain of watching families stumble through a stunted grieving process”, as well as the pandemic of moral distress and angst associated with enforcing visitation restrictions, as this burden falls to bedside clinicians.

As this study included six Māori whānau, it is important to understand Māori customs and practices around dying and death. Tikanga is “the set of beliefs associated with practices and procedures to be followed in conducting the affairs of a group or an individual... coming from the accumulated knowledge of generations of Māori”.<sup>19</sup> According to Mead,<sup>19</sup> in Māori culture a person becomes increasingly tapu as death approaches. Tapu is the most important personal, spiritual attribute. There are therefore important traditional practices and procedures around the person who is dying and upon their death. In Moeke-Maxwell et al,<sup>20</sup> pre-pandemic research on bereaved families’ perspectives of end-of-life care, a bicultural Whare Tapa Whā palliative care model is recommended. They note that the “Indigenous model (Whare Tapa Whā) was applicable to both Indigenous and non-Indigenous experiences of end-of-life care for those in advanced age”. Mason Durie’s Te Whare Tapa Whā model, which encompasses the physi-

cal (Taha tinana), the spiritual (Taha wairua), the psychological (Taha hinengaro) and family needs (Taha whānau), finds common ground with a holistic palliative model of patient care and their whānau.<sup>21</sup> With a bicultural understanding similar to the above,<sup>19,20,21</sup> the CCDHB Whānau Care Service offered their support to all patients in the hospital during Levels 3 & 4, irrespective of their cultural affiliation.

## Method

Seventy patients died in Wellington Hospital in the period under Alert Levels 3 & 4. Of these, 20 died under General Medicine, the largest group of patients under a particular service. Six patients identifying as Māori also died in this period, and their whānau were also invited to participate in the study.

Next of kin for these 26 patients were contacted by telephone to explain the study. Email or postal written consent was obtained. A range of interview options were offered: days, evenings or weekends; in person, Zoom or telephone; with one or more whānau members; in te reo or English. Whānau were asked to describe their experiences of their relatives dying in hospital, which were recorded and transcribed. Kaihautū (leader) assisted in interviews with six Māori whānau. Interviews were undertaken July to August 2020 with a mean length of 16 minutes and 33 seconds, and ranging from 10 minutes and 45 seconds to 29 minutes and 6 seconds.

The research method draws on a qualitative, descriptive approach with an inductive approach to analysis. This method was deemed appropriate as it is especially amenable to obtaining minimally theorised answers to questions of special relevance to practitioners and policymakers.<sup>22</sup> Inductive analysis<sup>23</sup> was considered to be most suited to this research as it allowed extensive and varied raw data text to be condensed into a brief, summary format.

Data collection and analysis occurred concurrently. Following verbatim transcription, the transcripts were read and analysed to identify emerging codes, themes and categories (FM, SD).<sup>24-26</sup> To avoid potential investigator bias and to validate the findings, all transcripts were reviewed by a third researcher (CG). FM maintained a reflective diary, bracketing potential bias, and discussed the research process regularly with the senior researcher (SD). Ideally, recruitment continues until data saturation, but in this case maxi-

mum recruitment occurred at the beginning as the number of patients who had died was established. Inductive thematic saturation was also achieved where saturation is based on the number of new codes or themes emerging.<sup>27</sup>

Qualitative research studies investigate a specific issue or phenomenon in a certain group, of a focused locality in a particular context, and hence generalisability of qualitative research findings is usually not an expected attribute.<sup>28</sup> In line with that, it cannot be assumed that the findings of this study represented the experiences of all families in New Zealand. However, they may credibly reflect the experiences of many families, given the high participation rate of 22/26 families. Ethical approval was granted by the University of Otago Health Research Ethics Committee – H20/073. Participants were identified by P with sequential numbering; MP was used to indicate Māori whānau. Families and friends were referred to as whānau.

## Results

Of the selected 26 deceased patients, two families declined participation and two families were unable to be contacted. Thus, a total of 22 next of kin were interviewed. The demographics for the deceased patients are summarised in Table 1. Two of the inpatient deaths occurred during COVID-19 Alert Level 3 and 20 deaths occurred during COVID Alert Level 4. Only one of the 22 patients was positive for COVID-19 (SARS-CoV-2 PCR).

Several themes emerged from the transcripts. Some of the experiences related to general nursing care rather than specific COVID-related care. Positive and negative experiences relating to the COVID-19 pandemic period are summarised in Table 2 and Table 3, respectively.

Positive experiences included better access in the hospital environment as compared to residential care facilities, excellent clinical care and gratitude for receiving telephone calls from the research team. For many of the families, it was advantageous to be transferred from a residential care facility to the hospital at the end of life because of stricter RVPs in the residential care facility. The telephone call from the research team was perceived as an extension of bereavement care provided by the hospital.

Negative experiences related to clinical care, the patient being alone at the time of death, poor communication from the treating team, delays in turn-around-time of COVID-19 test results and the door screening process for visitors. Limita-

tion of access to visitation was a major theme identified in the study. Video visits by Zoom for whānau were used in ICU for the patient who died of COVID-19, but not offered for patients dying on the wards.

Although the CCDHB had a RVP, some families perceived that they got in “by sneaking in”, by accompanying the ambulance staff, being fortunate in having a particular doctor advocate for them or being on particular wards and by having younger nurses in attendance who were more relaxed about the rules. From the families’ descriptions, there did not appear to be a cohesive application of RVP between the different wards.

Two participants (MP21 and P1) suggested making access at the front door easier by giving the family of a dying patient “a laminated red card so they wouldn’t be embarrassed (by being asked repeatedly); maybe separate table like when you go to the polling booth, for those people that are in the process of passing away”.

Table 4 summarises experiences described by Māori whānau. Themes included compliments regarding clinical care, being rushed to leave resulting in their relative being alone and issues specific to their cultural preferences, eg karakia, having staff familiar with tikanga and assistance from Whānau Care Services.

**Table 1:** Demographics of deceased patients (n=22)

<b>Ethnicity</b>	
NZ European	14
Maori	6
Samoan	2
<b>Gender</b>	
Female	10
Male	12

**Table 2:** Positive experiences described by participants

<b>Theme</b>	<b>Participant</b>	<b>Quote</b>
Hospital allowed more access to visit than a residential care facility	P7	<i>It was a blessing in disguise for us (to be admitted to hospital) because it was the only way we could physically see him. Level 4 gave us time to grieve as an immediate family. We didn't have to worry about funeral arrangements, just be here for each other and the icing on the cake was just for mum to see him.</i>
	P13	<i>When the lockdown came through, at the rest home, we were blocked from going to see him. It was fortunate he was in the hospital and we were allowed to have the day with him before he passed. So from my end, I'm at peace that I had a day plus with my dad before he passed.</i>
Gratitude for the research	MP21	<i>Thank you very much for actually doing the hard yakka and the difficult job of actually talking to people, to try and make it better for the next round.</i>
	P13	<i>Thank you for making this call, and asking us. This means a lot. It just means that you are looking at ways in which you can do things differently. That's just really positive, so thank you.</i>

**Table 3:** Negative experiences described by participants

<b>Theme</b>	<b>Participant</b>	<b>Quote</b>
Being alone at the time of death	P5	<i>Sad she died alone. That was the hard part about it. I just feel guilty, I just feel kind of sad that she was alone, that could have been done differently.</i>
	P13	<i>We planned that she would stay with Dad, and then she was told to leave, and no one was with Dad. So that was really hard, just really hard. He passed only hours after she left. If one of us could have been with him at the end that would have meant everything to us.</i>
Communication	P17	<i>Well if they couldn't let me in, they should have been ringing me and telling me. I wanted to know how he was and they wouldn't ring me and tell me that information, unless he had a dramatic change. Either way they wouldn't ring me and that was really hard.</i>
	MP23	<i>She needed me. They said they would tell me when something changed. They never rang me. I rang them three or four times.</i>
	P17	<i>They said 'We haven't got time to ring anybody' and I was really angry about that. That was what the doctor said. In the end the consultant confirmed that at the meeting: 'Well my doctors can't be ringing everybody'. That was it.</i>
Turn-around-time for COVID-19 test result	P8	<i>My sister came in and my daughter. They got to wave at her through the door. I realised that you had to test everybody, but if the test had been done quicker, we could have spent more time with her.</i>
	MP24	<i>They told me it would take 12 hours. I started ringing as soon as it got close to 12 hours. I kept ringing the hospital saying: 'my sisters need to get in there'. Third time they told me she didn't have COVID and that my sisters could go in. Fifteen minutes later, they rang me saying she had gone. They didn't get there in time. It was obvious she was not going to make it. It is hard, and it was hard leaving her.</i>
Door screening process for visitors	P1	<i>Perhaps making the access more accessible, every time I went in there, I had to be asked the same questions: Who are you? Where are you going? Why are you here? That was quite disturbing because I was stressed anyway.</i>

**Table 3** (continued): Negative experiences described by participants

<b>Theme</b>	<b>Participant</b>	<b>Quote</b>
Access to visiting	P1	<i>The access was quite difficult from that time (Level 3). I insisted that I get to see him. I spoke to the nurses on the ward. I said: ‘Look he is dying. This is my last opportunity to spend time with him. I want to be here and I’m not leaving until you let me do that.’ They were fine with that. They were excellent. I wasn’t rude but I was insistent and they knew the situation and they let me in.</i>
	P4	<i>When Level 4 kicked in, they made it very plain to us that we couldn’t stay with him and one of his daughters went right off her head at that stage.</i>
	P8	<i>It’s so very, very raw to us because I had a great relationship with my mother and she was my best friend. Just putting yourself in our perspective as a family it was very difficult. Definitely, our grieving was worse—not being able to be in there with her and actually spend the time was actually the hardest.</i>
	P11	<i>One of the nurses was holding dad’s hand and you’re just watching (by Zoom), you’re going: ‘God, I wish I could get there’. So it was probably one of the most difficult things I’ve had to go through in my life. I think it’s always difficult saying goodbye to a parent, but not being there, that’s just really hard.</i>

**Table 4:** Experiences described by Māori whānau

<b>Theme</b>	<b>Participant</b>	<b>Quote</b>
Excellent nursing and medical care	MP21	<i>The nurses on the ward are just angels, are amazing and the doctor that dad had, he was so lovely. When he came back to make sure that he was dead it was nice that he took the time to explain ‘this is what I need to do’. He did it so calmly and nicely and politely.</i>
	MP22	<i>Exceptional, respecting care to the last moment. The hospital was beautiful. We were looked after on Ward 7 beautifully. Whānau Care were contacted if needed and were available if needed. Absolutely amazing.</i>
	MP26	<i>The care in the hospital, from the nurses, was absolutely brilliant. Like they were amazing. They were very caring and they tried their utmost. It was two Māori ladies, they just knew the protocol for us. It really was (a help) because they understood where we were coming from.</i>
Insufficient time	MP23	<i>Everyone was like ‘okay see you later, you have to go’ and I didn’t feel any compassion or empathy from anybody in there really, until the last nurse, she was awesome. She was the kindest, most compassionate.</i>
	MP26	<i>We just found that it was really rushed, we didn’t get time to dress her ourselves. We didn’t get time to really say goodbye. I know that is because of the COVID—it just made things a hell of a lot harder. I rang the funeral parlour and they were cremating her then and there. So we didn’t even get to do that either; just made things a hell of a lot harder. It breaks your heart to watch your niece sit outside the funeral home for two weeks nearly every day with her children so that she was closer to her mum.</i>
Visiting restriction	MP23	<i>We told the ICU staff we don’t leave our people alone like this. Not having the support, it was quite hard. It was quite lonely.</i>
	MP24	<i>I didn’t want to leave her. At a young age we all looked after each other as kids growing up so we looked after our mum as well, but to lose her in a situation where she had to die with no family around, it was really hard for me to be the one to leave her.</i>
Whānau care support	MP23	<i>I wasn’t informed of them. [Whānau were not aware of the Whānau Care Services who could have helped organise transport of the body back to Hawkes Bay. Nor were they offered the opportunity to assist with washing and dressing her mother after she died].</i>
	MP26	<i>Would have helped, because we would know that they know all things that we would want to happen, like dressing her and doing the karakia; that they would have probably made it a little bit easier for the daughter.</i>

## Discussion

This COVID-19 lockdown research provided us with an opportunity to look at what recently bereaved people need. Our conversations show their needs were not much different to what people always need when their relative is dying in hospital.<sup>1-4</sup> The inconsistent practice regarding access to the hospital may have been due to the difficulty in filtering information down to staff as the RVP changed rapidly. The high response rate to our telephone calls and the gratitude expressed by participants demonstrated the value of hospital follow-up for bereaved whānau.

The hospital services usually offered to bereaved families were not offered to the families we spoke to. The Te Wai symbol usually placed on the door where a patient has died, and subsequently offered to families to take home, as well as the ward bereavement quilts normally used to cover the mortuary trolley, were all removed. The CCDHB Te Wai bereavement symbol is a reminder of the respect and solemnity that the death of a person requires in an acute service. The bereavement quilt, which is also part of the CCDHB Te Wai process, covering the metal mortuary trolley (previously described by families as a “meat van”)<sup>2</sup> adds dignity to the transfer of the patient’s body to the mortuary. These practices were suspended during Levels 3 & 4 due to the perceived risk of infection.

Whānau Care Services were offered to only one of the six Māori whānau. The Whānau Care team’s offer to support all families was communicated by way of the CCDHB intranet, but clinical staff seemed unaware of this offer. Experiences of Māori whānau in this study supports the importance of workforce initiatives that reflect the demographics and cultures of our community. As Moeke-Maxwell et al<sup>20</sup> have said “culture is a useful framework to understand peoples’ unique needs and is particularly relevant for those nearing death”. The significance of these practices was highlighted by the efforts of MP26’s niece (see Table 4) not to abandon her mother’s body at the funeral home, which is consistent with tikanga.<sup>19,20,21,29,30</sup> One of the important traditional Māori practices is the unbroken accompaniment of the dying person and the body. The RVP adversely affected these practices. Other tikanga practices including washing the body, use of water for blessing the room and recitation of karakia were offered to some but not all Māori whānau in this study. As in our study, Moeke-Maxwell et al<sup>20</sup> found that

acts of kindness from health professionals helped to soften the experience of bereavement, as did the accompaniment of the dying by family or by a health professional, and being able to stay with the older person when they were dying.

Our findings, in a country where deaths during lockdown were mostly not COVID-related, mirror the findings in countries where COVID-19 deaths were common. The needs that emerged for family members in a similar Italian study<sup>31</sup> included the need for information, the need for reassurance, to be listened to and supported, to preserve a relationship with their loved ones, and the need to be supported in the grieving process. Lissoni et al<sup>31</sup> describe how telephone conversations from physicians at least once a day and at an agreed time kept families informed. Borghi et al<sup>8</sup> recommend telephone call follow-ups to families after the death, describing a telephone-based early psychological intervention by clinical psychologists to families of hospitalised patients who died with COVID-19, two or three days after the death and one week to two months later to prevent or treat complicated grief.

Exploring the importance of palliative care in the COVID-19 pandemic, Wynne et al<sup>6</sup> remind us that: “palliative care is a field defined by its ability to face some of the darkest and most frightening aspects of life and still preserves our hope and humanity.” In the COVID-19 pandemic, palliative care has received unprecedented levels of societal attention. Unfortunately, this has not been enough to prevent patients from dying alone or to enable relatives to say goodbye. Fadul<sup>32</sup> says that palliative care considerations needed to be incorporated into COVID-19 pandemic planning: one of which is bereavement support for family members who are likely to be isolated from patients at the moments of death.

Andrist<sup>33</sup> notes that RVP has been widely implemented as a means of decreasing the transmission of COVID-19: “This must not be the only good that quality healthcare must aim to achieve. Severely RVP undermines our ability to provide FCC particularly at end of life and during critical illness. The enforcement of these policies consequently increases the risk of moral distress and injury for providers”. Feder<sup>34</sup> surveyed bereaved families and concluded that communication between patients, families and healthcare teams at the end of life remains critically important during RVP. The importance of establishing final contact before the patient died was highlighted by Hanna et al.<sup>35</sup> Strategies include prioritising virtual con-

nectedness and creating alternative opportunities for relatives to say goodbye. Wallace et al<sup>15</sup> state that: “we cannot underestimate the power of sitting alongside a loved one as they die, having a shared space to reflect on life and a relationship and a real chance to say goodbye”. Plunkett et al<sup>36</sup> describe the RVP as “draconian health service rules” placing an immediate and ongoing burden on clinicians and families alike, negatively impacting the quality of dying with the sole visitor at the bedside being without the comfort of a companion. They highlight the moral injury suffered by clinicians enforcing severe restrictions and conclude that one size does not fit all during a global crisis.

We recommend that specific plans related to care of patients dying from COVID-19 and non-COVID-19 illnesses, care of the deceased and care of their whānau throughout the process—including bereavement—be established and prioritised in hospital pandemic policy. Plans should include the provision of access cards for whānau of dying patients; daily telephone/Zoom communication with an update by the doctor for whānau; e-mailing of photos of doctors/nurses and the room to whānau; allowing two people rather than one at the bedside; establishing a bereavement whānau coordinator to keep in touch with whānau of dying patients; and follow-up telephone calls to whānau after the death. Tikanga around dying

and death for Māori whānau must be known, understood and accommodated. During a pandemic, cutting back on support structures for the dying and bereaved will cause significant distress and harm. Reflecting on experiences of whānau will enable us to create wiser, more compassionate policies now for future pandemic situations.

#### Limitations of this study

Although New Zealand’s death rate from COVID-19 was low, we adopted hospital RVPs similar to many countries. For that reason, exploring families’ experiences in New Zealand provides valuable information.

We restricted our research to patients who died under General Medicine as the principal researcher is a General Medicine physician. In addition, General Medicine had the largest percentage of deaths. We recognise that the experience of families on other services may be different, for example oncology or surgical wards.

As this was collaborative research with the Whānau Care team, we identified in addition six Māori patients who died during that period. We did not purposefully seek out other cultural groups such as Pacifica peoples. We did this because, in response to the rapidly changing status of the pandemic, the Whānau Care team rapidly adapted its service delivery highlighting the importance of patient whānau centred care for all during and after death.

**COMPETING INTERESTS**

Nil.

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# A Delphi exercise with rheumatologists to identify consensus on essential components of a rheumatology service in district health boards of Aotearoa New Zealand

Hamish Nigel Gibbs, Rebecca Grainger

## ABSTRACT

**AIM:** To identify consensus of rheumatologists on components of best practice rheumatology service in district health boards (DHB) in Aotearoa New Zealand (AoNZ).

**METHODS:** A consensus survey of rheumatologists in AoNZ was informed by an initial survey inviting modifications to statements about best practice rheumatology from international literature and requested additional statements. The three-round consensus email exercise asked rheumatologists to indicate their level of agreement with each statement for a DHB serving a small or large population. Consensus for each statement was achieved when ≥80% of participants' votes were within a pre-determined category (essential, potentially desirable, to be avoided).

**RESULTS:** Ten rheumatologists reviewed the 19 initial statements with three additional statements offered—the consensus survey had 22 statements. Twenty-six rheumatologists responded in the first consensus round, with 21/26 (81%) responding in rounds two and three. After three rounds, 16 statements met consensus as essential for both small and large DHB rheumatology services. One statement met consensus as potentially desirable for a large rheumatology service. Five statements did not reach consensus.

**CONCLUSIONS:** The component statements identified by consensus can inform policy and implementation of rheumatology services in the AoNZ health system reforms and be used for benchmarking.

Rheumatology is a medical specialty dedicated to the assessment and management of acute and chronic rheumatic diseases. Rheumatologists are trained to provide expert medical care for people with inflammatory arthritides, like psoriatic and rheumatoid arthritis, and systemic immune diseases, such as systemic lupus erythematosus and vasculitis. The management of these rheumatic diseases is often complex, and care for people with active disease requires frequent review, with defined patient-care goals and ideally a multidisciplinary approach.<sup>1</sup> Rheumatic diseases also have potential for significant morbidity, and even mortality, highlighting the need for specialist care.<sup>2,3</sup>

There are many guidelines that describe the evidence-based components of care for people with different rheumatic diseases aiming to achieve optimal health outcomes. These address many aspects

of care including diagnosis and pharmacologic management, frequency and type of clinical care events, and the contribution of specific healthcare professionals (HCP) such as nurses, occupational therapists, psychologists and physiotherapists.<sup>4-10</sup> These guidelines could inform essential requirements of an evidence-based rheumatology service that provides care to optimise health outcomes for people with rheumatic disease.

In Aotearoa New Zealand (AoNZ), most rheumatology care is provided in the public health system, delivered in district health boards (DHBs), although there is a significant contribution from private practice.<sup>11</sup> Over the last 20 years, the reported number of full-time equivalent rheumatologists in public and private practice has been well below recommendations.<sup>11, 12</sup> There is also significant variation in the rheumatologists per capita between DHBs.<sup>11, 12</sup> Other aspects of rheu-

matology services provision, such as access to other HCPs, what services are provided by the HCP, and how these are organised, has not been reported. In addition, there are not yet agreed or recommended service benchmarks for what a rheumatology service should provide in DHBs. Benchmarks might include types of HCPs available, what types of care should be provided by these HCP, and how often.

The aim of this study was to identify consensus from rheumatologists on components of a best practice rheumatology service in DHBs in AoNZ, using an online Delphi consensus approach.

## Methods

### Setting and sample

Potential participants were members from the Fellow of the Royal Australasian College of Physicians (or equivalent), practicing under the scope of “rheumatologist”, who were members of the New Zealand Rheumatology Association (NZRA) as of December 2020. These rheumatologists were considered the clinical experts in comprehensive care of people with rheumatic disease.

### Identification of statements from literature

The first iteration of the Delphi exercise was an ideas generation survey, to determine statements for consensus voting. The National Institute of Health and Care Excellence (NICE) guideline for the management of rheumatoid arthritis in adults 2019,<sup>13</sup> and the NICE quality standard for rheumatoid arthritis in over 16's 2020,<sup>14</sup> were the primary sources for statements describing components of care in an optimally delivered service for care of people with rheumatoid arthritis, the most common form of autoimmune inflammatory arthritis. NICE is part of the Department of Health in the United Kingdom and develops quality stands and performance metrics for the commissioning and provision of healthcare.<sup>15</sup>

Additional statements were sourced from a recent systematic review of quality measures for inflammatory arthritis<sup>16</sup> generated by the researchers, or adapted from guidelines found in searches of major international rheumatology guideline groups pertaining to different aspects of delivery of evidence-based care in rheumatology.<sup>17,18,19</sup> The wordings of the statements were adapted slightly for consistency. Two additional statements were added to address the principles of the Treaty of Waitangi/Te Tiriti o Waitangi and

addressing the aim to achieving equitable health outcomes for Māori.

### Data collection

An invitation email was sent, independently of the researchers, to NZRA members in December 2020. This contained a link to an initial online survey using Qualtrics that included all the statements describing components of a best practice rheumatology service. For each statement, participants could offer free text comments. Participants were also asked for free text offering additional statements to be included in the consensus rounds. The two authors reviewed feedback, refined initial statements, and added suggested statements. The finalised list of statements was included in a consensus survey tool for the Delphi exercise.

The consensus survey link was emailed to NZRA members, independently of the researchers. Baseline, non-identifying demographic data were collected from each participant. Participants were asked to rate their agreement with each statement as it applies to the delivery of a rheumatology service in a “small DHB” and a “large DHB”. A seven-point Likert scale was used for each statement (Anchors 1 = strongly agree, 7 = strongly disagree), as well as an “I don't know” option. A small DHB was defined as having a catchment population of less than 250,000 people, and a large DHB, a catchment population of greater than 250,000 people (Supplementary Table 1).<sup>20</sup>

The consensus survey had three rounds. After the first round only participants who had responded in full were invited to round two. For second and third rounds, only statements that had not yet met consensus were rated. Participants were provided a table summarising the distribution of the group's ratings from the previous round and asked to re-rate each remaining statement. A reminder email was sent to non-responding participants after a week, and a further week was given to complete the survey round. Participants remained anonymous to each other throughout.

### Data analysis

A statement was determined to have met consensus when ≥80% of respondent's votes were within one of three pre-determined categories:

- Either 1 (strongly agree), or 2 (agree)—consensus met to be considered as an essential component of rheumatology service delivery
- Either 3 (somewhat agree), or 4 (neither)

agree nor disagree)—consensus met to be considered as a potentially desirable, but non-essential component of rheumatology service delivery

- Either 5 (slightly disagree), 6 (disagree), or 7 (strongly disagree)—consensus met to be considered as a component to be avoided in rheumatology service delivery.

The  $\geq 80\%$  level for consensus is consistent with previous definitions of consensus in Delphi exercises.<sup>21</sup> Ratings of “I don’t know” were excluded from the denominator. The median rating and an accompanying interquartile range (IQR), which is equal to the difference between the 25th and 75th percentiles, were calculated for each of the statements when they met consensus, or at the end of the final round of the survey.

### Ethics

The study protocol was approved by the University of Otago Human Ethics Committee (D20/0257). Consent was obtained electronically before participation in the initial survey and first round of Delphi survey.

### Results

The NZRA invited 76 potential participants. There were ten respondents to the initial survey of the proposed 19 statements. Four statements (statements 2, 3, 16, 19) were refined or amended on the basis of feedback received (Supplementary Table 2), and three were added (statements 20, 21, 22) leading to a total of 22 statements the consensus survey (Table 1).

The first round of the consensus survey had 30 responses, with four responses excluded as the survey was incomplete ( $n=3$ ), or the respondent was not rheumatologist ( $n=1$ ). The characteristics of the 26 respondents are in Table 2. Almost 2/3 (16/26, 61.5%) of participants were employed by a large DHB. Five participants in the first round did not provide an email address for participation in rounds two and three. All remaining 21 participants completed rounds two and three.

In the first consensus round, consensus was reached for nine statements (9/22, 40.9%) as essential service components for a small DHB rheumatology service, and fourteen statements (14/22, 63.6%) as essential service components for a large DHB rheumatology service. In the second round, seven further statements met consensus to be considered as essential for a small DHB service, and a

further two statements for a large DHB service. In the third and final round, one further statement gained consensus to be considered as potentially desirable, but non-essential, for a large DHB service. After three rounds, the same 16 statements (16/22, 72.1%) describing best practice components of a rheumatology service had met consensus to be considered essential for both small and large services (statements 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 19, 21). One statement had met consensus to be considered potentially desirable, but non-essential, for a large DHB service but not for a small DHB service (statement 15). Of these 17 statements, 13 were derived or adapted from guidelines in the literature. The remaining five statements failed to reach consensus for any of the pre-determined agreement categories (statements 4, 17, 18, 20, 22). There were no statements that met consensus to be avoided in rheumatology service delivery.

### Discussion

In this Delphi consensus exercise rheumatologists in AoNZ agreed on 16 statements describing components of a best practice rheumatology service to be considered as essential in both large and small DHB rheumatology services. One statement met consensus to be considered as potentially desirable, but non-essential, for a large DHB rheumatology service only. Most of the statements that met consensus (13/17, 75%) were sourced or adapted from existing rheumatology service recommendations.<sup>13, 14, 22–26</sup> Only one statement derived from guidelines, relating to receiving advice within one working day of contacting a rheumatology service (statement 4), failed to reach consensus. Three researcher/rheumatologist-generated statements also reached consensus as essential (14, 19, and 21). These attempted to encapsulate typical aspects of a rheumatology service that were not described in the literature and one related to the Treaty of Waitangi/Te Tiriti o Waitangi and equitable health outcomes for Māori (statement 19). Statement 19 met consensus to be considered an essential component of a rheumatology service in round two. This is of particular importance, given there is known inequity in health outcomes for some chronic rheumatologic conditions, for example gout, amongst Māori and Pacific communities in AoNZ.<sup>27</sup>

Three of the statements that failed to meet the  $\geq 80\%$  agreement required for consensus for any of the pre-determined categories (statements 4,

18, 20) were rated 1, 2, 3 or 4 on the seven-point Likert scale by >90% of participants, indicating the majority of rheumatologists deemed these services to be of at least “neutral” importance. Further understanding of the circumstances in which, and for whom, these service elements are important is required. For example, statement 20 related to the use of Telehealth in rheumatology, which has become more relevant during the COVID-19 related restrictions on health service delivery. While there are limited empiric data evaluating the use of telemedicine in rheumatology,<sup>28</sup> it has been adopted in emergency situations in AoNZ and provided adequate rheumatology service delivery, at least in the short term.<sup>29</sup> Since Telehealth has been proposed as a mechanism to expand reach of a limited rheumatology workforce, the implementation of Telehealth in rheumatology services, where clinically appropriate, probably warrants further consideration, even if not considered essential at this time.<sup>30</sup>

Some statements may have not reached consensus due to differences in views on scope of DHB rheumatology services in AoNZ. Statement 17, relating to provision of assessment for non-inflammatory conditions, did not reach consensus. This is consistent with previous report that only 43% of public practice rheumatologists in AoNZ accepted referrals for non-inflammatory conditions such as fibromyalgia.<sup>11</sup> In contrast, 97% of rheumatologists in private practice accepted referrals for non-inflammatory conditions. This might suggest that lack of consensus relates to differences in views on scope of DHB rheumatology services in the setting of resource constraint, rather than scope of rheumatology practice per se. There was also no consensus to consider discharging clinically stable patients with chronic rheumatic disease to primary care (statement 22) as either potentially desirable or essential. This may capture the tension between the best practice of longitudinal care of people with inflammatory rheumatic disease in specialist clinics, and the limited capacity of these services. The model of “shared-care” arrangements with primary care and rheumatology has been considered previously in the United Kingdom for stable patients with inflammatory arthritis.<sup>31</sup> Such models may require further refinements in models of collaboration between primary and secondary care in

AoNZ, which are not yet adequately established.

Almost all statements of best practice care that reached consensus as essential did so for both large and small DHB rheumatology services. The only exception was statement 15, relating to the combined specialist clinics, which was not deemed essential for a small DHB service. This likely reflects the challenges of combining clinics in DHB with overall fewer specialists, perhaps also with more general scope of practice, or absence of a smaller specialties in small DHBs. It also highlights that rheumatologists expect that people of AoNZ should get access to a similar quality and scope of rheumatology care whether they reside in the catchment of West Coast DHB (~32,000 catchment population) or of Waitematā DHB (~630,000 catchment population).<sup>20</sup> These views are consistent with the vision for the New Zealand health system reforms in which excellence in care delivery includes “consistent high-quality care everywhere”.<sup>32</sup> Studies similar to this one may assist in describing what excellent care for the people of AoNZ requires.

This study has some limitations. About 1/3 (26/76, 34%) of eligible rheumatologists in AoNZ participated, so findings may not represent of the views of all rheumatologists in AoNZ. However, the response rate is in the acceptable sample size for a Delphi exercise.<sup>33, 34</sup> Furthermore, the majority of participating rheumatologists (61.5%) practiced in large DHBs, who may not fully understand the contexts for small DHBs. This study also collected the views of only one stakeholder in rheumatology service delivery, the rheumatologist. It would be important in future research to elicit views of other stakeholders, particularly users of rheumatology clinics, the patients.

In conclusion, this study has identified that 16 best practice components of a rheumatology service are considered essential in DHB rheumatology services by rheumatologists, regardless of size of DHB catchment population. These recommendations could be used to inform the development of services in Health New Zealand when this is established in July 2022 and developed into benchmarking standards for rheumatology services. The views of users of rheumatology services in DHB in AoNZ on these best practice components and other aspects of care that are important to them also need to be explored.

**Table 1:** Final list of statements for consensus survey

<b>Statement</b>	<b>Source</b>
1. Patients with active rheumatoid arthritis should be offered the opportunity to commence conventional disease-modifying anti-rheumatic drug (DMARD) therapy (e.g., methotrexate, sulfasalazine, hydroxychloroquine), within six weeks of referral to a rheumatology service.	NICE <sup>14</sup>
2. Patients with active rheumatoid arthritis should be monitored 3-monthly, using a composite score such as DAS-28 CRP/ESR, until their treatment target is met.	NICE <sup>14</sup>
3. Patients with chronic rheumatic disease should have access to a rheumatology service to support coordinating their care (e.g., with a rheumatology nurse specialist or rheumatologist).	NICE <sup>13</sup>
4. Patients with chronic rheumatic disease and disease flares, or possible treatment-related side effects, should receive advice within one working day of contacting a rheumatology service.	NICE <sup>14</sup>
5. Patients with chronic rheumatic disease should have access to a nurse for education.	EULAR <sup>22</sup>
6. Patients with chronic rheumatic disease should have access to a nurse-led telephone service for ongoing support.	EULAR <sup>22</sup>
7. Specialist rheumatology nurses should participate in comprehensive disease management of chronic rheumatic disease.	EULAR <sup>22</sup>
8. Within an outpatient rheumatology clinic, a specialised rheumatology nurse should have their own consultations with chronic rheumatic disease patients.	Van Hulst <sup>23</sup>
9. Patients with chronic rheumatic disease, and difficulties with activities of daily living (ADLs), or hand function, should have access to specialist occupational therapy, and/or hand therapy.	NICE <sup>13</sup>
10. Patients with chronic rheumatic disease and active foot problems should have access to podiatry assessment and ongoing review.	NICE <sup>13</sup>
11. Patients with chronic rheumatic disease should have access to specialist physiotherapy, with periodic review.	NICE <sup>13</sup>
12. A rheumatology service should have timely access to musculoskeletal imaging, including ultrasound and magnetic resonance imaging (MRI), to aid in the diagnosis and management of inflammatory arthritis.	Researchers adapted from EULAR <sup>24</sup>
13. Patients with chronic rheumatic disease who suffer from pain issues, should have access to a qualified health professional who specialises in chronic pain management (e.g., specialist pain management physician or psychologist).	Researchers adapted from EULAR <sup>25</sup>
14. A rheumatology service should include an infusion unit for the delivery of specialist-prescribed intravenous medications (eg infliximab, tocilizumab, rituximab), which is supervised (directly, or at a distance) by a member of the rheumatology service.	Researcher generated
15. A rheumatology service should aim to involve other specialists in “combined clinics”, where the management of chronic disease spans across different specialties (e.g., combined clinics with dermatology or ophthalmology).	Researcher generated
16. A public rheumatology service should involve at least one full time equivalent (FTE) rheumatologist per 80,000 people within the served population.	Researchers adapted from RCP <sup>26</sup>
17. A rheumatology service should provide outpatient assessment for patients with non-inflammatory musculoskeletal conditions, such as fibromyalgia and osteoarthritis, when specialist input is sought by primary care.	Researcher generated

**Table 1 (continued):** Final list of statements for consensus survey

<b>Statement</b>	<b>Source</b>
18. A rheumatology service should be supported in undertaking health equity assessments, using tools such as the Health Equity Assessment Tool, at appropriate time intervals.	Researcher generated
19. A rheumatology service should have a plan for implementing and evaluating processes that aim to achieve equitable health outcomes for Māori and other priority groups, as appropriate.	Researcher generated
20. Patients under the care of a rheumatology service should be offered telephone or video follow-up consultations, providing it is clinically appropriate to do so.	Rheumatologist generated
21. Healthcare professionals providing care to patients with chronic rheumatic disease, admitted to a public (DHB) hospital, should be able to access inpatient review by a member of the rheumatology service that the patient's care falls under, if requested and clinically appropriate.	Rheumatologist generated
22. Patients with chronic rheumatic disease who are clinically stable, and have a clear treatment plan, should be considered for discharge to primary care for ongoing follow-up without ongoing need for rheumatology service input (apart from administrative responsibilities, such as endorsement for methotrexate).	Rheumatologist generated

Abbreviations: EULAR = European Alliance of Associations for Rheumatology;  
NICE = National Institute of Health and Care Excellence; RCP = Royal College of Physicians.

**Table 2:** Demographic characteristics of round one consensus survey participants

<b>Round 1 respondents (n=26)</b>	
<b>Practice location in DHB population estimate</b>	
<100,000 people	2 (7.7%)
100,000–250,000 people	5 (19.2%)
>250,000 people	16 (61.5%)
Not applicable (e.g., private practice/locum)	3 (11.5%)
<b>Years' experience as a rheumatologist</b>	
<10 years	6 (23.1%)
10–20 years	11 (42.3%)
>20 years	9 (34.6%)
<b>Full time equivalent in rheumatology practice</b>	
0–0.2	4 (15.4%)
0.3–0.4	10 (38.5%)
0.5–0.6	5 (19.2%)
0.7–0.8	5 (19.2%)
0.9–1.0	2 (7.7%)

**COMPETING INTERESTS**

The authors declare that they are both employees of District Health Boards in New Zealand. Rebecca Granger is a rheumatologist. Hamish Gibbs did this study when he was an advanced trainee in Rheumatology. He is now a Physician employed at Hawke's Bay DHB. The authors do not believe these are potential or actual competing interests.

**ACKNOWLEDGEMENTS**

The authors thank Associate Professor William Taylor for support in survey distribution to members of the New Zealand Rheumatology Association. We also thank Professor Nicola Dalbeth for feedback on the survey instrument and all the rheumatologists who participated in the Delphi.

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[www.nzma.org.nz/journal-articles/a-delphi-exercise-with-rheumatologists-to-identify-consensus-on-essential-components-of-a-rheumatology-service-in-district-health-boards-of-aotearoa-new-zealand](http://www.nzma.org.nz/journal-articles/a-delphi-exercise-with-rheumatologists-to-identify-consensus-on-essential-components-of-a-rheumatology-service-in-district-health-boards-of-aotearoa-new-zealand)

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## Supplementary Tables

**Supplementary Table 1:** District Health Board population data, 2018 estimates

District Health Board	Population estimate
<i>Northland</i>	179,370
<i>Waitematā</i>	628,970
<i>Auckland</i>	545,640
<i>Counties Manukau</i>	563,210
<i>Bay of Plenty</i>	238,380
<i>Waikato</i>	419,890
<i>Lakes</i>	110,410
<i>Tairawhiti</i>	49,050
<i>Taranaki</i>	120,050
<i>Hawke's Bay</i>	165,610
<i>Whanganui</i>	64,550
<i>MidCentral</i>	178,820
<i>Capital and Coast</i>	318,040
<i>Hutt Valley</i>	149,680
<i>Wairarapa</i>	44,905
<i>Nelson-Marlborough</i>	150,770
<i>West Coast</i>	32,410
<i>Canterbury (including Chatham Island)</i>	567,870
<i>South Canterbury</i>	60,220
<i>Southern</i>	329,890
<b>Total</b>	<b>4,917,735</b>
<b>Mean</b>	<b>245,887</b>

*Ministry of Health, Manatū Hauora:* <https://www.health.govt.nz/new-zealand-health-system/my-dhb>

**Supplementary Table 2:** Amendments made following first iteration of survey

Final statements for consensus survey	Amendments (if any) made following first iteration of survey
<i>Statements identified from literature:</i>	
2. Patients with active rheumatoid arthritis should be monitored 3-monthly, using a composite score such as DAS-28 CRP/ESR, until their treatment target is met. <sup>15</sup>	<i>Statement initially described “monitored monthly”—changed to 3-monthly following majority of feedback disagreeing with 1-monthly; majority felt 2–3 months was adequate.</i>
3. Patients with chronic rheumatic disease should have access to a rheumatology service to support coordinating their care (eg with a rheumatology nurse specialist or rheumatologist). <sup>14</sup>	<i>Statement initially stated “named member of MDT”—this was generalised to “rheumatology service” to avoid issues with reliance on single health care professional.</i>
<i>Statements added by researchers</i>	
16. A public rheumatology service should involve at least one full time equivalent (FTE) rheumatologist per 80,000 people within the served population.	<i>Statement initially read “at least one FTE rheumatologist per 100,000 people”, amended after respondents referenced quoted figure of 1 in 86,000 from the Royal College of Physicians.<sup>12</sup></i>
19. A rheumatology service should have a plan for implementing and evaluating processes that aim to achieve equitable health outcomes for Māori and other priority groups, as appropriate.	<i>Statement initially referenced Māori only—amended to include additional priority groups.</i>

# Update on Canterbury Charity Hospital Trust activities 2013 to end of 2020: adapting to changing unmet secondary elective healthcare need.

Philip Bagshaw, Lynne Briggs, Susan Bagshaw, Vivienne Levy, Carl Shaw, Averill Williamson, Anita Tuck, Alice Brown

## ABSTRACT

**AIM:** To update activities of the Canterbury Charity Hospital (CCH) and its Trust over the eight-year period 2013 to end of 2020, following previous reports in 2010 and 2013.

**METHOD:** CCH continued to provide free secondary elective healthcare services to some patients in the Canterbury Distinct Health Board (CDHB) region who were unable to access healthcare they needed through public hospitals and were unable to pay for private care. CCH's services were supplied by a large volunteer workforce, supported by a skeleton staff, and were financed solely by charitable giving. Changes occurred periodically in the quantity and nature of regional unmet healthcare need, largely due to changes in services provided by the CDHB. In order to accommodate these changes, major structural and infrastructural developments were necessitated at CCH.

**RESULTS:** Many healthcare services at CCH remained the same as before this period but new changes occurred there as a result of: (i) establishment of a flexible sigmoidoscopy day clinic for the management of fresh rectal bleeding in those under 50 years of age; (ii) requirement for a sudden increase in counselling services immediately after the terror attacks at Christchurch mosques; (iii) expansion of the Dental and Oral Surgery Service; and (iv) interruption of CCH service provision by the COVID-19 pandemic.

**CONCLUSIONS:** CCH continued to fill some of the regional unmet elective healthcare need. This is, however, a national problem as attested by the presence of a charity hospital in Auckland and another being planned for Invercargill. Hopefully present and future governments will appreciate that free universal access to secondary elective healthcare is not only a humane imperative, but also a sound economic investment.

It is now generally accepted that there is a large amount of unmet healthcare need in Aotearoa New Zealand. This unmet need often goes unrecognised and is not only due to inadequate accessibility to, and quality of, healthcare services but also to much wider problems of poverty, colonisation, racial discrimination and other aspects of socio-economic deprivation.<sup>1,2</sup> Regarding secondary elective healthcare, many younger people are unable to access care for non-life threatening problems such as groin hernias that affect their ability to work, and many older people cannot have care such as cataract surgery that allows them to function socially and independently.

As described in more detail elsewhere,<sup>3,4</sup> following the failed New Zealand Health Reforms of the 1990s, the Canterbury Charity Hospital Trust (CCHT) was formed in 2004. The objective of this

charity was to meet some of the increases in this unmet healthcare need for the people of Canterbury District Health Board (CDHB) region. The vision of the CCHT was: (i) to provide free secondary elective healthcare for some of those who were refused care in the public health system, did not have medical insurance (personal or through the national Accident Compensation Corporation scheme) and could not afford private healthcare; (ii) for the care to be provided by a largely volunteer workforce; and (iii) for the charity to be funded solely by public charitable giving.<sup>5</sup> The objective and vision have not changed.

To meet the vision of the CCHT, an old family villa was purchased in the Bishopdale area of Christchurch in 2005 (Building One; Figure 1) and, with major funding from the Ron Ball Charitable Trust and public donations, converted into a mod-

ern day hospital, the Canterbury Charity Hospital (CCH), with facilities for contemporary medical, surgical and other health services. The clinical services provided by the CCH changed with time, in an attempt keep in step with the areas of clinical need that were not adequately addressed by the local public healthcare system. At the time of the Christchurch earthquakes, a large counselling service was started; in 2011 the adjacent property was purchased (Building Two; Figure 1) to accommodate the counselling and to allow the introduction of a dental and an endoscopy service.

The CCH has been well received by the general public. It has never been short of people willing to work in Medical, Nursing, Technical, Administrative and as other volunteers. These people have been managed and supported by a small skeleton staff of employees. It has never taken government contracts or been paid for any of its services. Generous funding has always come from the general public, local community groups and numerous individual philanthropic organisations and individuals.

## METHODS

**Figure 1:** Aerial photograph of Canterbury Charity Hospital Trust properties 2020.



Corner of Harewood Road and Leacroft Street, Christchurch—CCHT properties encircled in red.

Building One (Ron Ball House, 349 Harewood Road)—Main operating theatre and recovery ward, clinical examination rooms and offices.

Building Two (Patsy Mauger House, 351 Harewood Road)—Endoscopy unit, counselling rooms, lecture/staff room and offices.

Building Three (Warner Mauger House, 353 Harewood Road)—Twin oral surgery units, community room, and administration offices.

Buildings Four and Five (66b Leacroft Street and 355 Harwood Road)—both for future developments.

## Chronology of main events

The main clinical planning, developments, structural and infrastructural changes, and fund-raising events during the eight-year period from the beginning of 2013 to the end of 2020 are listed in the timeline (Table 1).

Between May and November 2016, the CCHT Board was increased from four to six members. From then, the board comprised: a general surgeon; an adolescent health physician; a lawyer; a businessperson; a retired anaesthetist; and a colorectal surgeon. CCHT has always had an independent Clinical Board, which has remained at arm's length from the Trustee Board. Its membership remained diverse, consisting of: the CCHT executive officer; two GPs, a dentist; a retired anaesthetist; a clinical psychologist; a senior nurse; a Māori advisor and an Anglican vicar. It has given advice on clinical issues such as eligibility of patients for treatment, changes to service provision, research and credentialing approvals. Incident reporting and all complaints were also heard by the Clinical Board for both their advice and decisions.

Staff employee numbers changed very little (Table 2). Spontaneous volunteer workers came

**Table 1.** Chronology of some main events.

February 2013	CCHT received Vice-regal patronage from Governor-General Sir Jerry Mateparae
February 2013	Celebrity Fundraising Visit—Sir Cliff Richard
March 2013	Celebrity Fundraising Visit—Kevin Milne
May 2015	Major donations from Mauger Charitable Foundation allowed purchase of: (i) Building Four (Figure 1) for future development; and (ii) Building Three (see below)
July 2015	Official opening of Building One (Ron Ball House; Figure 1) recovery room extension, theatre upgrade and alterations by Sir Jerry Mateparae
November 2015	Commencement of Vascular Venous Surgical Service
May 2016	Purchase of Building Three (Warner Mauger House; Figure 1) for expansion of Dental & Oral Health Services
May 2016	Reintroduction of Ophthalmic Services in conjunction with a private provider Christchurch Eye Surgery
May 2016	Decision to increase board of Trustees to six members. Full board complete by November with three new members
February 2017	Building Three opened with twin Oral Surgery units. Officially opened by Sir Jerry Mateparae. Oral Surgery moved from Building Two (Patsy Mauger House)
July 2017	Collaborative FS rectal bleeding service commenced with CDHB and initially with St Georges Hospital; also CRC screening for 59 year olds from low decile areas*
November 2017	Celebrity Fundraising Visit—Chris Harris, Richie McCaw and Fergie McCormick
February 2018	Burnham Camp Army Dental Surgery Unit started helping CCHT provide services
February 2018	CCHT awarded Community of the Year at New Zealander of the Year Awards
December 2018	Urology Services commenced
March 2019	Major expansion of Counselling Services with additional volunteer counsellors immediately following the Christchurch terror attacks
March 2019	Upgrade of dental X-ray facility with the installation of an OPG machine
May 2019	Purchase of 355 Harewood Road completed (Building Five; Figure 1) as provision for future development
November 2019	Celebrity Fundraising Visit—Shaun Wallace (Dark Destroyer)
Nov/Dec 2019	Assistance started for the development of the Southland Charity Hospital Trust
December 2019	Educational videos for patients on what endoscopies are like—with Jason Gunn
2012 to 2019 incl.	Ongoing studies into long-term psychological effects of Canterbury earthquakes

**Table 1 (continued):** Chronology of some main events.

March 2020	COVID-19 pandemic lockdown started. CDHB & CCH staff made preparations for possible use of CCH as small isolation unit or overflow ICU. Planning done to expand Endoscopy Unit and bring up to GESA Standards <sup>6</sup>
May 2020	CCH not required for use by CDHB; services returned as alert levels reduced
July 2020	Major donation from Reid estate
July 2020	Presentation at Alternative Aotearoa Conference on work of CCHT to address health inequity <sup>7</sup>
November 2020	Renovations of Endoscopy Unit (Building Two) complete; normal Endoscopy Services resumed
November 2020	Breast Milk Service started. Run and supported by Rotary; Information Technology support provided by CCHT

FS: flexible sigmoidoscopy; CRC: colorectal cancer; \*to be reported separately; OPG: Orthopantomogram X-ray machine; GESA: Gastroenterology Society of Australia.

**Table 2:** Numbers of volunteers and employees active each year by the end of 2020.

Staff	2005 to 2012 incl.	2013	2014	2015	2016	2017	2018	2019	2020
<b>Nurses</b>	73	57	42	41	39	36	47	29	48
<b>Anaesthetists</b>	24	16	18	14	12	11	7	5	4
<b>Physicians</b>	11	0	0	0	0	0	0	1	0
<b>Surgical Specialists</b>	34	21	24	20	19	28	19	22	21
<b>Dentists/Dental Assistants</b>	34/26	29/22	12/14	11/13	11/12	31/12	13/11	11/12	18/6
<b>Counsellors/ Psychologists</b>	58	7	5	4	5	5	31	32	6
<b>Technicians</b>	12	5	5	5	4	4	5	3	3
<b>Non-medical</b>	86	27	58	52	52	49	68	57	46
<b>Part time employees</b>	2	3	3	3	4	4	3	2	3
<b>Full time employees</b>	4	1	1	1	1	1	1	2	2

from a pool, which averaged about 280 people over the eight-year period. Their individual work commitments at CCH varied greatly. Some worked there every week and others only several times a year. The staff comprised: a full-time executive officer, and senior nurse; two part-time nurse specialists; and a part-time fundraising person.

The CCH facilities and services were extensively developed during the eight-year period to meet the changing and increasing unmet secondary elective healthcare needs of the CDHB region (Table 1). In 2015, the operating theatre and post-operative recovery room in Building One were comprehensively upgraded and expanded. In 2016, an adjacent property (Building Four; Figure 1) was purchased for future development. Another adjacent property (Building Three; Figure 1) was purchased, extensively renovated and opened in 2017 with twin oral surgical units. Dental and oral surgery was then moved there from Building Two.

## Finances

The part-time fundraiser and a small support committee of volunteers organised a programme of annual and special fundraising activities. These included: regular appeals in local media, sometimes enhanced by publicised visits to CCH by national and international celebrities; lectures to community groups; an annual dinner and other community events; donations from charitable trusts; and applications to philanthropic trusts. Other funding sources included bequests and returns from investments.

The influence of social media and the phasing out of cheques by the major banks, meant there were some changes in the sources of funding for the CCHT. However, much funding still came from middle-aged and elderly members of the community, and the rates of charitable donations did not change significantly. As a result of the CCHT Board, Management's careful financial stewardship, and the relatively small staff budget, the average proportional expenditure over the eight-years period for patient treatment and running costs was 89% of budget, with only 7% for fundraising and 4% for fixed costs.

## Relationships with local healthcare organisations

Based on CCHT's general utilitarian philosophy and specific role to address as much of the unmet

need as possible, it endeavoured to foster and strengthen working relationships with other local healthcare providers. To these ends, it had a Memorandum of Understanding with the CDHB since 2008. It also shared ownership of some surgical equipment as follows: orthopaedic equipment with Southern Cross Hospital; gynaecology equipment with Christchurch Women's Hospital; and eye equipment with Christchurch Eye Surgery, Papanui.

## RESULTS

### Clinical throughput

The types of clinical services and the numbers of cases assessed and treated at CCH changed over the eight-year period (Table 3). The onsite services included: General Surgery, Audiology (facilities only provided by CCHT), Orthopaedics, Urology, Gynaecology & Family Planning, Dentistry, Oral Surgery, Vascular Surgery, Lower Gastrointestinal (GI) Endoscopy, Counselling and Dietician Services. The offsite services included Ophthalmic Surgery, and Dermatology. Dermatology open-day clinics were run on a Saturday in 2017, 2018 and 2019 at CCH. At these members of the public were able to have skin lesions assessed by specialist dermatologists and any suspicious lesions were automatically accepted for treatment by the CDHB. Unfortunately, COVID-19 restrictions prevented the possibility of holding such a clinic in 2020.

What services CCH offered at any particular time was largely dictated by changes made by the CDHB to which services it was providing, and by what workforce and physical resources were available to CCH to fill the emergent deficiencies. For example, CCH started an elective groin hernia repair service when it opened in 2007, as such surgery was not routinely offered by the CDHB. However, the CDHB then restarted doing such surgeries in late 2016, with many of the cases done under contracts with private healthcare providers, so CCH stopped providing this routine service.

Most patients were referred directly to CCH by their GPs when the service was not available through the CDHB. In these circumstances, GPs were usually advised to do so through their computerised patient management system (called Health Pathways by the CDHB). For some CCH clinical services, however, other specific referral processes were in place (*vide infra*).

Table 3: Numbers of interventions and outpatient visits.

<b>Numbers of interventions by specialty</b>	<b>2005–2012 incl.</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Category totals (all years)</b>
Counselling	1784	388	462	337	401	335	163	1039	256	5165
Dental	285	487	328	270	411	418	475	603	338	3615
Gynaecology	205	99	95	120	99	101	100	64	36	919
Endoscopy	17	35	27	36	31	335	434	426	274	1615
General Surgery	868	202	150	141	138	61	51	36	38	1685
Orthopaedic	166	41	80	116	44	26	43	24	10	550
Urology	36	20	31	17	6	0	8	21	8	147
Audiology	0	0	31	118	98	125	114	114	154	754
Ophthalmic	54	0	1	6	8	10	9	5	1	94
Vascular	36	0	0	8	19	31	0	7	0	101
Dermatology	8	0	0	0	0	179	265	114	0	566
<b>Intervention totals</b>	<b>3459</b>	<b>1272</b>	<b>1205</b>	<b>1169</b>	<b>1255</b>	<b>1621</b>	<b>1662</b>	<b>2453</b>	<b>1115</b>	<b>15211</b>
Initial consultations	1564	351	364	334	270	156	140	136	148	3463
Outpatients—other	1002	219	290	390	284	153	210	274	184	3006
<b>Outpatient totals</b>	<b>2566</b>	<b>570</b>	<b>654</b>	<b>724</b>	<b>554</b>	<b>309</b>	<b>350</b>	<b>410</b>	<b>332</b>	<b>6469</b>
User totals—cases plus outpatients	6025	1842	1859	1893	1809	1930	2012	2863	1447	21680

## Patient numbers and profiles

During the eight-year period (Table 3), there were 3,903 outpatient appointments and 11,752 interventions performed for patients (39.78% male, 57.36% female, 2.86% unspecified; mean age of 54.0 years, range <1–97 years; n=8,520). Ethnicity proportions were as follows: African 0.45%; Asian 3.10%; Australian 0.07%; NZ Māori 10.20%; Pākehā/NZ European 78.24%; Pasifika peoples 4.84%; South American 0.84%; Middle East 0.97%; Other 1.29%.

## Clinical outcomes

CCH always invited all forms of, and routes for, comments about its clinical services. In particular, all patients were invited to take part in an anonymous satisfaction survey, but few took the opportunity to do so. The survey asked six questions on satisfaction with specific peri-consultation /interventional instances of care, and one question on overall satisfaction with patient experiences at CCH. Responses were registered on a five-point Likert scale of 1 (poor) to 5 (excellent). A random sample of 77 survey responses, taken from the period 2017 to 2020, showed scores of 4 and 5 by 11.36% and 88.20%, respectively for specific instances of care, and 3.90% and 96.10%, respectively for overall satisfaction (n=77). All significant issues raised in the surveys or by other routes were addressed immediately or, if necessary, brought to the attention of the Clinical Board.

During the eight-year period there were very few peri-procedural or 30-day complications. One operative case was terminated at the beginning of surgery because of a patient ventilatory problem—recovery was complete. Post-operatively, there was one wound infection (Grade II) and there were three cases with pain management issues (Grade I).<sup>8</sup>

## Specific clinical services

### Endoscopy Service

Since the CCH opened in 2007, local GPs referred cases of outlet-type rectal bleeding and other anorectal symptoms for management. In order to fully investigate these cases, a second operating theatre equipped for lower GI endoscopy was added in Building Two in July 2012, and has been mainly used for this purpose since then.

In May 2017, CCHT was approached by CDHB and requested, along with St Georges Hospital Christchurch, to help by providing a flexible sigmoidoscopy (FS) service for the management of patients less than 50 years of age with outlet-type rectal bleeding. The reasons for this request were:

(i) emerging national and international data showing an appreciable increase in the incidence of colorectal cancer (CRC) in such young patients;<sup>9</sup> and (ii) CDHB did not have the capacity to investigate these patients with endoscopy.

The service was started at CCH in July 2017, and St Georges Hospital helped with provision of the service for the first 10 months. Patients were referred from the CDHB and from local GPs via Health Pathways. After a one-day bowel preparation, patients underwent un-sedated FS and were discharged immediately afterwards. By the end of 2020, 759 patients (381 male, 374 female, 4 not specified; mean age of 36.64 years, ranging 15–79 years) had a FS (32 at St Georges Hospital; 727 at CCH), performed by 15 volunteer endoscopists. Among the findings were eight patients with CRCs and 212 with colorectal polyps; 74 of the latter had tubular adenomas or serrated polyps and required appropriate follow-up. Were it not for this rectal bleeding service, diagnoses of some of these colorectal pathologies would have been unduly delayed with serious prognostic consequences. Patients with CRC and serious colorectal pathology were referred back to CDHB; those with haemorrhoids and other benign causes for rectal bleeding were treated at CCH. In the absence of any relevant national or international guidelines, it was debatable which patients required a follow-up completion colonoscopy. Some local endoscopists thought the findings of advanced polyps or serrated lesions were necessary to merit such follow-up;<sup>10</sup> others thought the presence of any colorectal polyps was sufficient cause. To resolve this issue, advice was sought from a group of international experts. Recommendations for criteria for completion colonoscopy were formulated and published<sup>11</sup> and have since been implemented as the minimum required standards at CCH.

During the described eight-year period at CCH, a colonoscopy service was provided. This was for patients who had a previous FS at the CCH, with findings that indicated the need for completion colonoscopy, and those that had been declined by the CDHB for symptomatic investigation, as they did not meet the prioritisation threshold. Patients were referred on to CDHB after colonoscopy if: (i) their pathological findings indicated the need for inclusion in a regular surveillance programme; or (ii) there was significant pathology needing treatment beyond what CCH could offer, such as large lesions needing endoscopic mucosal resection or operative surgical treatment. The quality of the colonoscopy service at CCH from 1 October 2016

to 31 September 2017 was independently audited. The findings were that this service was safe and complied with the accepted quality indicators.<sup>12</sup>

FS is a quick, relatively safe and economic investigation. It is, however, uncomfortable for some patients. For this reason, modifications were tried in pre-procedure patient information systems and intra-procedural processes, with the objective of improving the experience for everyone having lower GI endoscopies. The whole Endoscopy Unit was upgraded in 2020 to improve the patient facilities and to comply with new GESA guideline standard for endoscope cleaning and storage, which came into effect in February 2022.<sup>6</sup>

### Dental and Oral Surgical Service

There was a high demand for the Dental Services provided at the CCH, with the number of people needing dental treatment increasing all the time. There are subsidies and grants available from Work and Income New Zealand (WINZ) for emergency care and relief of pain for low-income adults to allow them to be treated in the community by both private dentists and the Dental Department of Christchurch Hospital. However, this WINZ benefit did not cover the cost of routine dental care.

Since June 2012, CCH has offered treatment for the WINZ beneficiaries who have been referred from local dentists and who might not have otherwise been able to access necessary dental care. These people could no longer be treated at the Dental Department of Christchurch Hospital for routine dental care because of changes to the criteria for admission. The treatment needed could be complex and difficult, and the patients themselves often presented with complicated medical, psychiatric and social issues. They were a vulnerable population group, with great needs for treatment that were financially out of their reach.

During the eight-year period, dental surgeons and assistants volunteered their time and expertise, providing a total of 3,833 dental treatments at an average of 2.5 service sessions a week. The dentists offered a single course of treatment for adult WINZ beneficiaries (who had exhausted their annual \$300 WINZ dental grant) to get them "dentally fit". Treatments offered included check-ups, cleans and periodontal treatment, extractions, root canal treatment on front teeth and fillings. Complex oral surgery extractions were done using intravenous sedation. More recently nitrous oxide sedation was introduced, making routine dentistry much easier for many of the patients who suffered from anxiety and had

a deep fear of dental treatment. The efficiency of the dental service was significantly improved by the purchase and installation of an Orthopantomogram X-ray machine in March 2019.

Between 2013 and 2019, nine dental technicians from three companies staffed a denture clinic at CCH once a fortnight. Here, they provided full and partial dentures to those in need. The denture service was suspended in 2020 as a result of the COVID-19 pandemic.

### Counselling—Terror attacks

Around the time of the Canterbury earthquakes on 22 February 2011, CCH started a free counselling service for self-referred people and those referred by healthcare, social and care workers. This service continued afterwards but slowly reduced with time in numbers of referrals. As a consequence of the previously established local counselling networks and the nimble way CCHT was accustomed to reacting to change, in March 2019, following the terrorist attacks at the Christchurch mosques, the CCH was able to immediately ramp up its counselling service. This offered help to victims, their families and others who felt they needed support dealing with the mental and psychological impact of the shootings—it involved an extra 13 counsellors. While little is known about the effectiveness of therapeutic interventions in the recovery phase of disasters, it is recognised that, although immediate support is very important, it also allows for people experiencing more extreme reactions to be quickly identified, assessed and referred for further assistance as required.

There were 999 appointments for counselling between 15 March and September 2019. Most were terror-attack-related but, as all counselling records are strictly confidential, the total numbers of counselling sessions could not be classified by reason for referral, types of counselling received or of what methods were used.

### Effect of COVID-19 pandemic

The COVID-19 pandemic started in New Zealand with the first case on 28 February 2020. The pandemic had a serious impact in reducing the volume of work that could be done at CCH during the extended periods during which the hospital was unable to open. At the time of the initial lockdown period on 15 March, CCHT management started consulting with CDHB and followed Ministry of Health (MoH) advice as indicated.

Discussions were held with CDHB. It was suggested that, if the pandemic accelerated rapidly,

CCHT might be used as either a small isolation unit or as an overflow unit for cases needing ventilation. An assessment was made of the equipment and facilities at CCH, including the number of patient ventilators. A non-DHB hospitals COVID-19 reaction group was set up. This was coordinated by the CDHB and met on the internet (Zoom) most days of the week during the Level 4 lockdown to discuss plans, exchange ideas and update everyone with events. As the pandemic did not escalate, CCH remained in lockdown until MoH recommendations changed to Level 2 on 13 May 2020. Then CCH gradually returned to normal levels of clinical activity but implemented precautions as outlined by the MoH for general situations and by the Dental Council of New Zealand, in regard to Dental and Oral Surgery.

### Clinical research

During the eight-year period, CCHT undertook and published some original clinical research. One important component was a research project to assess the efficacy of the counselling service offered to the Christchurch earthquake victims in 2011. During 2017–2020, a randomised sub-sample of 60 (15% male, 85% female; mean age of 53.67 years, SD=15.5, ranging 14–91 years) from the 858 patients who had attended the counselling service between 2011–2012, were contacted and interviewed to ascertain how helpful the counselling had been. The number of sessions attended ranged from 1–20 (mean=3.28) with anxiety, low mood, sleep disturbance, earthquake trauma, stress and difficulties coping as the main presenting problems. While a small number were dissatisfied with the number of sessions offered, and

not having a choice in the gender of their counsellor, the large majority found the counselling very helpful.

The Short Form 36 Health survey (SF-36) was used to assess the patients' psychological wellbeing at the time of interview.<sup>13</sup> Table 4 shows the CCH sub-sample SF-36 subscale scores were considerably lower than the SF-36 participant scores in the 2006/07 New Zealand Health Survey. This suggests the patients attending the CCH Counselling Service were significantly less well than the general population at the 95% confidence level. These findings are supported in the study by Spittlehouse et al (2014),<sup>14</sup> where it was found that 212 participants, aged between 45–54 years and living in post-earthquake Christchurch, also had significantly lower scores on the mental health and wellbeing scales of SF-36 compared to 2006/07 national data.

CCHT staff and volunteers undertook and published other clinical research including: a survey of outcomes for open mesh repair of inguinal hernia at CCH;<sup>16</sup> a pilot study of methods to assess unmet secondary healthcare needs in New Zealand;<sup>17</sup> and a report on Southern DHB's colonoscopy service.<sup>18</sup> They also published on a number of healthcare issues including: the importance of measuring unmet healthcare need;<sup>19,20</sup> variation in policies for management of inguinal hernias;<sup>21,22</sup> adequacy of public healthcare funding;<sup>23,23</sup> physician advocacy in the twenty-first century;<sup>25</sup> the code of rights and bowel cancer screening;<sup>26</sup> enhanced bowel screening by FS;<sup>27</sup> effects of Neoliberalism on healthcare;<sup>28</sup> towards a better world after COVID-19;<sup>29</sup> and adequacy of publicly funded colonoscopy services in New Zealand.<sup>30</sup>

**Table 4:** Comparing CCHT SF36 subscale scores with the New Zealand Health Survey.

<b>Scale scores</b>	<b>New Zealand Health Survey 2006–07<sup>15</sup></b>			<b>CCHT Sample 2011–2012</b>		
	<b>Mean</b>	<b>SD</b>	<b>95% CI Mean</b>	<b>Mean</b>	<b>SD</b>	<b>95% CI Mean</b>
Emotional limitations	93.7	15.0	93.3–94.1	58.63	44.00	47.26–70.00
Energy fatigue-vitality	64.0	18.4	63.4–64.4	48.67	20.06	43.83–53.85
Mental health– emotional wellbeing	82.2	13.2	81.9–82.7	71.65	19.99	61.32–71.65

(Frieling et al, 2013, Table 4, 28)<sup>15</sup>

## CONCLUSIONS

It became clear at the time of the Health Reforms of the 1990s, that there was a large amount of chronic unmet need for secondary elective healthcare in Aotearoa New Zealand. This was estimated to be about 9% in the adult population,<sup>17,31</sup> and was undoubtedly higher in Māori and Pasifika communities, and those living in poverty. The CCHT has done extensive research on this subject and made numerous public calls for the quantity and nature of the unmet secondary elective healthcare need to be estimated repeatedly, independently and transparently, using validated population survey techniques.<sup>7,32</sup> However, until recently, successive governments and public health officials have shown little interest in measuring the size of this problem or doing anything substantial to address it. The CCHT was formed with the specific intent of offering as much help to as many of these people as possible to reduce their unmet healthcare needs.

During the eight-year history of the CCHT described in this article, secondary elective services provided by the CDHB changed periodically with time. The CCHT attempted to respond to these changes by trying to fill the moving gap between what the public and private healthcare systems provided. Although CCHT could never address all the unmet need, it was successful in providing quite large numbers of interventions across a diverse range of services, thanks to the unfailing generosity of the Canterbury public and the army of hospital volunteers that worked so tirelessly.

The main changes to the services offered by CCHT since the end of 2012 were: the sudden increased need for counselling after the Christchurch terror

attacks; the expansion of the dental and oral surgery service; and the increased endoscopy service. Most of the other services remained largely unchanged but some, such as general surgery reduced as CDHB reintroduced some elective services. The largest overall influence on the activities of the CCHT was, however, the COVID-19 pandemic, which unfortunately led to periods of closure or reduced services.

One area of improvement was better cooperation between CCHT and CDHB. This was particularly evident in the direct patient referrals from the latter to the FS rectal bleeding service run by the former. There was also cooperation in the organisation of dermatology days by the two organisations. Many possibilities remain, however, for greater future cooperation between them, particularly regarding the use of CCHT facilities, for example, for elective day surgery for low-risk general surgery cases.

The large amount of unmet secondary elective healthcare is not only a Canterbury problem, but actually a national one. This is attested by the fact there has been an Auckland Regional Charity Hospital since 2009, and planning started for a Southland Charity Hospital in Invercargill in 2019. These developments resulted from the humanitarian actions of local communities reacting to the unmet healthcare needs of their fellow citizens. It is earnestly to be hoped that present and future governments awaken to the fact that investment in health is not only a characteristic of a properly functioning society, but it has also been shown to be extremely economically advantageous.<sup>33</sup> If they do not do so, the likely long-term consequence will be "a charity hospital in every town".<sup>34</sup>

Canterbury Charity Hospital: [www.charityhospital.org.nz](http://www.charityhospital.org.nz)

**COMPETING INTERESTS**

Nil.

**ACKNOWLEDGEMENTS**

The authors wish to acknowledge the unfailing generosity of the people of Canterbury and the massive support of an army of volunteer workers.

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# X-ray misinterpretation in urgent care: where does it occur, why does it occur, and does it matter?

Crispian Wilson

## ABSTRACT

**AIMS:** To assess the error rate in plain film interpretation amongst urgent care doctors in the context of minor trauma, to determine where such errors occur and whether they affect patient care, and to identify possible causative factors.

**METHODS:** Five thousand X-ray interpretations occurring between March and August 2021 across six urgent care clinics were included in this retrospective study. Data analysis focused on demographic data, site of injury, the experience of the doctor interpreting the X-ray, and whether any change in management occurred following an error.

**RESULTS:** Six hundred and seventy-three X-ray interpretation errors occurred (13.5%), with 171 of these (3.4%) resulting in a change in patient management. Chest and elbow X-rays were misinterpreted most often. Both the age of the patient and training of the urgent care doctor had a significant effect on this error rate. The main impacts on patient management were cast removal and recall for review in the urgent care centre or an orthopaedic clinic.

**CONCLUSIONS:** X-ray misinterpretation occurs at equivalent rates in urgent care when compared to the emergency department. Errors occur more commonly with paediatric patients and for doctors with less urgent care-specific training. These errors rarely result in any serious impact on patient management.

Within New Zealand, urgent care clinics exist as an effective community-based alternative to the emergency department in certain situations. Operating on a walk-in basis and containing full resuscitation facilities, the urgent care centre is a demanding and high-pressure work environment. A business case (2014) produced by the Auckland After Hours Health Care Network demonstrated over double the number of out-of-hours attendances to urgent care clinics compared to the emergency department.<sup>1</sup> The need to rapidly diagnose a large variety of conditions in this setting may contribute to diagnostic errors. Alongside implications for patient care, missed diagnoses have significant implications for patient satisfaction: identified as the most frequent cause for medical malpractice claims in the United States,<sup>2</sup> most diagnostic errors within the emergency department are linked to cases of minor trauma.<sup>3,4</sup> However, no studies to date have examined the frequency of discrepancies that occur during X-ray interpretation within the context of urgent care, or whether such diagnostic error has a clinically significant impact on patient management. The goal of this study is to establish the X-ray misinterpretation rate in cases of minor trauma that present

to urgent care, where these errors occur, possible factors that contribute to misdiagnosis and whether such errors affect patient care.

## Methods

### Study design

This retrospective study was approved by the network's clinical governance board. As a retrospective audit of clinical care, no ethical approval was needed. Data were collected from six urban North Island practices in New Zealand serving a population of 1.8 million. Two of these facilities are open 24 hours a day seven days a week, with the other four open 0730–2000 or 0800–2000 seven days a week. Four centres are dedicated urgent care clinics and two are hybrid GP and urgent care facilities. Clinics are typically staffed with between two and four doctors, with overnight cover between the hours of 2300–0700 being provided by one doctor at the two 24-hour clinics. Doctors working at these clinics come from a variety of backgrounds; for the purposes of this study, they have been classified as, urgent care trainees (UCT), urgent care fellows (UCF), general practitioners (GP), provisionally registered (PROV) and others (GEN). See Table 1 for an explanation of

these classifications. Typically, PROV or UCT doctors will be paired on a shift with a GP or UCF doctor, allowing junior doctors to discuss films with a more experienced colleague.

Plain film radiography is available in private facilities adjacent to every urgent care clinic, and these are staffed during daytime and/or evening hours depending on the clinic, with one 24-hour clinic also having an on-call radiographer available overnight. X-ray reporting is provided by radiologists working offsite, with an X-ray report available within 72 hours of image acquisition. As a result, urgent care doctors are expected to provide their own interpretation of any X-rays ordered, and to use this interpretation to determine best management. Once reports are generated, these are passed electronically on to the doctor who requested the X-ray, with all results being actioned either by the responsible doctor or another duty doctor within 48 hours.

All clinical record-keeping is done electronically using software that integrates an inbox of patient results, and data collection was performed using this software. The 5000 plain film interpretations included in this study were selected from trauma consultations occurring between March and August 2021 across the six clinics. The X-ray sites were classified as face, mandible, finger, thumb, hand, wrist, forearm, humerus, elbow, shoulder, clavicle, chest, cervical spine, thoracic spine, lumbar spine, sacrococcygeal spine, pelvis, hip, femur, knee, tibia and fibula, ankle, foot or toe. Data were also collected on the following: date and time of consultation; the age of patient; the type of doctor; the doctor's initial interpretation of the X-ray; the radiologist's formal report; and whether any subsequent change in management occurred after the viewing of the radiology report.

**Table 1:** Description of medical classifications.

Group	Description
UCT	Trainees on the Royal New Zealand College of Urgent Care's (RNZCUC) four-year training programme in urgent care.
UCF	RNZCUC fellows who have completed the urgent care training programme
GP	Doctors registered under the Royal New Zealand College of General Practitioners who have completed an approved training programme in general practice
PROV	Doctors holding provisional general registration
GEN	Doctors whose training does not fit into one of the categories above, including those holding general registration

A discrepancy was recorded if the treating doctor's initial interpretation did not agree with that of the reporting radiologist, and this was judged to be a clinically significant discrepancy (CSD) if it resulted in a change of management. Any subsequent follow up or further imaging was also noted.

### Inclusion criteria

Records were included when a patient presented to a clinic following an injury, and received an X-ray with a report subsequently identifiable in the patient inbox. Where multiple X-rays were performed in the context of polytrauma, the interpretation of each X-ray was considered as a single data point.

### Exclusion criteria

Consultations were excluded if either a formal radiology report was present at the time of X-ray interpretation and was therefore substituted for the treating doctor's own interpretation, or if a radiology report was not linked to the patient record.

### Statistical analysis

Results were analysed using Pearson's chi-squared test and Pearson's product moment correlation coefficient. Both were calculated using inbuilt software available on Microsoft Excel.

## Results

Out of 5,000 interpretations analysed, 1,522 of these interpretations (30.4%) involved a paediatric patient, defined as a patient under the age of 15. Interpretations were evenly divided by gender, with 2,465 involving a female patient and 2,535, a male patient.

One thousand three hundred and fifty-four interpretations (27.1%) had an X-ray that was reported as having a positive finding. Six hundred and seventy-three discrepancies occurred (13.5%), with 171 of these judged to be CSDs (3.4%). Out of these discrepancies, there were 390 false positives (57.9%) where an abnormality was identified by the treating doctor but the X-ray was reported as normal, and 225 false negatives (33.4%) where the treating doctor interpreted the X-ray as normal but an abnormality was reported. Additionally, there were 58 cases (8.6%) involving both a false positive and false negative. This occurred where an abnormality was misidentified by the treating doctor at one site, and the radiologist reported a different abnormality at a second site.

Two hundred and thirty-four of the discrepancies and 90 of the CSDs had some form of follow-up or investigation that allowed the accuracy of the original radiology report to be assessed, as indicated in Table 2. For discrepancies, subsequent follow-up or investigation supported the conclusion of the radiologist in 77.8% of cases and that of the urgent care doctor in 16.2% of cases, with the remaining 6.0% suggesting a diagnosis different to that of either party. Figures were approximately the same for CSDs, with subsequent follow up or investigation agreeing with the radiologist 78.9% of the time, the urgent care doctor 18.9% of the time, and neither 2.2% of the time.

The upper limb and lower limb each accounted for roughly half of all X-rays taken (2386 and 2245 interpretations, respectively), with the ankle being the most popular single site to X-ray (946 interpretations). The wrist and finger were the

sites where the most abnormalities were detected (239 and 230 interpretations, respectively), while the clavicle and toe had the highest rates of abnormalities per X-ray performed (55.6% and 48.6%). For sites commonly X-rayed (more than 100 interpretations), the chest and elbow had the highest discrepancy rates in interpretation (24.0% and 23.8%) and false negatives (11.9% and 8.2%), while the elbow and hand had the highest rates of CSDs (8.2% and 6.5%). These results are tabulated in Appendix 1.

Of the abnormalities identified, finger, distal radius and toe fractures occurred most frequently (255, 200 and 148 consultations), while finger, clavicle and toe fractures had the highest likelihoods of being found on performing an X-ray at their respective sites (66.7%, 50.3% and 42.4%). For abnormalities with five or more occurrences in this dataset, lipohemarthrosis, bone tumours and glenoid fractures had the highest miss rates (85.7%, 80% and 80%), while bone tumours, glenoid fractures and patella fractures had the highest miss rates requiring a change in management (80%, 40% and 30.8%). For abnormalities with 20 or more occurrences, elbow effusions, distal tibia fractures and rib fractures had the highest miss rates (31.0%, 30.3% and 28.6%), while scaphoid fractures, proximal humerus fractures and elbow effusions had the highest miss rates requiring a change in management (15%, 11.5% and 10.3%). See Appendix 2 for a more comprehensive illustration of these figures.

With regards to the grade of the interpreting doctor, a discrepancy was most likely to be recorded if a GP made the initial interpretation,

**Table 2:** Types of follow up or further investigation for discrepancies and CSDs.

Follow up/investigation	Discrepancies	CSDs
Ultrasound	3	0
Urgent care review	44	27
Orthopaedic review	13	7
Repeat X-ray	135	43
Operating theatre	3	0
MRI	13	2
CT	23	11
Total	234	90

**Table 3:** Discrepancies by doctor grade.

Grade	Interpretations	Discrepancies	Percentage of total	False positives	Percentage of total	False negatives	Percentage of total
GP	512	87	17.0%	53	10.4%	26	5.1%
PROV	1126	173	15.4%	102	9.1%	52	4.6%
GEN	517	72	13.9%	37	7.2%	26	5.0%
UCT	1099	149	13.6%	94	8.6%	44	4.0%
UCF	1746	192	11.0%	104	6.0%	77	4.4%
Total	5000	673	13.5%	390	7.8%	225	4.5%

**Table 4:** CSDs by doctor grade.

Grade	Interpretations	CSDs	Percentage of total	False positives	Percentage of total	False negatives	Percentage of total
GEN	517	24	4.6%	7	1.4%	15	2.9%
PROV	1126	47	4.2%	20	1.8%	24	2.1%
UCT	1099	39	3.5%	16	1.5%	20	1.8%
GP	512	17	3.3%	7	1.4%	7	1.4%
UCF	1746	44	2.5%	6	0.3%	35	2.0%
Total	5000	171	3.4%	56	1.1%	101	2.0%

**Table 5:** Impact of CSDs on patient management.

Change in management	Total
Cast removed	51
Recalled for urgent care review	37
Referred to orthopaedic clinic	29
Cast applied	18
Discharged from hospital following unnecessary referral	8
Splint/sling applied	8
Referred acutely to hospital	6
Referred to hand physiotherapy	4
Referred to GP	4
Cast changed	3
Operation via emergency list	2
Referred to respiratory clinic	1
Total	171

while the GEN and PROV categories accounted for the most CSDs. UCF interpretations proved to have both the least discrepancies overall as well as the fewest CSDs, as demonstrated in Table 3 and Table 4. The largest amount of variation in error rates between these groups was accounted for by the false positive rates for discrepancies: over 4% variation in this rate was noted on comparing GP to UCF. Less than 2% of variation was explained by training when comparing false negative rates for discrepancies, or false positive and negative rates for CSDs.

Assuming a significance level of alpha = .05 and using Pearson's chi-squared test to assess for goodness of fit, UCF interpretations resulted in significantly fewer discrepancies than PROV ( $P = .00135$ ) or GP ( $P < .001$ ) interpretations as shown in Appendix 3, and significantly fewer CSDs than PROV ( $P = .015$ ) or GEN ( $P = .015$ ) interpretations as shown in Appendix 4. Significantly fewer false positive errors were also made by the UCF group compared to the GP ( $P < .001$ ), PROV ( $P < .001$ ) and UCT ( $P = .00846$ ) groups as demonstrated in Appendix 5.

The age of the patient also influenced the frequency of discrepancies, with significantly more CSDs ( $P < .001$ ) present in the paediatric sample. This can be explained by a significantly larger number of false positives within this group, and no significant difference in the number of false negatives.

The gender of the patient had no significant impact on the frequency of discrepancies or CSDs. The time of consultation also had no significant impact on discrepancy or CSD rate when comparing out of hours (1700–0800) consultations to those occurring during normal working hours.

Of the 171 CSDs, the main impacts on management were removal of casts applied at the initial consult ( $n = 51$ ), recall for review of the injury in the urgent care clinic ( $n = 37$ ), referral to orthopaedic clinic ( $n = 29$ ) and application of a new cast ( $n = 18$ ). A full breakdown of the impact on management is depicted in Table 5.

In only two cases—both involving missed fractures of the hip (see Figure 1)—was a patient referred to hospital for operative management. No complaints were identified that originated from either misdiagnosis or mismanagement.

## Discussion

No data currently exists on error rates among urgent care physicians when interpreting X-rays. However, equivalent studies based in the emergency department estimate the discrepancy rate between emergency physician's and radiologist's

readings as between 1% and 28%,<sup>5–15</sup> with errors that result in a change in management occurring at a rate of between 0% and 9%.<sup>5–15</sup> The findings of this study therefore suggest that comparable error rates exist between urgent care doctors at our facilities and emergency physicians for X-ray interpretation.

In our study, we found that factors contributing to mistakes included whether the patient was younger than 15 years old and the type of doctor interpreting the X-ray, both of which have a significant impact on patient management.

For CSDs amongst paediatric consults, the larger difference in error rate, when compared to the adult cohort, is accounted for by a larger proportion of false positives but the same proportion of false negatives. This suggests that urgent care doctors are more conservative in their interpretation of paediatric X-rays, and do not miss more fractures compared to the adult population—a reassuring result given that a false positive will at worst result in unnecessary immobilisation pending the formal radiology report.

For discrepancies that affected patient management, it is evident that the UCF category made significantly fewer errors compared to the GEN and PROV groups. Within the emergency department, it has been shown that physicians in training are more likely to make interpretive errors compared to those who have completed training.<sup>10</sup> This suggests that enrolment in or completion of a vocational training programme offers benefits in reducing interpretive errors that result in a change in patient management. As noted, while the GP group made mistakes more frequently, this did not translate into a proportionately higher rate of changes to patient management for this group, with GPs in fact having the lowest false negative (or missed abnormality) rate for CSDs.

Previous studies based in the emergency department have identified the foot<sup>15,19</sup> as the most common site of missed fractures, which differs from the results of this study where the chest and elbow accounted for the most frequent discrepancies in interpretation. However, as noted by Wei et al,<sup>19</sup> missed foot fractures in the emergency department typically occur in the context of major trauma, and it would be expected that these patients bypass urgent care clinics.

Our results suggest that the urgent care doctor's initial interpretation may have been correct for a proportion of discrepancies and CSDs. One study on the interpretation of plain film X-rays originating in the emergency department demonstrated

that, on double reading of an X-ray by experienced radiologists, disagreement occurred in 10–12% of skeletal and chest radiographs.<sup>20</sup> Given such rates of interobserver variability amongst radiologists, it is entirely possible that the true discrepancy and CSD rates for this dataset are somewhat lower.

Some of the important missed abnormalities are illustrated in Figures 2–5.

## Conclusion

In this study we found that 13.5% of X-rays reported were discordant with the subsequent report from the radiologist, with 3.4% of these judged to be CSDs. This is similar to the rate in the emergency department setting reported in the literature. In only two cases did patients have acute operative management delayed. In both

these cases, the patients involved were safely discharged following an operation with no complications identified due to delay in their treatment. Furthermore, when a patient was recalled for immobilisation, no cases of subsequent malunion or non-union were identified. While every mistake represents an opportunity for improvement, this suggests an excellent standard of care in the urgent care setting.

Potential avenues for reducing error include having a protocol where X-rays ordered by less experienced doctors are checked by the senior doctor on shift, and urgent care specific education. With regards to the latter, the findings of this study are being incorporated into an online teaching resource with ongoing discussions regarding how best to integrate this into the RNZCUC training programme.

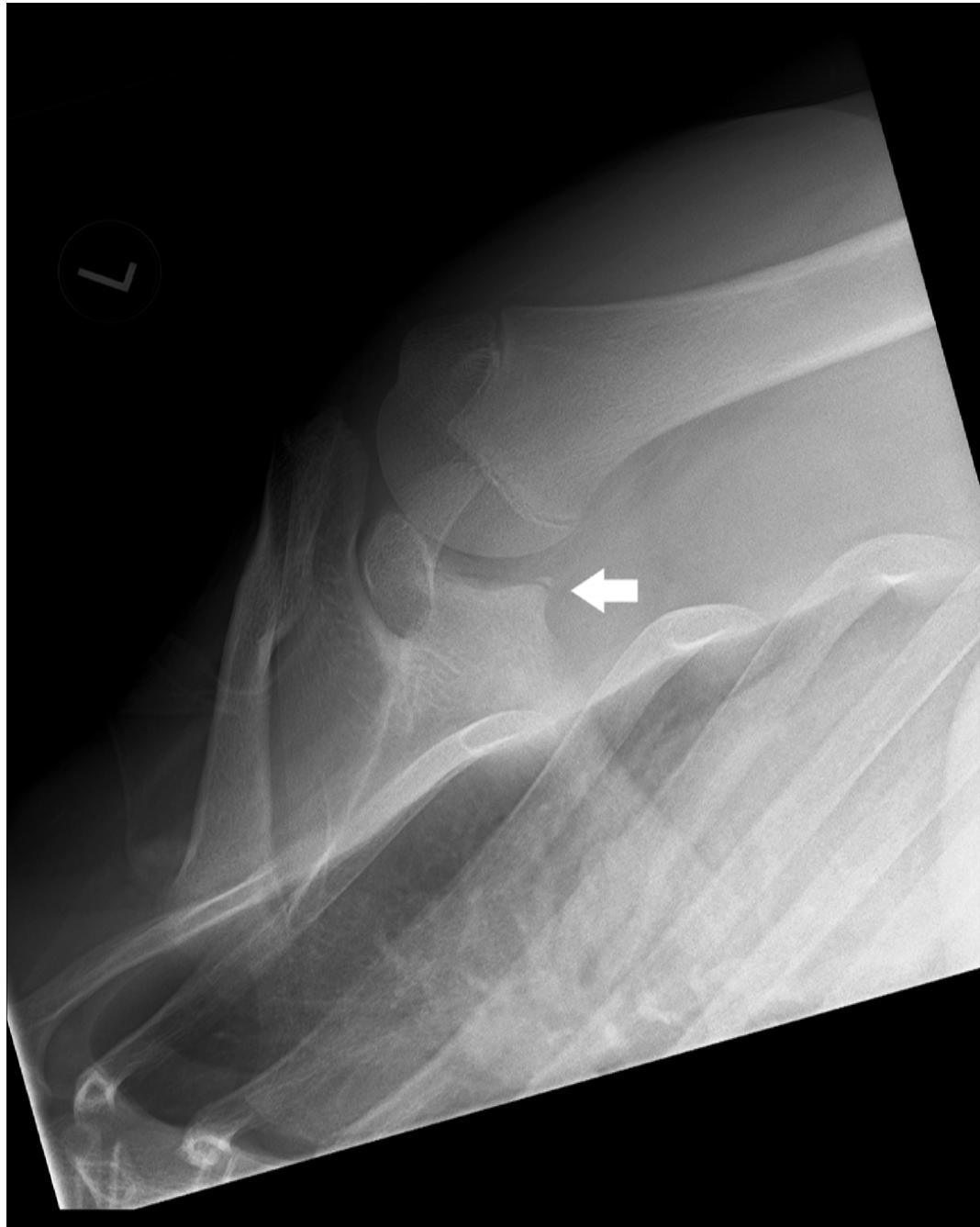


**Figure 1.** Missed left neck of femur fracture.

**Figure 2:** Missed lipohemarthrosis. These are associated with a high probability of an underlying intraarticular fracture. Note the presence of metalwork which distracts the eye from the relevant finding.



Figure 3: Missed glenoid rim fracture. These are associated with injuries of the glenoid labrum and can often lead to chronic instability.<sup>16</sup>



**Figure 4:** Missed elbow effusion. Occult fractures are typically associated with such effusions.<sup>17</sup> Note the subtle elevated anterior fat pad (sail sign).



**Figure 5:** Missed distal scaphoid fracture in the presence of a detected distal radius buckle fracture. This illustrates the problem of satisfaction of search, where a visual search is discontinued once the searcher spots an abnormality and becomes satisfied with the meaning of an image.<sup>18</sup>



**COMPETING INTERESTS**

Nil.

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## Appendices

**Appendix 1:** Findings, discrepancies, false negative discrepancies and CSDs by site.

Site	Total X-rays	Findings by site	Percentage of total	Discrepancies by site	Percentage of total	False negative discrepancies	Percentage of total	CSDs by site	Percentage of total
sacrococcygeal spine	19	4	21.1%	9	47.4%	3	15.8%	1	5.3%
chest	126	40	31.7%	30	23.8%	15	11.9%	6	4.8%
femur	11	3	27.3%	2	18.2%	1	9.1%	2	18.2%
elbow	329	122	37.1%	69	21.0%	27	8.2%	27	8.2%
cervical spine	39	1	2.6%	3	7.7%	3	7.7%	2	5.1%
pelvis	16	4	25%	2	12.5%	1	6.3%	1	6.3%
shoulder	246	58	23.6%	28	11.4%	15	6.1%	10	4.1%
hand	215	88	40.9%	23	10.7%	13	6.0%	14	6.5%
wrist	732	239	32.7%	116	15.8%	38	5.2%	40	5.5%
total	5000	1354	27.1%	673	13.5%	225	4.5%	171	3.4%
finger	601	230	38.3%	87	14.5%	25	4.2%	7	1.2%
ankle	946	160	16.9%	113	11.9%	39	4.1%	23	2.4%
thumb	221	47	21.3%	30	13.6%	9	4.1%	5	2.3%
face	25	4	16.0%	6	24%	1	4%	0	0%
foot	440	96	21.8%	60	13.6%	15	3.4%	15	3.4%
hip	65	6	9.2%	7	10.8%	2	3.1%	2	3.1%

Appendix 1 (continued): Findings, discrepancies, false negative discrepancies and CSDs by site.

<b>Site</b>	<b>Total X-rays</b>	<b>Findings by site</b>	<b>Percentage of total</b>	<b>Discrepancies by site</b>	<b>Percentage of total</b>	<b>False negative discrepancies</b>	<b>Percentage of total</b>	<b>CSDs by site</b>	<b>Percentage of total</b>
knee	432	49	11.3%	28	6.5%	12	2.8%	10	2.3%
clavicle	54	30	55.6%	4	7.4%	1	1.9%	0	0%
tibia and fibula	57	9	15.8%	5	8.8%	1	1.8%	2	3.5%
lumbar spine	66	9	13.6%	7	10.6%	1	1.5%	2	3.0%
toe	294	143	48.6%	42	14.3%	3	1.0%	2	0.7%
mandible	10	4	40%	1	10%	0	0%	0	0%
forearm	31	6	19.4%	1	3.2%	0	0%	0	0%
humerus	11	2	18.2%	0	0%	0	0%	0	0%
thoracic spine	14	0	0%	0	0%	0	0%	0	0%

Appendix 2: Reported abnormalities with corresponding false negative discrepancy and false negative CSD rates

Abnormality	Total	False negative discrepancies	Percentage of total	False negative CSDs	Percentage of total
distal radius fracture	200	14	7%	8	4%
toe fracture	148	10	6.8%	1	0.7%
distal fibula fracture	111	15	13.5%	6	5.4%
P3 fracture (finger)	88	12	13.6%	3	3.4%
metacarpal fracture	87	11	12.6%	8	9.2%
P2 fracture (finger)	84	15	17.9%	3	3.6%
P3 fracture (finger)	83	15	18.1%	4	4.8%
metatarsal fracture	70	14	20%	7	10%
distal ulna fracture	67	14	20.9%	0	0%
proximal radius fracture	51	7	13.7%	3	5.9%
clavicle fracture	36	4	11.1%	1	2.8%
rib fracture	34	10	29.4%	1	2.9%
distal tibia fracture	33	10	30.3%	2	6.1%
distal humerus fracture	30	3	10%	1	3.3%
elbow effusion	29	9	31.0%	3	10.3%
proximal humerus fracture	26	5	19.2%	3	11.5%
scaphoid fracture	20	4	20%	3	15%
foreign body	20	2	10%	1	5%
talus fracture	19	5	26.3%	1	5.3%

**Appendix 2 (continued):** Reported abnormalities with corresponding false negative discrepancy and false negative CSD rates.

Abnormality	Total	False negative discrepancies	Percentage of total	False negative CSDs	Percentage of total
patella fracture	13	4	30.8%	4	30.8%
proximal fibula fracture	13	2	15.4%	1	7.7%
acromioclavicular dislocation	13	2	15.4%	0	0%
proximal tibia fracture	12	4	33.3%	1	8.3%
calcaneus fracture	11	4	36.4%	2	18.2%
proximal ulna fracture	11	4	36.4%	1	9.1%
glenohumeral dislocation	10	0	0%	0	0%
triquetrum fracture	9	4	44.4%	2	22.2%
liphemarthrosis	7	6	85.7%	2	28.6%
Lisfranc injury	7	4	57.1%	2	28.6%
bony lesion	6	5	83.3%	5	83.3%
navicular fracture	6	1	16.7%	1	16.7%
glenoid fracture	5	4	80%	2	40%
lumbar vertebra fracture	5	3	60%	2	40%
cuboid fracture	5	1	20%	1	20%
nasal fracture	5	1	20%	0	0%
pelvic fracture	5	1	20%	1	20%
scapula body fracture	5	1	20%	0	0%
finger dislocation	5	0	0%	0	0%

**Appendix 3:** P values on assessing the significance of differences between total discrepancy rates by doctor grade.

	<b>GP</b>	<b>PROV</b>	<b>UCT</b>	<b>UCF</b>
<b>PROV</b>	0.44	*	*	*
<b>UCT</b>	0.09	0.26	*	*
<b>UCF</b>	<0.001	0.00135	0.054	*
<b>OTH</b>	0.21	0.48	0.85	0.087

**Appendix 4:** P values on assessing the significance of differences between CSD rates by doctor grade.

	<b>GP</b>	<b>PROV</b>	<b>UCT</b>	<b>UCF</b>
<b>PROV</b>	0.41	*	*	*
<b>UCT</b>	0.81	0.45	*	*
<b>UCF</b>	0.33	0.015	0.11	*
<b>OTH</b>	0.28	0.67	0.29	0.015

**Appendix 5:** P values on assessing the significance of differences between false positive rates by doctor grade.

	<b>GP</b>	<b>PROV</b>	<b>UCT</b>	<b>UCF</b>
<b>PROV</b>	0.51	*	*	*
<b>UCT</b>	0.15	0.34	*	*
<b>UCF</b>	<0.001	<0.001	0.00846	*
<b>OTH</b>	0.13	0.27	0.72	0.092

# Simulating the impact of vaccination rates on the initial stages of a COVID-19 outbreak in Aotearoa New Zealand with a stochastic model

Leighton M Watson

## ABSTRACT

**AIM:** The August 2021 COVID-19 outbreak in Auckland caused the New Zealand Government to transition from an elimination strategy to suppression, which relies heavily on high vaccination rates in the population. As restrictions ease and as COVID-19 spreads throughout New Zealand, there is a need to understand how different levels of vaccination will impact the initial stages of COVID-19 outbreaks that are seeded around the country.

**METHOD:** A stochastic branching process model is used to simulate the initial spread of a COVID-19 outbreak for different vaccination rates.

**RESULTS:** High vaccination rates are effective at minimizing the number of infections and hospitalizations. Increasing vaccination rates from 20% (approximate value at the start of the August 2021 outbreak) to 80% (approximate proposed target) of the total population can reduce the median number of infections that occur within the first four weeks of an outbreak from 1011 to 14 (25th and 75th quantiles of 545–1602 and 2–32 for V=20% and V=80%, respectively). As the vaccination rate increases, the number of breakthrough infections (infections in fully vaccinated individuals) and hospitalisations of vaccinated individuals increases. Unvaccinated individuals, however, are 3.3x more likely to be infected with COVID-19 and 25x more likely to be hospitalised.

**CONCLUSION:** This work demonstrates the importance of vaccination in protecting individuals from COVID-19, preventing high caseloads, and minimising the number of hospitalisations and hence limiting the pressure on the healthcare system.

In response to the COVID-19 global pandemic, New Zealand initially followed an elimination strategy that coupled tough lockdowns with strict border controls. The first COVID-19 case was reported on 28 February 2020 and on 19 March 2020 international borders were closed to all but New Zealand citizens and permanent residents.<sup>1</sup> On 25 March 2020, New Zealand moved to Alert Level 4 (Level 4 brings the toughest restrictions in the four-level alert system) with strict lockdown measures including the closure of educational and public facilities along with all non-essential businesses, stay-at-home orders, limits on travel and no gatherings allowed. From 10 April 2020, anyone entering the country had to undergo two weeks of managed isolation and quarantine (MIQ). These measures kept case numbers low with a total of 1504 cases before COVID-19 was declared eliminated in New Zealand on 8 June 2020.<sup>1</sup>

Mandatory quarantine of overseas arrivals has been broadly effective at keeping COVID-19 out

of New Zealand. In the period up to 15 June 2021 there have been 10 border-related reincursions,<sup>2</sup> although these outbreaks were able to be quickly detected and successfully eliminated. On 17 August 2021 a COVID-19 case of the highly transmissible Delta variant, with no clear link to the border, was detected in Auckland. As a result, the entire country moved from Alert Level 1 (minimal restrictions) to Alert Level 4 (toughest restrictions). The lockdown measures and the implementation of an internal boundary around Auckland were largely successful in containing the outbreak to Auckland. However, a small number of cases leaked through the border, leading to community transmission in Northland and Waikato with a limited number of further cases detected around the country, including in the South Island. After 35 days at Alert Level 4 in Auckland, the Government began to ease restrictions and transition from an elimination to suppression strategy.

On 22 October 2021, the Government outlined the COVID-19 Protection Framework, which uses

vaccination certificates along with public health measures to manage COVID-19 in the community. This system replaced the Alert Level framework when district health boards reached a vaccination target of 90% of the eligible population. As vaccination rates increased and restrictions eased, as expected, COVID-19 cases spread out of Auckland to other parts of the country (as was previously observed with prior outbreaks in Waikato and Northland). It is important to understand the impact of different vaccination rates on the growth of future outbreaks outside of Auckland along with the number of hospitalisations and stress on the healthcare system.

In this work, a stochastic branching process model<sup>3-5</sup> is used to simulate the initial stages of a COVID-19 outbreak within a community. Stochastic models are useful because they incorporate the randomness associated with the initial stages of an outbreak. For some simulations, COVID-19 will spread widely and form an extensive outbreak (eg Auckland in August 2021 where a returnee from Australia sparked an outbreak with >6000 cases at the time of writing), whereas for other simulations, despite the virus having a reproduction number larger than one, random chance will mean that COVID-19 does not spread far beyond the initial seed infection (eg Wellington in June 2021 when a COVID-19 infected traveller visited from Australia but did not infect anyone else). The stochastic model tracks each individual case and becomes computationally expensive for large case numbers. Therefore, while stochastic models are useful for simulating the initial stages of an outbreak, deterministic SEIR (Susceptible, Exposed, Infected, Recovered) models are frequently used for larger and longer-term population level studies of epidemics.<sup>5,6</sup>

Here, I use a stochastic model to study the how the number of infections and hospitalisations depend on the vaccination rate and population level controls. I calculate the likelihood that a new infected case or hospitalised individual is vaccinated and determine the relative risk of getting infected or hospitalised with COVID-19 between vaccinated and unvaccinated individuals.

## Methods

The stochastic model presented here tracks the number of infections in the community and categorises individuals as symptomatic (clinical infections) or asymptomatic (subclinical infections). Each infected individual infects a random num-

ber of other individuals,  $N$ , drawn from a Poisson distribution (Figure 1).<sup>3</sup> For a symptomatic individual, the Poisson distribution is defined by  $\lambda = RC$  where  $R$  is the reproduction number and  $C$  is the effectiveness of population level controls (eg Level 1, 2, 3 or 4 in the Alert Level Framework or Green, Orange, or Red in the COVID-19 Protection Framework). For an asymptomatic individual, the Poisson distribution is defined by  $\lambda = RC/2$ , which assumes that asymptomatic individuals infect, on average, half as many people as symptomatic individuals.<sup>7</sup> This model accounts for “super-spreading” events through the tail of the Poisson distribution.<sup>8</sup> A symptomatic individual in an Alert Level 1 environment, for example, has an 8% chance of infecting more than 10 people. It is possible, however, that the spread of COVID-19 is more heterogeneous, potentially with up to 80% of COVID-19 infections caused by only 10% of cases.<sup>9</sup> Therefore, while multiple realisations of this model can be used to obtain an average perspective of the initial stages of an outbreak (which is the focus of this work), alternative models (and distributions) should be used to investigate super-spreading events and their impact on the evolution of an outbreak.

Population level controls include public health measures such as physical distancing, wearing of masks, closure of schools and non-essential businesses, and restrictions on gatherings and social activities. The effectiveness of population level controls are taken from Plank et al<sup>3</sup> as  $C=1$  for Alert Level 1,  $C=0.72$  for Alert Level 2,  $C=0.52$  for Alert Level 3, and  $C=0.32$  for Alert Level 4. These values were estimated for the initial variant of COVID-19, and population level controls may be less effective against the more transmissible Delta variant.<sup>10</sup> In addition, the model does not account for illegal gatherings or other non-compliance with restrictions.

The generation times between an individual becoming infected and infecting  $N$  other individuals are independently sampled from a Weibull distribution with  $a=5.57$  and  $b=4.08$  where  $a$  is the scale parameter and  $b$  is the shape parameter (mean=5.05 days and variance=1.94 days)<sup>8</sup> (Figure 1). The model assumes that 33% of new infections are asymptomatic (subclinical) with the remainder symptomatic (clinical).<sup>11-13</sup>

I consider a range of vaccination rates,  $V$ , from 0% to 90% of the total population (rather than the *eligible population*, which at the time of writing is the over 12 years old population). Unlike previous work by Steyn et al,<sup>5,14</sup> age is not accounted

for in the model, either in the vaccination rollout where older individuals were initially prioritised (at the start of February 2022, two-dose vaccination rates are now relatively similar for all age groups over 12 years old, although older age groups have higher booster rates),<sup>15</sup> or in contact rates where younger people are likely to have more contacts, or in the susceptibility where older individuals are more likely to experience severe disease or death (individuals who are 65–69 years old are 19x more likely to be hospitalised than those who are 25–29).<sup>16</sup> Therefore, care should be taken when applying the model results across different age bands as there is considerable heterogeneity of risk with age.

The vaccination rate  $V$  is assumed to be constant throughout the simulated outbreak. Following Steyn et al,<sup>5,14</sup> the Pfizer-BioNTech vaccine, which is the only COVID-19 vaccine currently being widely administered in New Zealand, is assumed to be 70% effective against infection and 50% effective against transmission for breakthrough infections (infections in fully vaccinated individuals).<sup>17</sup> Throughout the simulations, the model tracks the total number of vaccinated and unvaccinated infections along with the number of symptomatic and asymptomatic cases. Infected individuals are assumed to be equally likely to interact with vaccinated and unvaccinated individuals, with probabilities based solely on the vaccination rate. This may lead to an underestimation of the spread of COVID-19 in unvaccinated communities, as unvaccinated individuals are more likely to have unvaccinated contacts. Other limitations of this model include not accounting for ethnicity, either in vaccination rates or differential risk factors for different ethnic groups<sup>18</sup> or socio-economic status. COVID-19 spreads rapidly through overcrowded households as well as posing a greater risk to those who do not have the economic resources to safely isolate or the ability to work-from-home.<sup>18</sup>

The likelihood of hospitalisations is also modelled. Clinical infections are assumed to have a 7.8% probability of being hospitalised.<sup>3,19</sup> I note that this hospitalisation rate was estimated from data prior to the emergence of the more severe Delta variant<sup>24</sup> and may underestimate the severity of Delta. Nonetheless, the modelled hospitalisation rate agrees with the total number of cases hospitalised during the August 2021 Auckland outbreak (7.6% hospitalisation rate for all cases as of 30 October 2021).<sup>20,21</sup> Based on Dagan et al<sup>22</sup> who examined the effectiveness of the Pfizer-BioNTech vaccine against hospitalisation in Israel, it is assumed that

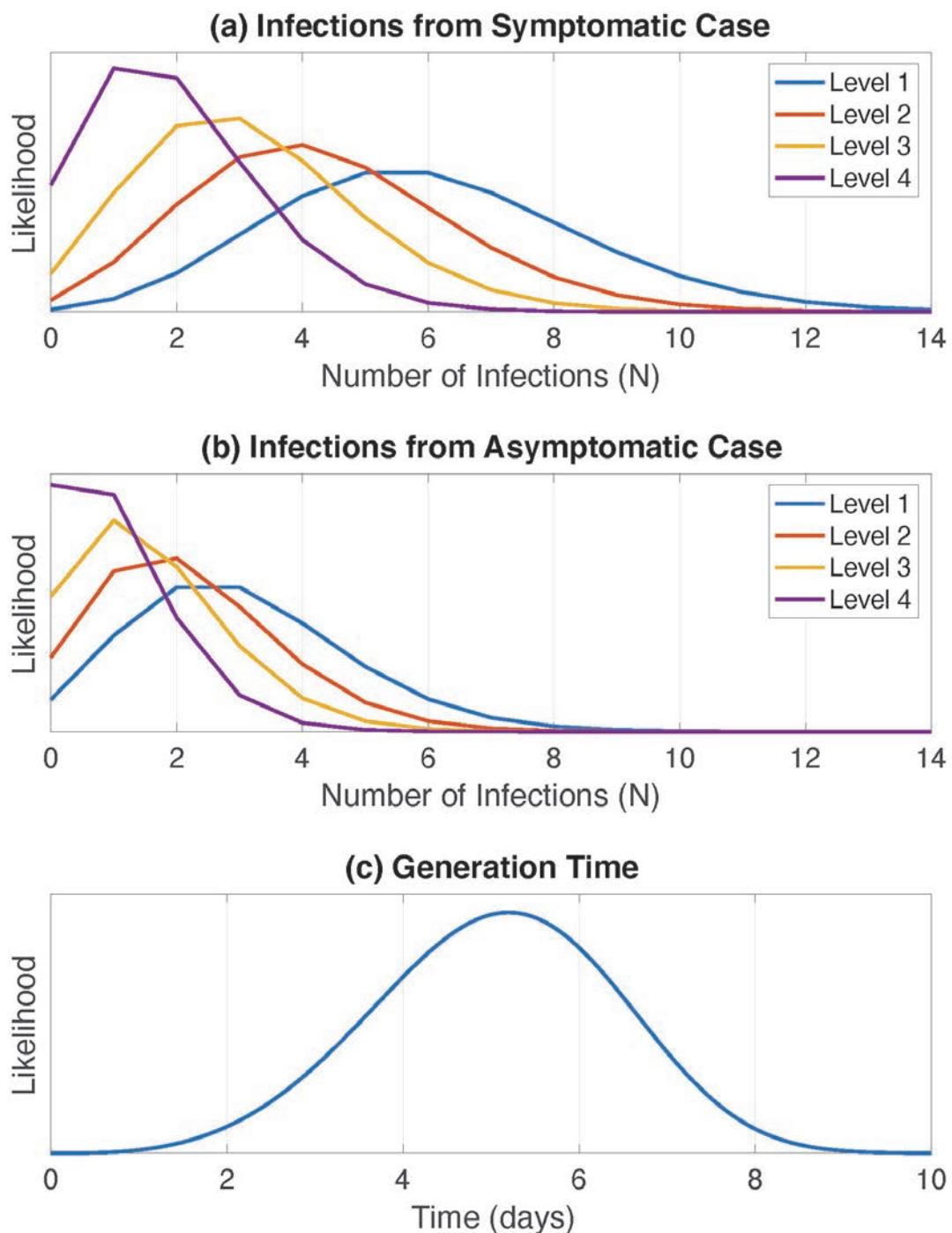
the vaccine is 87% effective at preventing hospitalisations after two doses. The model only allows for cases to be fully vaccinated (defined as more than two weeks after the second dose of the two-dose Pfizer-BioNTech vaccine) or unvaccinated. It is assumed that vaccine effectiveness does not wane with time. The model does not include the additional complexity of individuals who are partially vaccinated, either by only receiving one dose of the vaccine or by being within two weeks after receiving the second dose (note that this simulation work was performed prior to the booster rollout and hence boosters are not considered). In addition, there is no lag time between becoming infected and becoming hospitalised. The model is only run for a short duration (28 days), and hence I do not simulate the likelihood of hospitalised individuals dying.

Note that the model presented here does not include any testing, contact tracing, or isolation of cases. Instead, I focus on the impact of vaccination rates, particularly on the early stages of an outbreak when cases may be circulating undetected. The reader is referred to Steyn et al<sup>5</sup> for a model that includes testing and estimates the number of infections at the time of detection of the outbreak for various vaccination rates and testing scenarios.

## Results

The simulations are seeded with one unvaccinated symptomatic individual at  $t=0$  where  $t$  is the time in days. Simulations are run for 28 days with time steps of one day. The model tracks each infected individual, distinguishes between symptomatic cases (clinical infections) and asymptomatic cases (subclinical infections), tracks hospitalisation rates, and distinguishes between vaccinated and unvaccinated individuals. I consider vaccination rates between 0% and 90% of the total population in 5% increments (the vaccination rate referred to here is the total population rather than the eligible population, which is over 12 years old at the time of writing). The Government's vaccination target of 90% of the eligible population corresponds to 78.7% of the total population.<sup>20,21</sup> For each vaccination rate, we consider four different population level controls based on New Zealand's Alert Level system using the effectiveness values from Plank et al.<sup>3</sup> To get a representative sample of the possible outcomes for each scenario, we run the model 100,000 times for each combination of vaccination rate and population level controls.

**Figure 1:** Probability distributions used in the stochastic model. (a) Number of infections caused by a symptomatic case and (b) by an asymptomatic case. The number of infections caused by a symptomatic or asymptomatic case is governed by a Poisson distribution and can only take integer values. (c) The generation time, which is the time between an individual getting infected and infecting others, is governed by a Weibull distribution.



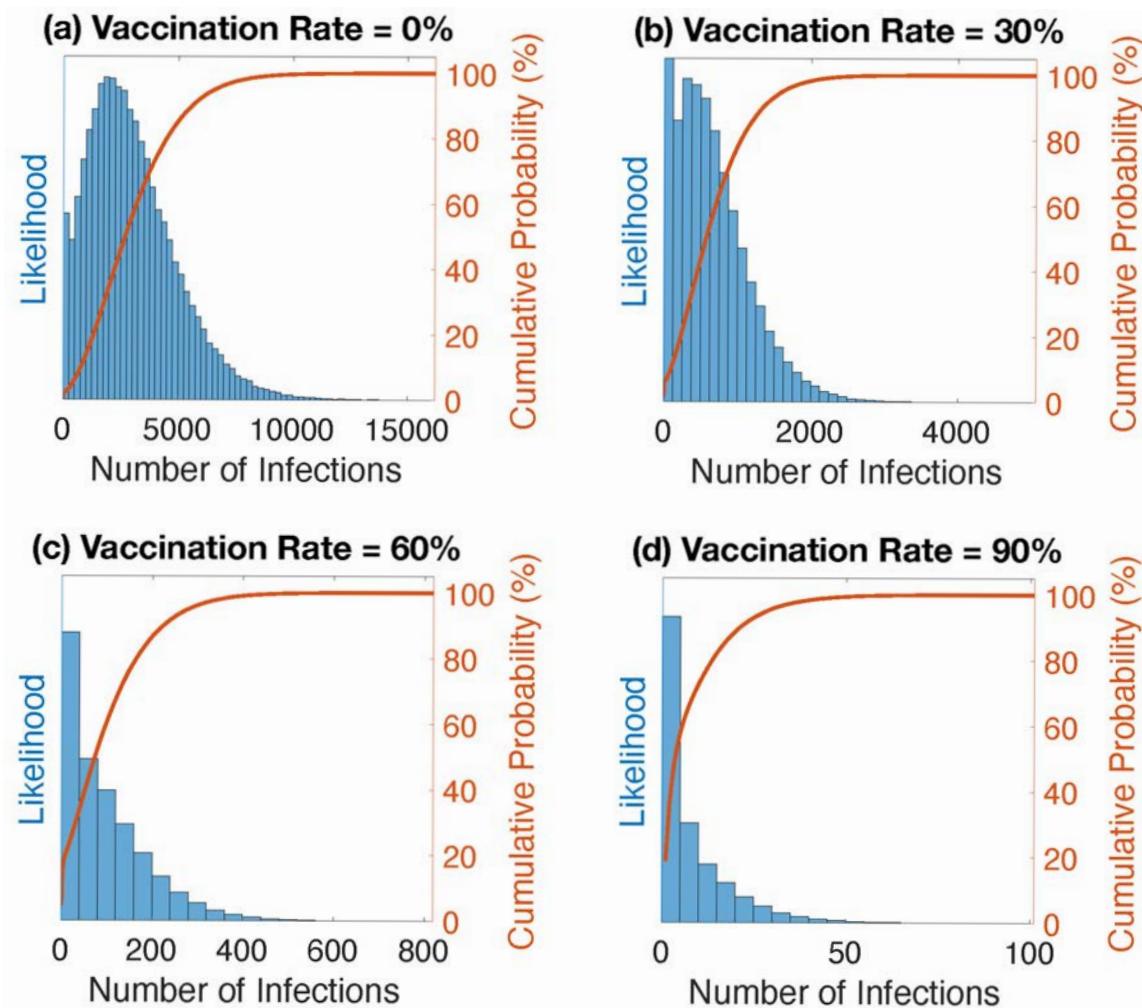
## Vaccination rate and population level controls

I consider the impact of the vaccination rate and population level controls on the total number of infections and hospitalisations. Figure 2 shows likelihood of the number of infections 28 days into an outbreak for  $V=0\%$ ,  $30\%$ ,  $60\%$ , and  $90\%$  and no population level controls ( $C=1$ ). The histograms indicate the likelihood of each number of infections and illustrate the randomness associated with the initial stages of an outbreak. For some simulations, random chance causes the outbreak to infect a small number of people, whereas for other simulations the outbreak can rapidly grow due to super-spreader events. For  $V=30\%$ , there is a 10% chance that an outbreak will cause less than 98 infections after 28 days. However, there is also a

10% chance that an outbreak will cause more than 1340 infections. The potential spread of an outbreak is strongly dependent on the vaccination rate. For  $V=0\%$ , there is a 50% chance than an outbreak will cause less than 2691 infections after 28 days compared to less than 75 infections for  $V=60\%$ .

The number of infections is strongly dependent on the vaccination rate, with higher vaccination rates decreasing the number of infections by several orders of magnitude. For  $V=0\%$ , the maximum number of infections after 28 days is 16,198 compared to 819 for  $V=60\%$  and 101 for  $V=90\%$ . The strong dependence of the number of infections on the vaccination rate is further visualised in Figure 3, which shows the median number of infections along with the 25% and 75% quartiles as a function of vaccination rate and population level controls.

**Figure 2:** Histograms showing the likelihood for a given number of infections 28 days into an outbreak for vaccination rates. (a) 0%, (b) 30%, (c) 60%, and (d) 90%. Red lines indicate the cumulative probability.



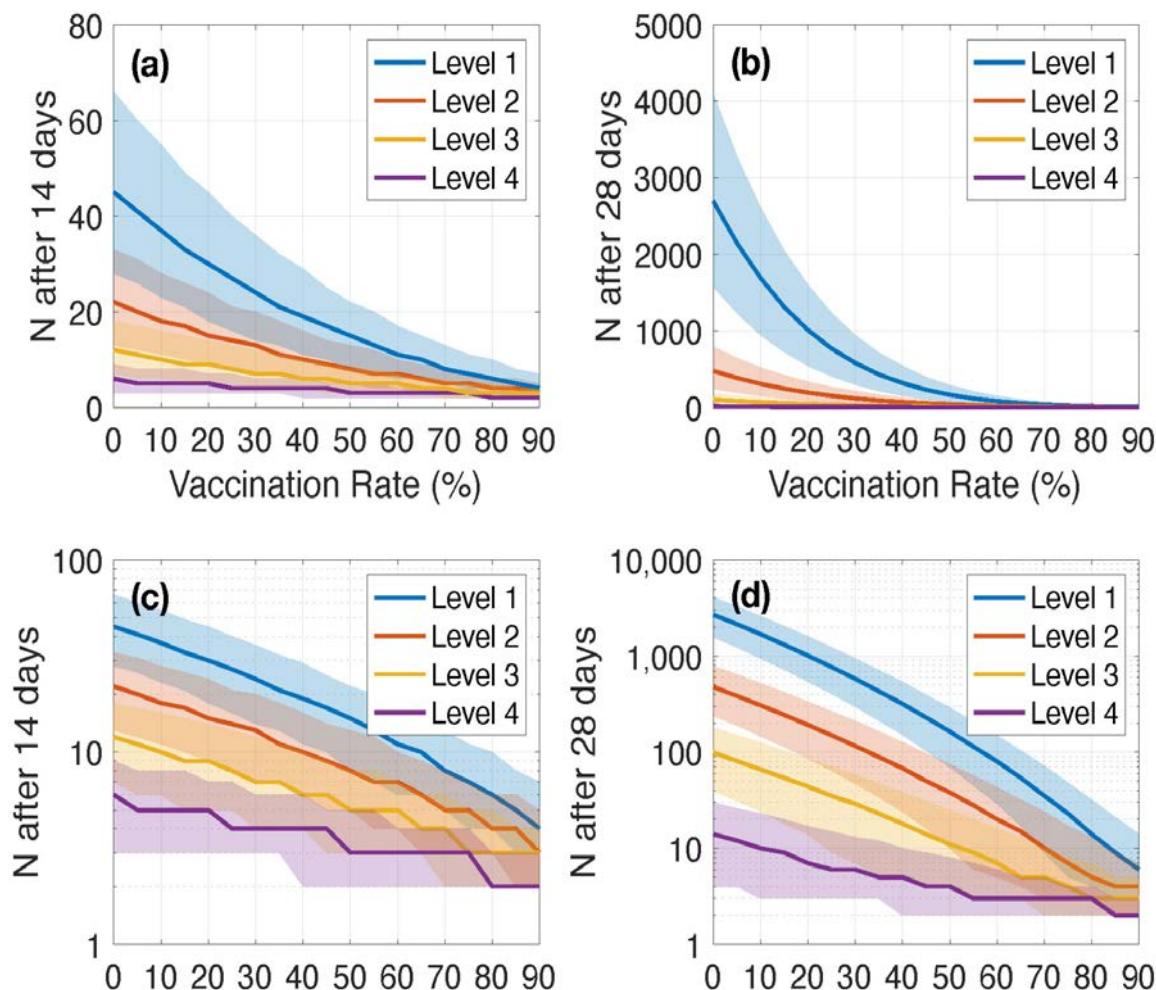
Increasing the vaccination rate can drastically decrease the number of infections and hence minimise the size of an outbreak.

Figure 3 also shows the importance of population level controls, especially at low levels of vaccination. For  $V=20\%$  (the approximate vaccination rate in New Zealand on 17 August 2021 when the Delta outbreak was first detected), the median number of infections after 28 days is 1,011 (542 and 1602 for 25% quantile and 75% quantile, respectively) at Level 1 but only 7 (3 and 17 and for 25% quantile and 75% quantile, respectively) at Level 4. This illustrates how, in the absence of high vaccination rates, population level controls are extremely important in limiting the growth of an

outbreak. It is noted that New Zealand only shifted from Level 1 to Level 4 after a case was detected. At this point, the virus had been circulating undetected for approximately a week prior to this and had potentially already seeded 800 to 1000 cases in the community.<sup>23</sup> Furthermore, the effectiveness values used here for the population level controls were estimated for the original strain of COVID-19.<sup>3</sup> It is unclear if these values are appropriate for the more transmissible Delta variant<sup>10,24,25</sup> or if population level controls are less effective against Delta.

The results shown in Figures 2 and 3 illustrate how a vaccine can be extremely effective in preventing or limiting an outbreak even if the vaccine does not provide individuals with 100% protec-

**Figure 3:** Number of infections as a function of vaccination rate and population level controls. (a,c) 14 days and (b,d) 28 days after an unvaccinated symptomatic individual is seeded into the community. Solid lines show the median of the 100,000 realisations while the shaded area shows the range between the 25% and 75% quantiles. Top plots (a,b) show the results on a linear scale while the bottom plots (c,d) show the results on a logarithmic scale. The vertical black dashed lines indicate vaccination rate for the total population that corresponds to the 90% target of the over 12 years old population (78.7%).

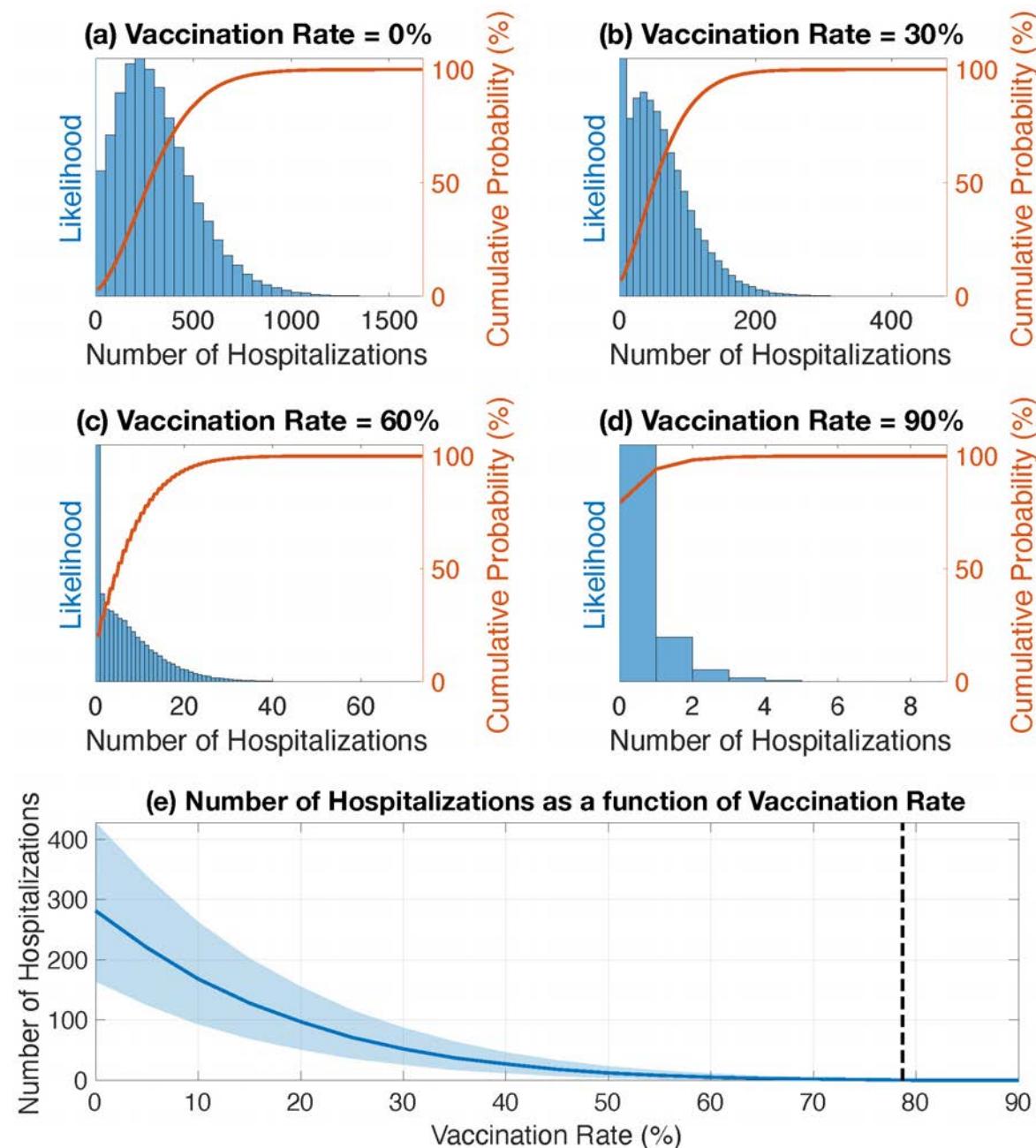


tion from infection. Here, it is assumed that the Pfizer-BioNTech vaccine is 70% effective in preventing infection and, for breakthrough infections, 50% effective at preventing onward transmission.<sup>17</sup> Despite this imperfect protection, at a population level the vaccine drastically reduces the spread of the virus. For  $V=60\%$ , the mean number of infec-

tions 28 days into the outbreak is only 3% of the mean number of infections for  $V=0\%$ . For  $V=90\%$ , the mean number of infections further decreases to only 0.3% compared to the unvaccinated scenario.

The number of hospitalisations is also strongly dependent on the vaccination rate (Figure 4). For  $V=0\%$ , there is a 50% chance of over 282 hospital-

**Figure 4:** Histograms showing the likelihood for a given number of hospitalizations 28 days into an outbreak for  $C=1$  and vaccination rates. (a) 0%, (b) 30%, (c) 60%, and (d) 90%. Red lines indicate the cumulative probability. (e) Number of hospitalisations 28 days into an outbreak as a function of vaccination rate showing the (solid line) median simulation result and (shaded area) 25th and 75th quantiles. Vertical black line indicates the vaccination rate of the total population that corresponds to 90% of the eligible (over 12 years old) population (78.7%).



isations 28 days into the outbreak compared to 50% chance of less than six hospitalisations for V=60% and one hospitalisation for V=90%. The hospitalisation results presented in Figure 4 are calculated for  $C=1$ , which gives a worst-case scenario. Implementation of population level controls (ie Alert Level restrictions or vaccination certificates) will reduce the total number of hospitalisations at all vaccination rates but the general trend is unchanged; high vaccination rates drastically reduce the number of hospitalisations.

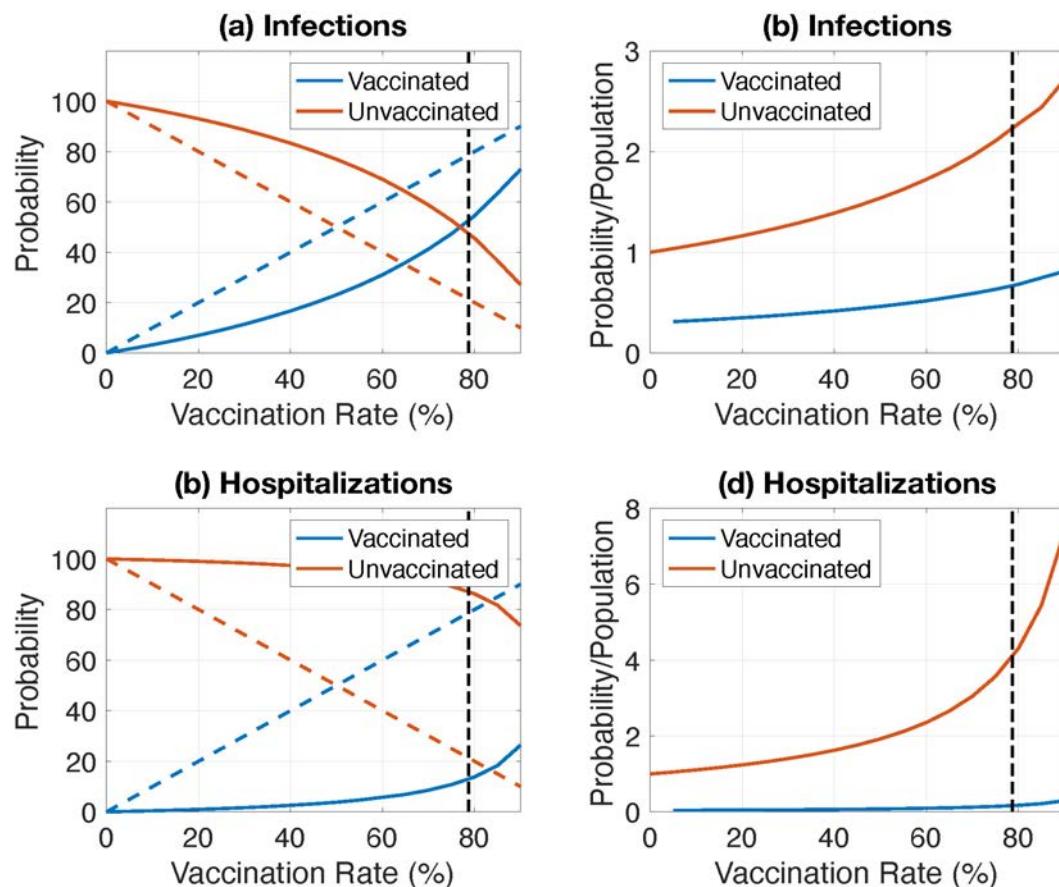
I assume that the vaccine is 87% effective against hospitalisation,<sup>22</sup> which results in a hospitalisation rate of 1.0% for fully vaccinated individuals. During the Delta outbreak, the hospitalisation rate for fully vaccinated individuals was 2.3% (as of 22 January 2022, prior to the emergence of Omicron in the community).<sup>21,26</sup> There are several possible reasons why the model presented here underpredicts the hospitalisation rate for fully vaccinated individuals. Firstly, the hospitalisation rate used

in the model was estimated from data prior to the emergence of the more severe Delta variant.<sup>19</sup> Hospitalisation rates for vaccinated individuals can be twice as high for the Delta variant as for Alpha.<sup>27</sup> Secondly, I assume that the effectiveness of the vaccine is constant in throughout time, whereas recent studies have shown that vaccine effectiveness decreases with time (hence the current "booster" campaign).<sup>28,29,30</sup> Thirdly, the Ministry of Health reports the number of individuals in hospital who have COVID-19, rather than the number that are in hospital due to COVID-19,<sup>26</sup> and hence may over estimate the number of hospitalisations relative to what is modelled.

### Risk factor for unvaccinated individuals

As the vaccination rate increases, there are more vaccinated individuals in the population, fewer unvaccinated individuals, and hence more breakthrough infections will occur. This is expected; the model assumes a 30% chance of breakthrough

**Figure 5:** Probability that an infected or hospitalised individual is (blue) vaccinated or (red) unvaccinated as a function of vaccination rate, as calculated from mean simulation result. (a) and (c) Probability that an (a) infected or (c) hospitalised individual is vaccinated or unvaccinated. Dashed lines indicate proportion of population that are vaccinated or unvaccinated as a function of vaccination rate. (b) and (d) Probability normalised by population that an (b) infected or (d) hospitalised individual is vaccinated or unvaccinated.



infections in vaccinated individuals.<sup>17</sup> As the number of vaccinated individuals increases, the number of cases in vaccinated individuals will increase, as shown in Figure 5a. For V=40%, there is an 83% chance that a new case will be unvaccinated and a 17% chance that they will be vaccinated. For V=80%, this switches to 46% unvaccinated and 54% vaccinated. It is important to note that, even though the number of infections in vaccinated individuals increases, it stays below the population proportion, which is shown by the dashed lines in Figure 5a. This indicates that, per population, infections are still more likely to occur in unvaccinated individuals. It should also be noted that infections in unvaccinated individuals are more likely to lead to onward transmission and hospitalisation than breakthrough infections.<sup>17,22</sup>

Figure 5b shows the probability that an infection occurs in a vaccinated or unvaccinated individual normalised by population. At all vaccination rates, an unvaccinated individual is more likely to be infected than vaccinated individual. Dividing the unvaccinated probability normalised by population by the vaccinated probability normalised by population gives the risk factor for unvaccinated individuals, which quantifies the likelihood of an unvaccinated individual getting infected compared to a vaccinated individual. This calculation shows that, even though the number of breakthrough infections increases with increasing vaccination rate, an unvaccinated individual is 3.3x more likely to be infected than a vaccinated individual for all vaccination rates.

I then perform the same analysis for hospitalisations. Figure 5c shows that the probability that a hospitalised case is vaccinated increases slower than the probability that an infected case is vaccinated. This shows that while the vaccine provides substantial protection against infection, it provides even greater protection against hospitalisation. At all vaccination rates, hospitalisations are significantly more likely to be unvaccinated than vaccinated (at V=80%, there is an 86% chance that a hospitalised case will be unvaccinated compared to 14% vaccinated). Figure 5d shows the probability of hospitalisation normalised by population. Unvaccinated individuals are 25x more at risk of hospitalisation than vaccinated individuals. This reinforces the need to vaccinate a large percent of the population to minimise hospitalisations and prevent strain on the healthcare system.

The results shown here are in broad agreement with a CDC study of 43,127 COVID-19 cases in Los Angeles County that showed that infection and hos-

pitalisation rates among unvaccinated individuals were 4.9x and 29.2x, respectively, higher than for fully vaccinated individuals.<sup>31</sup> The risk factors calculated here may be lower due to underestimating the protection that the vaccine provides against infection or because I focus on the Delta variant, which transitioned to becoming the dominant variant during the study period of Griffin et al.<sup>31</sup>

## Conclusions

The COVID-19 outbreak in New Zealand which began in August 2021, had resulted in the highest case counts experienced in New Zealand during the pandemic, prior to the arrival of Omicron in January 2022. Cases were centred in Auckland but spread to Northland and Waikato, with isolated cases spread around the rest of the country, including the South Island. The Government's switch from an elimination to suppression strategy has emphasised the importance of vaccination in preventing COVID-19 from overwhelming the health-care system. As restrictions eased, there was a need to understand how different vaccination rates will impact the initial stages of COVID-19 outbreak as cases become seeded in communities around New Zealand.

Here, I use a stochastic branching process model to examine the impact of vaccination rates on the initial spread of an outbreak. I show that increasing vaccination rates greatly decrease the number of infections (1.4% median number of infections 28 days into the outbreak for V=80% compared to V=20%), even if the Pfizer-BioNTech vaccine only provides individuals with imperfect protection (assumed to be 70% effective against breakthrough infection). This illustrates the effectiveness of the vaccine on a population level.

As the vaccination rate increases, the number of breakthrough infections and hospitalisations among vaccinated individuals will increase. This is expected and reflects the increased proportion of vaccinated individuals in the population. Unvaccinated individuals are 3.3x more likely to be infected and 25x more likely to be hospitalised than vaccinated individuals. The model results presented here agree with real-world data<sup>31</sup> and highlight how the Pfizer-BioNTech vaccine provides good protection against infection and extremely good protection against hospitalisation. This work illustrates the need for high vaccination rates to reduce infections and prevent the healthcare system from being overrun with COVID-19 patients.

The latest version of the code is hosted at GitHub (<https://github.com/leighton-watson/COVID>) and the version used in this manuscript is archived at <https://doi.org/10.5281/zenodo.6361172>.

**COMPETING INTERESTS**

Nil.

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[www.nzma.org.nz/journal-articles/simulating-the-impact-of-vaccination-rates-on-the-initial-stages-of-a-covid-19-outbreak-in-aotearoa-new-zealand-with-a-stochastic-model-open-access](https://www.nzma.org.nz/journal-articles/simulating-the-impact-of-vaccination-rates-on-the-initial-stages-of-a-covid-19-outbreak-in-aotearoa-new-zealand-with-a-stochastic-model-open-access)

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# Hospitalisation during lockdown—patients' beds-eye views

Kyu Hyun Lee, Bernard Wong, Seif El-Jack, Guy Armstrong, Ruth Newcombe, Li Ma, John Ramos

## ABSTRACT

**AIMS:** The global COVID-19 pandemic and lockdowns have affected the patterns of hospital presentations for non-COVID related illnesses. Apprehension and perceived risk of hospitalisation has been postulated to be a significant deterrent to presentation. This study aims to explore pandemic- and- lockdown-related concerns with regards to hospital admission from a patient's perspective.

**METHODS:** A cross-sectional study was undertaken in the form of an inpatient questionnaire for patients admitted to a coronary care unit and the cardiology ward during the Level 4 lockdown. The questionnaire included six questions designed to gather patient perception of the impact of lockdown on their hospital presentation.

**RESULTS:** Out of 91 patients who completed the questionnaire, 41 (45%) were >70 years old. Twenty (22%) patients answered that lockdown delayed or affected their decision to present to hospital. Within this cohort, there was a statistical difference between those aged 70 years and younger, and those over 70 years old (16/50 (32%) versus 4/41 (10%), p=0.011).

**CONCLUSIONS:** Apprehension and concerns regarding the risk of COVID-19 was prevalent in a significant proportion of patients and affected/delayed their decision to present to hospital. This may partly explain lower rates of presentation during the pandemic.

The novel coronavirus strain and its associated severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (subsequently termed COVID-19) spread rapidly, achieving global pandemic status a few months after being first identified.<sup>1</sup> Countries have employed various strategies to combat its spread, including public health measures, managed quarantine facilities, border closures, lockdowns and vaccination.

A relatively isolated island nation of five million persons, New Zealand saw its first case of COVID-19 on 28 February 2020. Within a month, New Zealand adopted a four-level alert system and entered the most stringent, Level 4, which included complete lockdown—closure of all non-essential services, a stay at home order and other public health measures such as social distancing and Quick Response (QR) code tracking.<sup>2</sup> This was paralleled by a tiered hospital alert system that saw non-urgent consultations and elective procedures deferred with instructions to patients, especially the most vulnerable, (age>70 years, those with serious chronic conditions or who are multiply co-morbid) to only seek hospital care for serious symptoms and default to

being triaged first by their family doctors (General Practitioners). The first 5-week lockdown successfully eliminated the virus from New Zealand. Through various levels and durations of subsequent lockdown measures, New Zealand experienced only occasional, isolated cases of COVID-19 until August 2021, when it saw its first case of the Delta variant. This led to a second Level 4 lockdown, which lasted for two weeks nationwide, but for five weeks in the greater Auckland Region (population approximately 1.57 million).<sup>3</sup>

In response to the pandemic, New Zealand hospitals' alert responses adopted strict regulations on patient screening and significant limitations on visitation.

Waitematā District Health Board (WDHB) has a catchment of 629,000 and is representative of the greater Auckland, and New Zealand, population.<sup>4</sup> Like elsewhere, our cardiology service experienced falls in admissions due to acute coronary syndromes, heart failure, cardiac arrhythmias or cardiac arrest during the lockdown in 2020.<sup>5</sup>

Multiple hypotheses have been proposed to help explain this phenomenon, including sedentary life-

style during lockdown masking symptoms, limited contact—especially face-to-face appointments with general practitioners—and reduced air pollution.<sup>5</sup> We are not aware of reports of patients' perspectives on reasons for reduced hospitalisation rates. It may be that the reduced admissions relate to patients feeling apprehensive about being in hospital during this time. As cases, including number of hospitalised COVID-19 patients, are broadcast daily on various media channels, patients may perceive hospitals to be locations of high risk that should be avoided.

In the current study, we aimed to explore patient perspectives and potential lockdown-related concerns during their admission to our cardiology department.

## Methods

We conducted a cross-sectional study in the form of an anonymous questionnaire provided to all inpatients admitted to the cardiology service at North Shore Hospital in Auckland, New Zealand during the Level 4 lockdown period between 17 August to 21 September 2021. To avoid capturing patients admitted prior to the lockdown, participant recruitment commenced nine days after it started. The survey had questions addressing the patients' experiences during the Level 4 lockdown period, plus free text comments. Only fully completed questionnaires were analysed.

The questions were:

1. Did the current COVID lockdown affect/delay your decision to come into the hospital/Emergency Department?
2. Are you concerned being in the hospital during the current COVID lockdown?
3. Do you think that having visitor restrictions has negatively impacted your hospital stay/experience?
4. Are you concerned that you might contract and pass COVID to your family due to your current hospital admission?
5. Do you feel safe to stay in the hospital and wait for any non-urgent procedures/tests that are usually routinely done for your condition before discharge during COVID lockdown?
6. Is there anything that we could have done differently to provide you with reassurance during this time?

## Statistical Analysis

Categorical variables are presented as absolute numbers, percentage of the study population or a specific subset. Comparisons between groups were made using Pearson's chi-square test for categorical variables. Two-sided p-values <0.05 were considered statistically significant. The IBM SPSS Statistics for Windows, Version 25.0. (IBM Corp. Armonk, NY, USA) was used for statistical analysis.

## Results

Ninety-one of 95 patients agreed to participate in the study and returned completed questionnaires. Fifty-six (62%) were male, with 41 (45%) patients greater than 70 years old. A majority (67 patients, 74%) identified ethnically as New Zealand European (Table 1).

Answers to each of the questions are displayed in Table 2; 20 (22%) of participants reported that the lockdown delayed or affected their decision to present to hospital, and 28 (31%) of patients were concerned about being in hospital during lockdown. After admission, 34 (38%) of participants felt their hospital stay was negatively impacted due to visitor restrictions, and 28 (31%) were concerned about contracting COVID-19 during hospitalisation and passing it onto their social bubble at home. Once admitted, the majority (73 patients, 80%) were willing to remain in hospital for routine tests/procedures prior to discharge. Overall, only 8 (9%) patients felt that improvements could be made to better reassure them during the admission. There were no significant differences in responses according to sex and the ethnic distribution, which was too limited to draw any conclusions.

Delays in presentations were more likely to occur in younger patients: 16 of 50 (32%) aged ≤70 years compared to 4 of 41 (10%) aged >70 years ( $p=0.011$ ).

Thirty patients provided additional free comments. Eight were complementary of the care they received, 4 specifically "felt safe", 10 had comments on improving the patient's experience of which 3 requested more information on COVID-19. The word "scared" was mentioned once, and 2 other patients indicated concern of hospital-acquired infections. Two expressed concern about lack of family support, especially with choices of treatment.

**Table 1:** Patient demographics including a) sex, b) age group, and c) ethnicity.

<b>Gender</b>	Male	56
	Female	35
<b>Age group</b>	20–29	2
	30–50	13
	51–70	35
	71–90	40
	91–110	1
<b>Ethnicity</b>	NZ European	67
	NZ Māori	5
	African	1
	Asian	7
	Middle Eastern	1
	Pacific Island	6
	Other	4

**Table 2:** Question responses.

<b>Question</b>	<b>Yes (%)</b>	<b>No (%)</b>
Did the current COVID lockdown affect/delay your decision to come into the hospital/Emergency Department?	20 (22%)	71 (78%)
Are you concerned being in the hospital during the current COVID-19 lockdown?	28 (31%)	63 (69%)
Do you think that having visitor restrictions has negatively impacted your hospital stay/experience?	34 (37%)	57 (63%)
Are you concerned that you might contract and pass COVID to your family due to your current hospital admission?	28 (31%)	63 (69%)
Do you feel safe to stay in the hospital and wait for any non-urgent procedures/tests that are usually routinely done for your condition before discharge during COVID lockdown?	73 (80%)	18 (20%)
Is there anything that we could have done differently to provide you with reassurance during this time?	8 (9%)	83 (91%)

## Discussion

The most alarming finding from our study was that 22% of participants acknowledged that their presentation was affected or delayed by the COVID-19 pandemic. This figure is likely to be an underestimate as it excluded those who ultimately never came into hospital. This previously postulated patient-level apprehension of seeking medical attention seems to be real when explaining reductions in non-COVID-related admissions during the pandemic. Especially that patients with minor symptoms are likely to avoid the perceived risk of coming to hospital. This is clinically significant, as there are obvious health risks when patients do not present in timely manner, with delayed treatment leading to poorer outcomes.<sup>6</sup> Interestingly, a significantly higher proportion of patients aged ≤70 years reported delayed presentation to hospital compared to those >70 years (32% vs 10%, p=0.011), contrary to the public health message advising older people to stay home. This suggests there may be an age-related difference in perception of risk, which can lead to adverse clinical outcomes for younger patients who are generally less vulnerable to COVID-19 than older patients.

Almost a third of patients had concerns of contracting COVID-19 themselves or passing it onto their family. In a US based analysis, Nallabelle et al. suggested that the risk of contracting COVID-19 when admitted with a non-COVID-related illness was significantly lower than the risk in the general population, with an odds ratio of 24.1, attributed to strict patient screening, use of personal protective equipment and other infection control measures in the hospital setting.<sup>7</sup> However, patients' behaviour would be more influenced by social media and news outlets than by peer-reviewed scientific literature. It is interesting that some patients in this group did not feel COVID-19 delayed their presentation nonetheless it still affected their perception of the risk of coming to hospital.

Mental wellbeing is a major contributor to the experience of any patient admitted to hospital. This is often shaped by the level of support a patient has beyond the clinical care. Limited or prohibited visits by family members was viewed as a problem by 38% of our patients even though

only 9% disagreed with the lockdown restriction protocols. This may reflect a level of apprehension that "justifies all measures" to mitigate COVID-19 risk.

Despite the delayed presentation in some patients and the ongoing concern by a few others, most patients (80%) were happy to remain in hospital to complete their investigations and treatment. In the free comments, a handful stated that they felt safe in hospital. This reflects that patients' perceptions of their heart-risk relative to their in-hospital COVID-19 risk changed after admission. Once in hospital, they became more comfortable staying on to complete their treatment and investigations.

## Limitations

There are several limitations to our study. The number of participants is small and not ethnically diverse, which may be important when trying to extrapolate these findings to other groups who may hold different healthcare beliefs. We studied patients from the cardiology ward and coronary care unit, which have a narrow subset of conditions, namely acute coronary syndrome, heart failure and severe cardiac arrhythmias. These tend to have more acute and urgent presentations which may have favoured more patients seeking hospital care. There are inherent biases in the study because it only surveyed inpatients, omitting those who avoided hospital admission. We did not record reasons from those inpatients who declined to participate, but the written nature of the questions and answers would have been a barrier to those with limited literacy and those with English as a second language.

## Conclusion

A significant proportion of cardiology inpatients expressed apprehension about seeking medical attention or hospitalisation in the setting of the COVID-19 pandemic, which may partly explain lower rates of admissions of non-COVID-related illnesses. Once in hospital, patients were mostly happy to stay until their cardiac condition was managed. This suggests that a positive in-hospital experience reduced their concerns about the COVID-related risks of hospitalisation.

**COMPETING INTERESTS**

Nil.

**ACKNOWLEDGEMENTS**

The authors acknowledge the assistance of our cardiology in-service team in deploying and conducting the survey. More importantly we acknowledge their dedication and care during difficult times both for patients and healthcare workers.

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# Insulin pump special eligibility criteria in New Zealand: a survey of prescriber opinion and practice

Michaela Groves, Sara Styles, Martin de Bock

## ABSTRACT

**AIM:** Funding for insulin pump therapy (CSII) in New Zealand for people with type 1 diabetes is determined by meeting PHARMAC special authority (SA) criteria. We aimed to survey the opinion and practice of CSII prescribers with respect to the current SA criteria and contextualise the results with respect to contemporary literature and best practice.

**METHOD:** Quantitative and semi-qualitative survey of CSII prescribers in New Zealand. Mixed qualitative and quantitative analyses were used.

**RESULTS:** Of the 94 survey respondents, 88% stated the criteria needed updating. However, 75% maintained CSII funding by PHARMAC should remain under updated SA criteria. Most (60%) of respondents thought the current criteria did not promote health equity for Māori and Pasifika. Only 33% of respondents strictly adhered to the criteria. Thematic analyses of free text responses indicated that the criteria did not reflect quality of life benefits offered by CSII, changes in life course, clinician or patient autonomy, and beneficence of CSII not otherwise stated in the current criteria.

**CONCLUSION:** The majority of CSII prescribers in New Zealand disagreed with the SA criteria, resulting in most not strictly adhering to them. Updated criteria are required to improve health equity, and reflect best evidence.

Type 1 diabetes (T1D) is a lifelong condition that requires considerable effort and changes in lifestyle to effectively manage glucose levels. There are approximately 20,000 people with T1D in New Zealand.<sup>1</sup> More intensive insulin therapy regimens have been proven to achieve glycaemic control ( $\text{HbA1c} \leq 53 \text{ mmol/mol}$ )<sup>2</sup> and decrease long term complications from T1D.<sup>3</sup>

One way of delivering insulin therapy is via a continuous subcutaneous infusion of insulin using a pump (CSII). CSII delivers a continuous infusion of rapid-acting insulin. It is cost-effective compared to multiple daily insulin injections<sup>4</sup> and its use worldwide has been increasing steadily since its introduction.<sup>5-7</sup> Currently in New Zealand, public funding for CSII is provided through the New Zealand Pharmaceutical Management Agency (PHARMAC). Approximately 11% of New Zealanders living with T1D use CSII, which is much lower compared to other high-income countries.<sup>8</sup> Māori and Pasifika peoples with T1D are even less likely to use a publicly funded CSII.<sup>8</sup> Since September 2012, PHARMAC requires applicants to meet specific special authority (SA) criteria in order to be eligible for CSII. There are three main categories for initial applications: severe unexplained hypoglycaemia; HbA1c criteria; and previous pump

use before 1 September 2012.<sup>9</sup> For each of these categories there are multiple sub-criteria that need to be met. Renewal criteria also exist for continuation of CSII which comes up bi-annually for insulin pump consumables and every four years for the insulin pump.

The PHARMAC SA criteria have not been significantly updated since their implementation 10 years ago. Since then, there has been a growing evidence base for use of CSII, and many health authorities internationally have adapted their own access pathways.<sup>10,11</sup> Global position statements also support CSII, and cite the literature in support of them.<sup>2,12-14</sup> New Zealand is unique in that there is no private health insurance pathway to CSII. Hence, people with T1D are reliant on PHARMAC criteria, or need to personally pay for the insulin pump (~\$10,000) and the annual running cost of the consumables (~\$2500/year). Publicly funded CSII is lowest among people experiencing the most socio-economic deprivation (8%, most deprived vs 15%, least deprived),<sup>8</sup> suggesting the current criteria may be disadvantaging those with most financial need.

Anecdotally, it is known that prescribers in New Zealand face a dilemma with respect to adhering to PHARMAC SA criteria for CSII. Applicants

often do not meet funding criteria despite the fact they may show significant benefit, or due to health reasons outside of their control (ie adolescence). This is despite the growing evidence that CSII improves the lives of young people with T1D<sup>15</sup> and is associated with diabetes treatment satisfaction in adults.<sup>16</sup> To further understand this, we designed a survey to gauge prescriber practice and prescriber opinion about the current public funding criteria. We also examined contemporary literature and health funding reimbursement policies from comparable countries to contextualise the responses to the survey. In doing so, our intent is to highlight the need for the current CSII criteria to be reviewed and updated urgently to ensure better (and equitable) long-term health outcomes for people with type 1 diabetes in Aotearoa New Zealand.

## Methods

### Study design

We created a web-based quantitative and semi-qualitative survey using Qualtrics software (Version [Aug, 2021] of Qualtrics, Qualtrics, Provo, UT, USA). There were 43 questions, which took approximately 10 minutes to complete. Five of these questions were qualitative, with a free text comment box. (See Supplemental Document 1 for the full set of questions contained in the survey.) Before circulation, the survey was peer reviewed by three senior clinicians. The survey opened on 10/8/2021 and closed on 28/8/2021. Eligible participants were all CSII prescribers in New Zealand. An email via the New Zealand Society for Study of Diabetes (NZSSD) and the New Zealand Clinical Network for Children and Young People with Diabetes email databases was circulated, with an anonymous link to the survey and instructions to complete the survey only if they are an active CSII prescriber. Two email reminders were sent throughout the time period. There was no incentive to complete the survey. A returned survey from respondents indicated consent. It is not possible to reliably estimate how many people invited through the email databases are active CSII prescribers in New Zealand (eg allied health), and there is overlap in both databases. This study was approved by the University of Otago Ethics Committee (D21/264).

### Data analysis

Quantitative data was examined using simple descriptive statistics. Qualitative data analysis was

undertaken on responses to free text survey questions. The qualitative data was manually coded by MG and MdB. All free text responses were exported into an Excel document, then read and re-read by MG and MdB. The qualitative data then underwent independent content analysis by MG and MdB where data was grouped around central, recurrent themes. The preliminary coding schema was discussed with a third researcher (SS) and revised before all data within each theme was re-examined. Direct quotes have been used to illustrate important findings.

## Results

### Quantitative

A total of 94 participants completed the survey. 41% of participants prescribed exclusively for paediatrics, 53% for adults and 6% for both. CSII prescribers from every DHB were represented. The vast majority of respondents agreed that the current criteria need updating (88%). When asked if the current SA criteria promoted health equity for Māori and Pasifika, 60% of respondents disagreed. The majority agreed that CSII should remain under a SA process (75%). Only 33% responded that they always strictly adhered to the PHARMAC criteria when prescribing, while 48% adhered to the criteria 75–100% of the time and 14% adhered 50–75% of the time. Similar proportions of adults and paediatric prescribers agreed that the criteria needed to be changed (88% vs 92%), and a similar number of adult and paediatric prescribers adhered 100% of the time (29% vs 32%).

The current specific requirements for each of the main categories of initial CSII application SA criteria were not agreeable with the majority of respondents. With respect to the severe hypoglycaemia criteria, 80% disagreed with the current sub-criteria. For example, 49% felt that placing a time frame on the occurrence of severe hypoglycaemia should be removed, and 89% of those who disagreed with the current sub-criteria expressed that there should be less than the currently required four episodes. With respect to the current HbA1c category, 85% of respondents disagreed with the current sub-criteria. Both the upper limit of  $\leq 90\text{mmol/mol}$  (62% felt no upper limit is appropriate), and the lower limit of  $\geq 65\text{mmol/mol}$  (63% felt no lower limit is appropriate) were disagreeable. Further, the majority of responders (65%) disagreed with sub-criteria requiring HbA1c improvements of at least

10mmol/mol using CSII. Of these, 52% selected that no amount of change should be included in the criteria. Sub-criteria specific to CSII use prior to 2012 which states “HbA1c has not deteriorated more than 5mmol/mol from baseline” was not agreeable with 73% of respondents. Of those who disagreed, 78% believed applicants should be allowed a 10mmol/mol increase from baseline. Other responses were mixed, with suggestions ranging from no increase to 9mmol/mol.

The majority disagreed with the current SA requirements for CSII renewal. For example, 76% disagreed with sub-criteria of: “HbA1c has not increased by more than 5mmol/mol from baseline”. Of those who disagreed, 71% thought a deterioration of up to 10mmol/mol should be allowed. The rest of the participants largely felt that no increase from baseline should be the standard. One of the renewal criteria for HbA1c requires the applicant to achieve and maintain “a reduction in HbA1c from baseline of 10mmol/mol”. Most (69%) of participants disagreed with these criteria. All those who disagreed thought the reduction should be less than 10mmol/mol, with 78% stating that no increase from baseline was appropriate. For renewal criteria for previous use before 2012, 77% of participants disagreed with the criteria “HbA1c has not deteriorated more than 5mmol/mol” since commencing pump therapy. Most (60%) felt that the increase from baseline should be 10mmol/mol, while 36% felt that there should be no increase from baseline since starting treatment.

## Qualitative

Most participants (60/94) provided at least one free text response to a question. Of those 60 respondents, there were 101 free text comments. Themes identified were equity, beneficence that the current criteria did not reflect, quality of life, autonomy, life course and future proofing. A sub-theme for beneficence was identified (punitive), and for autonomy (clinician autonomy, or person with diabetes autonomy).

Many responses commented on the issue of equity, typically commenting that Māori, Pasifika and people with lower socio-economic status were discriminated against in the current criteria. When asked to provide general comments, 16 participants (27.7%) specifically raised this as an issue. An illustrative example is:

*I also think these criteria discriminate against the groups who do poorest*

*in NZ, Māori, Pasifika and those of lower socioeconomic status. They are less likely to reach the criteria or continue to meet them over time, yet have the most to benefit.*

Beneficence for the person with diabetes outside of the current criteria was commonly expressed by respondents, without specifically mentioning quality of life. Twenty-three respondents (48.9%) mentioned this. For example:

*CSII has many benefits other than just HbA1c eg making life easier, promoting education, and not more adverse effects than injections. It should be seen as part of modern diabetes treatment options.*

Eighteen participants (81%) felt that all or part of initial application criteria requiring unpredictable and significant variability in blood glucose, including significant hypoglycaemia affecting the ability to reduce HbA1c, was not relevant as it restricted applicants benefitting from CSII therapy. Similarly, under the previous use criteria requiring the patient to have no increase in severe unexplained hypoglycaemic episodes from baseline, seven participants (41.2%) disagreed on the basis of beneficence:

*I think if there is an increase [in hypoglycaemia], then it needs to be addressed, but it does not mean that the pump is an inappropriate method of administering insulin.*

Seven participants (14.9%) responded that the criteria could be punitive, for example circumstances where applicants were being punished by removal of CSII:

*I think that the criteria that mandate there must be continued reduction in hypoglycaemia or continued excellent control, would lead to many children having pumps removed, despite them being the most effective treatment for their diabetes.*

Similarly, quality of life was mentioned frequently by responders as being an area that the current funding criteria did not take into account. In the final comments, 11 participants (23.4%) mentioned this specifically.

Two autonomy subthemes identified were 1) the person with diabetes' autonomy and 2) clinician autonomy, with most participants referring to clinician autonomy:

*All patients with Type 1 should be allowed pumps if their specialist thinks they would benefit from one. (example of clinician autonomy)*

*The criteria take away the option for individuals who work hard to maintain their control but do not meet criteria because their HbA1c is too good. Because of the requirements for reduction in HbA1c this causes inequity, particularly as socioeconomic impacts causing HbA1c to climb can result in losing funding despite there still being benefit from pump over MDI. (example of patient autonomy)*

Life stage/course affecting glycaemic control also presented as a prominent theme. This was mentioned by 12 of the respondents (25.5%). Pregnancy, where tighter control than previous is required for better obstetric and neonatal outcomes, and adolescence were two particular areas that were specifically mentioned:

*HbA1c limits make no sense in the developing child and adolescent, with changing social and developmental challenges.*

*We recommend an additional criteria for pre-conception and pregnancy care given these women often have low HbA1cs that don't meet current criteria.*

Finally, seven respondents (14.9%) made note of a need to change the SA criteria in order to allow future proofing of diabetes technology. Mention of continuous glucose monitoring in particular came up, as did closed loop systems and automation.

*With the closed loop systems, there is significant improvement in QOL and mental burden with pump use, which should also be considered in setting of criteria.*

## Discussion

In this study, we gauged prescriber opinion and practice with respect to the PHARMAC CSII SA criteria in New Zealand. With 94 respondents, who work across all DHBs, the sample is representative of the majority of CSII prescribers in New Zealand. CSII technology is rapidly advancing,<sup>17</sup> presenting a challenge to keep publicly funded access criteria contemporary. Whilst the majority of prescribers felt that SA criteria are still needed in order to access CSII, the overwhelming majority (88%) felt that the criteria need updating. The results show that many criteria are largely disagreeable with prescribers. This has led to a significant portion of prescribers not strictly adhering to the criteria when making an application and prescribing CSII. This has the potential to cause a moral, ethical, and professional conflict both in workplaces, due to different prescribing practices, and when taking the needs of people with T1D into account.

Health equity is a priority in New Zealand. The majority of prescribers felt that the current SA criteria did not meet this obligation. The qualitative responses elaborated on this further, with prescribers describing that CSII has widened the health gap due to inequitable access despite Māori and Pasifika having much to gain from easier access to this technology. Māori and Pasifika patients are known to have low CSII use compared to NZ Europeans,<sup>8,18,19</sup> and are two to three times more likely to cease CSII technology once obtained.<sup>18</sup> This is likely due to Māori and Pasifika people with T1D having higher HbA1c values.<sup>19,20</sup> It is universally agreed that intensive insulin regimens are vital in decreasing microvascular complications of diabetes,<sup>3</sup> and contemporary evidence has shown that CSII has the largest improvement in HbA1c in people with the poorest glycaemic control.<sup>5</sup> Therefore, improving CSII access and uptake for Māori and Pasifika could improve health outcomes. Recently, with the introduction of SGLT2 inhibitors to the Pharmaceutical Schedule, health equity was addressed by having all people of Māori and Pasifika ethnicity eligible to benefit from this drug class in the management of type 2 diabetes. Therefore, there is precedent within the PHARMAC framework to address health inequity by removing barriers created due to eligibility criteria.

CSII is known to improve quality of life for both people with T1D and their caregivers.<sup>15,21-23</sup>

The lack of this consideration in the current SA criteria was highlighted by survey respondents. Other countries which publicly fund CSII, such as the UK, have specifically considered quality of life when forming their criteria.<sup>11</sup>

The current requirement of specific HbA1c values with the criteria was disagreeable to most prescribers, and also divergent from best evidence on many levels. The lower value of  $\geq 65\text{mmol/mol}$  is above the recommended international guidelines,<sup>2,13</sup> effectively excluding a proportion of the population where there is evidence that CSII could help reach glycaemic targets.<sup>6</sup> An unintended consequence of not including quality of life benefits is that people with good glycaemic control are known to deliberately worsen their glycaemic control in order to access funded CSII, which is clinically and ethically inappropriate. Pregnancy, where very tight glycaemic control is required, is a particular population where the current criteria are too restrictive to allow access. At the other end of the glycaemic spectrum, the upper HbA1c cut-off of  $\leq 90\text{mmol/mol}$  is in contrast to evidence which states people with the poorest glycaemic control have the largest improvements in HbA1c when placed on CSII therapy.<sup>5,21</sup> CSII is also much more cost-effective the greater the HbA1c improvement.<sup>4,24</sup> Renewal criteria based on HbA1c were also disagreeable and often seen as punitive. Such limits do not take into account the change in glycaemic control over the course of a person's life. Physiological and developmental reasons make glycaemic control more challenging in adolescence compared to early and middle childhood, regardless of compliance.<sup>5-7,25,26</sup> However, evidence shows that adolescents who use CSII tend to hold their HbA1c steady during this period, compared to those on MDI regimens who show a trend of increasing HbA1c during puberty.<sup>5,21</sup>

The criteria based on severe hypoglycaemia were also disagreeable to most respondents. Episodes of severe hypoglycaemia can have significant consequences in all age groups, including short term cognitive impairment, seizures, cardiovascular events and death.<sup>27-29</sup> Within this evidence base there is no reference to a time frame or frequency of events, despite this being written into the SA criteria. There is also no reflection on the risk of such an event—for example, even one severe hypoglycaemic event in a truck driver poses significant risk. Further, meeting the current criteria requires an individual to raise their HbA1c. However, evidence now shows that people most at risk of severe hypoglycaemia have very high HbA1c,<sup>30</sup> which is in direct contradiction to this requirement. The current definition of

severe hypoglycaemia by PHARMAC states an episode “requiring the assistance of another person”. This disadvantages adult applicants, who are much less likely than children to have a second party present to assist them with a hypoglycaemic event. Overall, the current criteria access on the grounds of severe hypoglycaemia are discrepant with the current evidence base, and do not allow for important clinical scenarios including safety. Based on the evidence presented above, the current PHARMAC CSII SA criteria are misaligned with the evidence base and comparable health systems.

There were several limitations in our study. The results may be biased if those most interested in the topic were also those who were most likely to respond. The computer survey design of the free text questions meant that our qualitative responses were limited, and we were unable to clarify or expand on comments further. This led to some answers lacking enough detail to be included into themes. Indeed, given so many responders stated that they did not strictly adhere to the criteria, it would have been interesting to explore prescribing practice when the patient doesn't meet them, yet the process is still completed. We also could not calculate the percentage of insulin pump prescribers who responded to the survey, as we do not have a complete list of all insulin pump prescribers in New Zealand. The assumption was that anyone who responded was a prescriber, however it is possible that not all prescribers were on the email lists that the survey was sent out on. However, these are balanced by the following strengths of our study: a peer reviewed survey design that provided a lens on how the current criteria may contribute to health inequity, the high number of CSII prescribers who participated, and representation of prescribers from every DHB. This means that our results are more likely to be representative of the true opinion from the majority of the cohort who work within the PHARMAC criteria.

## Conclusion

The current SA criteria for both initial application and renewal for CSII are disagreeable with the majority of prescribers who frequently do not strictly adhere to them. This is likely a result of the existing SA criteria being out of date with the contemporary evidence base. Of primary concern is that the SA criteria do not promote health equity. Therefore, renewed criteria, with consultation from healthcare professionals involved in diabetes management, is urgently required.

**COMPETING INTERESTS:**

Nil.

**ACKNOWLEDGEMENTS**

The New Zealand Society for the Study of Diabetes and the New Zealand Child & Youth Clinical Network for Diabetes for help in disseminating the survey.  
Dr Karen MacKenzie, Dr Ryan Paul, Dr Craig Jefferies and Associate Professor Ben Wheeler for reviewing the survey structure.

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# Likelihood of infecting or getting infected with COVID-19 as a function of vaccination status, as investigated with a stochastic model for Aotearoa New Zealand for Delta and Omicron variants

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## ABSTRACT

**AIM:** The New Zealand Government has transitioned from the Alert Level framework, which relied on Government action and population level controls, to the COVID-19 Protection Framework, which relies on vaccination rates and allows for greater freedoms (for the vaccinated). Under the COVID-19 Protection Framework and with current widespread community transmission of Omicron, there is significant interest in understanding the relative risk of spreading COVID-19 posed by unvaccinated, vaccinated, and boosted individuals.

**METHODS:** A stochastic branching process model is used to simulate the spread of COVID-19 for outbreaks seeded by unvaccinated, vaccinated, or boosted individuals. The likelihood of infecting or getting infected with COVID-19 is calculated based on vaccination status. The model is applied to both the Delta and Omicron variants.

**RESULTS:** For the Delta variant, a vaccinated traveller infected with COVID-19 is 9x less likely to seed an outbreak than an unvaccinated traveller infected with COVID-19; however, for the Omicron variant, there is little difference between outbreaks seeded by unvaccinated and vaccinated individuals (boosted individuals are slightly less likely to seed large outbreaks). For the Delta variant, unvaccinated individuals are responsible for 87% of all infections whereas only 3% of infections are from vaccinated-to-vaccinated when normalised by population. Therefore, a vaccinated individual is 6.8x more likely to be infected by an unvaccinated individual than by a vaccinated individual. For the Omicron variant, unvaccinated individuals are responsible for 45% of all infections compared to 39% for vaccinated (two doses) and 15% for boosted (three doses) individuals when normalised by population. Despite the vaccine being less effective at preventing breakthrough transmission for Omicron, only 3% of all infections are from boosted-to-boosted individuals when normalised by population, indicating that three doses of the vaccine provides good protection from infection and breakthrough transmission.

**CONCLUSIONS:** This work demonstrates that most new infections are caused by unvaccinated individuals, especially for the Delta variant. These simulations illustrate the importance of vaccination in stopping individuals from becoming infected with COVID-19 and in preventing onward transmission. For Omicron, individuals vaccinated with two doses are only slightly less likely to spread COVID-19 than those who are unvaccinated. This work suggests that for the current Omicron outbreak the COVID-19 Protection Framework be updated to distinguish between those who have received two primary doses of the Pfizer-BioNTech vaccine (vaccinated individuals) and those who have received three doses (boosted individuals).

The 2021 Delta outbreak of COVID-19 in New Zealand caused the Government to transition from an elimination strategy to suppression, which relies heavily on vaccination rates. Since the detection of the Delta outbreak on 17 August 2021, double-dose vaccination rates have

increased from approximately 22% of the eligible (over 12 years old) population to 93% on 22 January 2022, prior to the detection of Omicron in the community.<sup>1,2,3</sup> As a result, the COVID-19 pandemic is turning into a pandemic of the unvaccinated; only 11% of hospitalisations in the Delta outbreak

were fully vaccinated (defined as more than one week since the second dose of the two-dose Pfizer-BioNTech vaccine).<sup>1,2,3</sup> Under the COVID-19 Protection Framework—which predominantly uses vaccination certificates—instead of the Alert Level system—which uses population level controls—it is important to understand the relative likelihood of vaccinated/boosted versus unvaccinated individuals spreading COVID-19. This is particularly applicable due to the current widespread community transmission of the Omicron variant.

Here, I use the stochastic model developed in Watson (2022)<sup>4</sup> to estimate the likely number of infections caused by an outbreak seeded by an unvaccinated versus vaccinated/boosted individual. This information can help inform reopening decisions and restrictions on travel (eg requiring vaccination or a negative test prior to travel). I calculate the likelihood of infecting others or getting infected with COVID-19 based on vaccination status. Mathematical modelling is a useful tool for understanding these probabilities because, as the number of COVID-19 cases in the community has increased, contact tracers have prioritised preventing onwards transmission compared to finding the source of infections.<sup>5</sup> As a result, the likelihood of infecting others or getting infected as a function of vaccination status is not available for real-world cases, but can be determined from model simulations. Results are shown for both the Delta and Omicron variants.

## Methods

A stochastic branching process model is used to simulate the initial spread of a COVID-19 outbreak, similar to previous work by Plank et al (2020, 2021)<sup>6,7</sup> and Steyn et al (2021)<sup>8</sup>. The model tracks the number of infections and the vaccination status of the infecting and infected individuals. The stochastic model used here is the same as presented in Watson (2022)<sup>4</sup>, which focused on the Delta variant, with the pertinent details summarised below.

### Delta

Each infected individual infects a random number of other individuals,  $N$ , drawn from a Poisson distribution.<sup>6</sup> For symptomatic individuals, the Poisson distribution is defined by  $\lambda = RC$  where  $R$  is the reproduction number (chosen to be 6 for the Delta variant) and  $C$  is the effectiveness of population level controls (eg Level 1, 2, 3, or 4 in the

Alert Level Framework or Green, Orange, or Red in the COVID-19 Protection Framework).<sup>6</sup> For an asymptomatic individual, the Poisson distribution is defined by  $\lambda = RC/2$ , which assumes that asymptomatic individuals infect, on average, half as many people as symptomatic individuals.<sup>9</sup> In this work, I only consider  $C=1$ , which is the situation without any public health measures.

The generation times between an individual becoming infected and infecting  $N$  other individuals are independently sampled from a Weibull distribution with  $a=5.57$  and  $b=4.08$  where  $a$  is the scale parameter and  $b$  is the shape parameter (mean=5.05 days and variance=1.94 days).<sup>10</sup> The model assumes that 33% of new infections are asymptomatic (subclinical) with the remainder symptomatic (clinical).<sup>11-13</sup>

The Pfizer-BioNTech vaccine, which is the only COVID-19 vaccine currently being widely administered in New Zealand, is assumed to be 70% effective against infection and 50% effective against transmission for breakthrough infections.<sup>8,14</sup>

High levels of community testing have been essential in identifying cases in the community and, combined with contact tracing and isolation, have been effective at preventing cases that escape from MIQ becoming widespread outbreaks.<sup>15</sup> It is unclear how testing rates will change in a highly vaccinated public; vaccinated and boosted individuals may feel less need to get tested while unvaccinated individuals may not want to get tested. Therefore, I focus purely on the impact of vaccination rates, particularly on the early stages of an outbreak when cases may be circulating undetected, and following the approach of Watson (2022)<sup>4</sup>, do not consider testing, contact tracing, or isolation of cases.

Age is not accounted for in this model, either in the vaccination rollout where older individuals are more likely to be vaccinated, or in the susceptibility where older individuals are more likely to experience severe disease or death. Age also plays a role in transmission with young children being less likely to transmit the virus<sup>16,17</sup> and as different ages groups have different levels of mobility and hence different numbers of contacts. See Steyn et al (2021)<sup>8,14</sup> for a New Zealand focused model that accounts for age. Other limitations include not accounting for ethnicity, either in vaccination rates or differential risk factors for different ethnic groups,<sup>18</sup> or socio-economic status. COVID-19 spreads rapidly through overcrowded households as well as posing a greater risk to those who do

not have the economic resources to safely isolate or the ability to work from home.<sup>18</sup>

Vaccinated and unvaccinated individuals are modelled as equally likely to interact (based on the vaccination rate). This is a modelling assumption that should be explored further in future work as the COVID-19 Protection Framework and use of vaccine certificates means that in public settings vaccinated individuals are more likely to interact with vaccinated individuals, and likewise for unvaccinated individuals. This clustering effect may be more apparent in private gatherings, where unvaccinated individuals are potentially more likely to have unvaccinated guests than vaccinated individuals are.

## Omicron

The model described above, originally developed in Watson (2022),<sup>4</sup> was focused on the Delta variant. Given the rapid emergence and spread of Omicron in the community, I also apply the model to the Omicron variant with the following modifications.

The population is divided into unvaccinated, vaccinated (two doses of the Pfizer-BioNTech vaccine), and boosted (three doses of the Pfizer-BioNTech vaccine). For two doses, the vaccine is modelled as 14% effective against infection of Omicron and 3% effective against transmission for breakthrough infections, which corresponds to 15+ weeks since the second dose was administered. For three doses, the vaccine is 58% effective against infection and 26% effective against breakthrough transmission, which corresponds to 2–5 weeks after the booster was administered. Vaccine effectiveness are taken from Golding and Lydeamore (2022),<sup>19</sup> Andrews et al (2021),<sup>20</sup> and the UK Health Security Agency (2022),<sup>21</sup> and are similar to the values used by Vattiato et al (2022)<sup>22</sup> who modelled an Omicron outbreak in New Zealand. Times are chosen to reflect that many people got their second dose over three months ago, and that the booster campaign started in earnest a few weeks prior to widespread community transmission of Omicron. Natural immunity from previous COVID-19 infections is not included because, at the time this study was conducted, the cases numbers are still relatively small compared to the population of New Zealand.

Each infected individual infects a random number of other individuals drawn from a Poisson distribution  $\lambda = R_0$  where  $R_0$  is the effective reproduction number in the presence of public health measures (not to be confused with  $R$ , which is

the reproduction number). Following Vattiato et al (2022),<sup>22</sup> I use  $R_0 = 2.6$ , which accounts for the public health measures under the Red level of the COVID-19 Protection Framework (unlike for the Delta variant where I consider  $R=6$  and do not account for public health measures, similar to previous work by Steyn et al (2021)<sup>8</sup>). This corresponds to the baseline scenario from Vattiato et al (2022).<sup>22</sup>

Omicron has a shorter incubation period than Delta.<sup>23,24</sup> For Omicron, the generation time is sampled from a normal distribution with a mean of 3.3 days and standard deviation of 1.3 days.<sup>22</sup>

## Results

### Delta

The simulations are seeded with either one vaccinated (two doses) or one unvaccinated individual at  $t=0$ , where  $t$  is the time in days, and are run for 31 days (~1 month) with time steps of one day. The simulations are run 100,000 times for each scenario to get a representative sampling of the possible outcomes from the stochastic model.

### Vaccination status of seed infection

During the Delta outbreak, a regional boundary was enforced around Auckland to limit the spread of the COVID-19 outside Auckland, which was the epicentre of the outbreak. The boundary was effective and enabled much of the country to experience minimal restrictions while Auckland was at Alert Level 3 or 4. The regional boundary was relaxed on 15 December 2021, and people were able to travel in and out of Auckland if they were fully vaccinated or had proof of a negative test within 72 hours of traveling.<sup>25</sup> This situation persisted until 17 January 2022, when the border was removed entirely. Despite these protective measures, the movement of people out of Auckland resulted in COVID-19 being seeded in other locations around the country including Waikato and Northland. Here, I consider the possible numbers of infections in an outbreak based on the vaccination status of the seed infection (Figure 1). The simulations are performed for a vaccination rate of 78.7% of the total population; this is approximately 90% of the eligible population (over 12 years old), which was the Government's vaccination target for all district health boards during the Delta outbreak. Note that this work assumes that an infected individual can travel and seed a new outbreak. I do not model the impact of vaccination or testing requirements on preventing infected people from travelling and catching cases

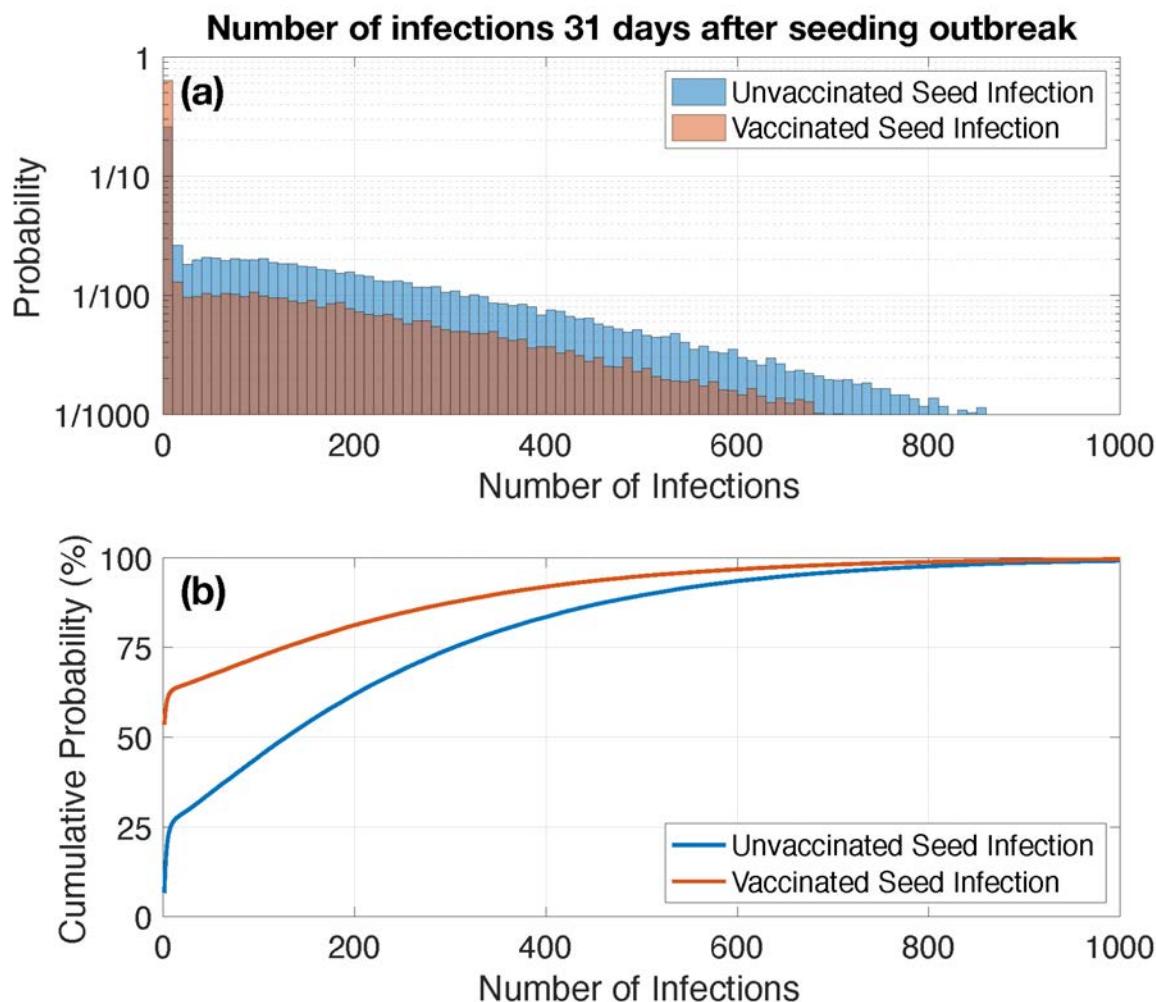
before they travel and seed new outbreaks.

Figure 1a shows the probability of a given number of infections 31 days into an outbreak seeded by a vaccinated individual or unvaccinated individual, with the cumulative probabilities shown in Figure 1b. For both vaccinated and unvaccinated seed infections, there is a small possibility of large outbreaks developing within the first 31 days of an infection being seeded (5% chance of >506 cases and >657 cases for the vaccinated and unvaccinated seed, respectively). However, for a vaccinated seed infection it is much more likely that COVID-19 does not spread beyond the initial case; there is a 54% chance that COVID-19 does not spread to anyone else while for an unvaccinated seed infection there

is only a 6% chance. This is because the vaccine is assumed to be 50% effective at preventing onward transmission.<sup>8,14</sup> For an unvaccinated seed infection, there is a 54% chance that the outbreak has up to 151 infections after 31 days.

Figure 1 shows the importance of vaccination in stopping outbreaks from being seeded. A vaccinated traveller is 9x less likely to seed an outbreak in a community than an unvaccinated traveler (note that this model does not account for the protection provided by testing requirements prior to travelling, which would reduce the risk factor posed by unvaccinated travellers). This illustrates the importance that travellers are vaccinated (or tested prior to travelling, or both), especially if

**Figure 1:** Delta variant. (a) Histograms showing probability of number of infections 31 days into an outbreak and (b) cumulative probabilities for an outbreak seeded by (red) one vaccinated individual or by (blue) one unvaccinated individual.



travelling from regions with significant COVID-19 community transmission (eg Auckland) to regions with low vaccination rates (eg Northland). Continued community testing (not modelled here) is required to rapidly identify any outbreaks that are seeded before they grow.

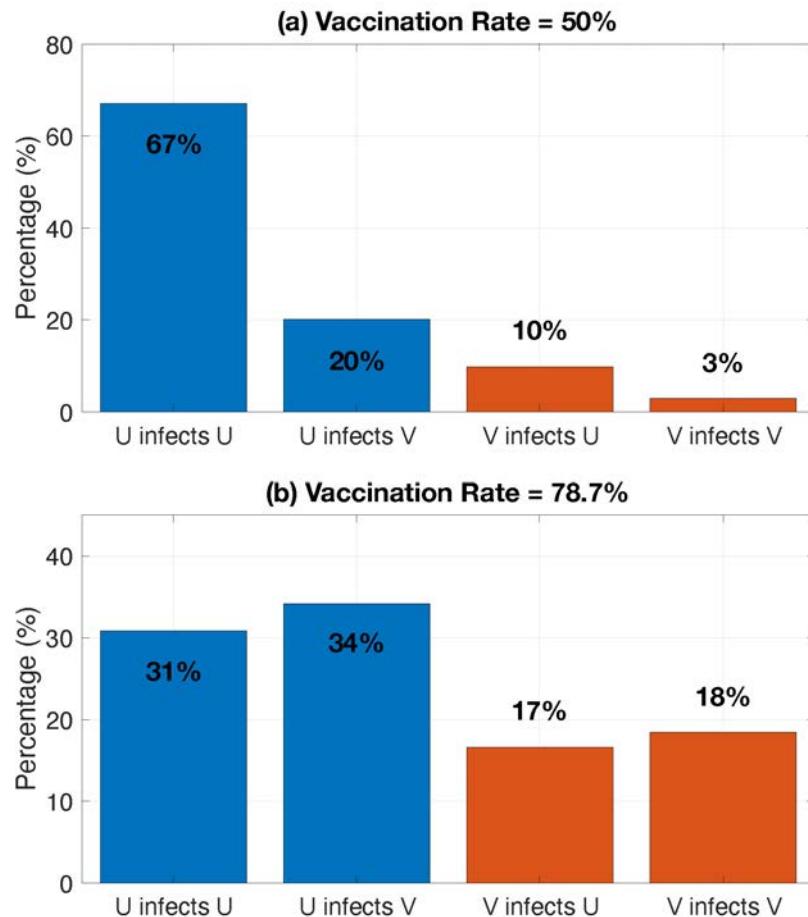
#### **Likelihood of infection/infecting based on vaccination status**

The model tracks the number of vaccinated and unvaccinated cases, as well as the vaccination status of the individuals that cause the infections. This enables me to calculate the probability of infection based on the vaccination status of the infecting and infected individuals. The results are calculated from the mean of the 100,000 realisations.

Figure 2a shows the results for a vaccination rate of 50% of the total population, which means that there are an equal number of unvaccinated individuals and vaccinated individuals in the pop-

ulation. 87% of all infections are caused by unvaccinated individuals, with 67% of all infections being from unvaccinated individuals to unvaccinated individuals. By contrast, only 13% of infections are caused by vaccinated individuals, and only 3% of these are from vaccinated to vaccinated. This illustrates the importance of vaccination in preventing individuals from (a) getting infected and (b) passing COVID-19 on to others. Figure 2a also illustrates that, while the vaccine provides significant protection from getting infected, vaccinated individuals can still get infected, predominantly from unvaccinated individuals. Vaccinated individuals are 6.8x more likely to be infected by an unvaccinated individual than by a vaccinated individual. Although Figure 2a is calculated for a vaccination rate of 50%, it also gives the values that would be observed at different vaccination rates after normalising for population (dividing the number of infections by the number of people in each category). Normal-

**Figure 2:** Delta variant. Likelihood that a new infection is caused by a (U) unvaccinated or (V) vaccinated individual and that the new infection is in an unvaccinated or vaccinated individual. (a) shows a total vaccination rate of 50%, where there are an equal number of vaccinated and unvaccinated individuals in the population, while (b) shows a total vaccination rate of 78.7%, which is approximately the 90% eligible population target. (a) shows the expected result when normalising by population.



ising by population removes the influence of the number of people in each category (for example, more cases amongst vaccinated individuals than unvaccinated, which occurs simply because there are many more vaccinated people). This illustrates that most infections are caused by unvaccinated individuals.

Figure 2b shows the results for a total vaccination rate of 78.7%. Unvaccinated individuals are responsible for 65% of infections despite only making up 21.3% of the population. By contrast, vaccinated individuals are only responsible for 35% of infections while making up 78.7% of the population. Even at these high levels of vaccination, where there are 3.7x as many vaccinated individuals as unvaccinated individuals, a new infection is almost twice as likely to be caused by an unvaccinated individual. A vaccinated individual has a 65% chance of being infected by an unvaccinated individual, compared to a 35% chance of being infected by a vaccinated individual (1.9x more likely to be infected by unvaccinated individual even though there are far fewer unvaccinated individuals in the population). Figure 2b illustrates that, even at high levels of vaccination, unvaccinated individuals are the main cause for continued spread of COVID-19 with only 18% of infections from vaccinated to vaccinated. This suggests that restricting unvaccinated individuals from high-risk locations (ie potential super-spreader events) will help to minimise the spread of COVID-19, which is the goal of the COVID-19 Protection Framework.

The model assumes that unvaccinated and vaccinated individuals are equally likely to interact. In reality, unvaccinated and vaccinated individuals are likely to interact with individuals with the same vaccination status, both in private gatherings and in public spaces as mandated by the COVID-19 Protection Framework. Therefore, the results in Figure 2 may underestimate the spread of COVID-19 between unvaccinated individuals.

## Omicron

The simulations are seeded with either one boosted (three doses), one vaccinated (two doses), or one unvaccinated individual at  $t=0$ , where  $t$  is the time in days, and are run for 31 days (~1 month) with time steps of one day. The simulations are run 100,000 times for each scenario to get a representative sampling of the possible outcomes from the stochastic model. I consider a population that is 10% unvaccinated, 40% vaccinated (two doses) and 50% boosted (three doses), although the

booster uptake is varied in Figure 4 to examine the effect of increasing booster coverage.

### Vaccination status of seed infection

I perform a similar analysis to Figure 1 for the Omicron variant, and consider outbreaks seeded by unvaccinated, vaccinated, and boosted individuals with the results shown in Figure 3. Figure 3a shows the probability of a given number of infections 31 days into an outbreak as a function of the vaccination status of the seed infection, while Figure 3b shows the cumulative probabilities. The model assumes that the Pfizer-BioNTech vaccine is significantly worse at preventing infection and transmission against Omicron than Delta (two doses are assumed to be 70% effective against infection and 50% effective against transmission for Delta but only 14% and 3%, respectively, against Omicron). Therefore, there is not much difference between the unvaccinated and vaccinated seed infections (69% and 71% chances of less than 500 infections after 31 days for unvaccinated and vaccinated seeds, respectively). Three doses of the Pfizer-BioNTech vaccine provide decent protection from infection and transmission (58% and 26%, respectively), although three doses are still less effective against Omicron than two doses were against Delta. Note that vaccine effectiveness wanes with time, and that model results shown here are only applicable for a snapshot in time. For a boosted seed infection, there is a 78% chance of less than 500 infections after 31 days.

Seed infections caused by boosted individuals are more likely to lead to small outbreaks that self-extinguish after a small number of infections. An outbreak that starts from a boosted individual has a 56% chance of stopping after 10 or fewer infections whereas the probability is only 42% for a vaccinated seed infection or 40% for an unvaccinated seed infection.

This demonstrates that while the Pfizer-BioNTech vaccine is less effective against preventing infection and transmission of Omicron compared to Delta, those who are boosted are slightly less likely to seed a large outbreak.

### Booster vaccination rate

I also consider the impact of increasing booster rates from 50% to 70% and 90% (assuming 10% of the population remain unvaccinated). The results are shown in Figure 4 for an unvaccinated seed infection. Increasing the percentage of the population who are boosted drastically reduces the

likely number of infections. For a booster rate of 50%, there is an 47% chance of less than 100 cases after 31 days compared to 77% and 98% for booster rates of 70% and 90%, respectively. This clearly illustrates that while three doses of the vaccine provide imperfect protection (the model presented here assumes 56% effective against infection, and only 26% effective against breakthrough transmission), high levels of booster coverage provide good protection against infection on a population level. This demonstrates the need for everyone to get boosted to provide the best possible protection for themselves and their community.

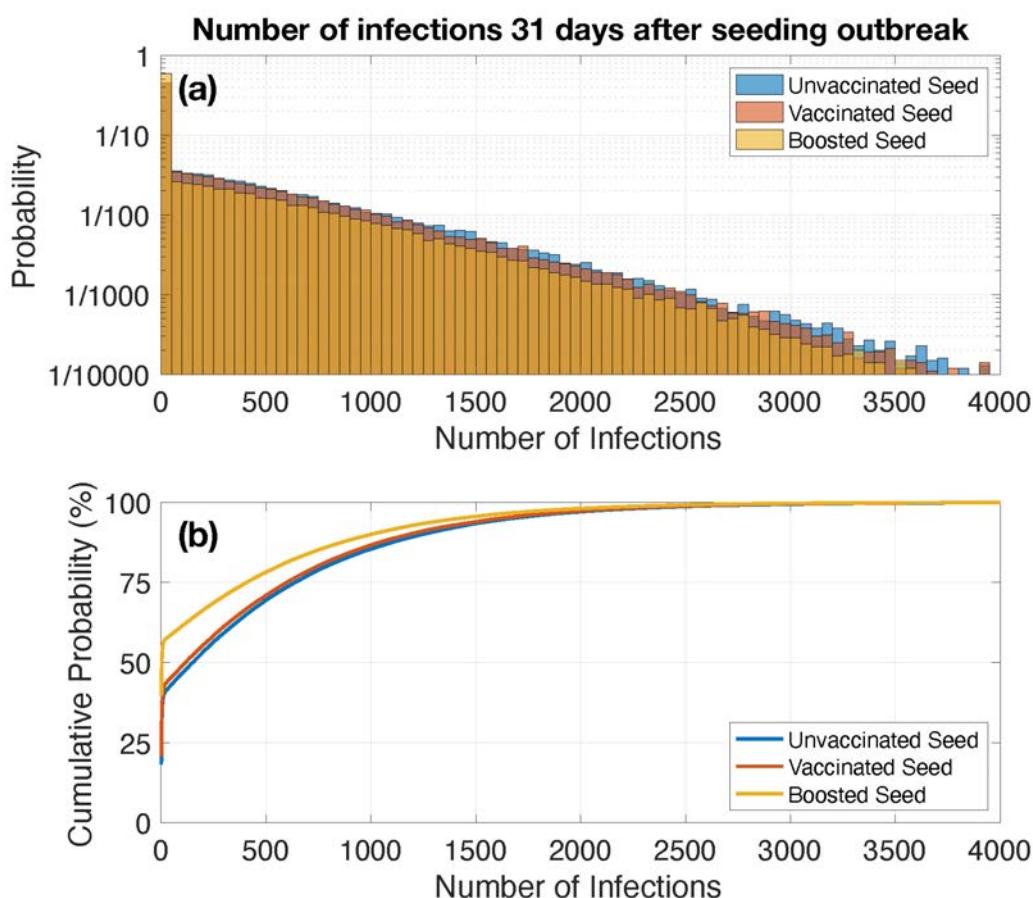
#### **Likelihood of infection/infecting based on vaccination status**

The Omicron version of the model tracks the number of unvaccinated, vaccinated and boosted cases, as well as the vaccination status of the individuals that cause the infections. Like the results

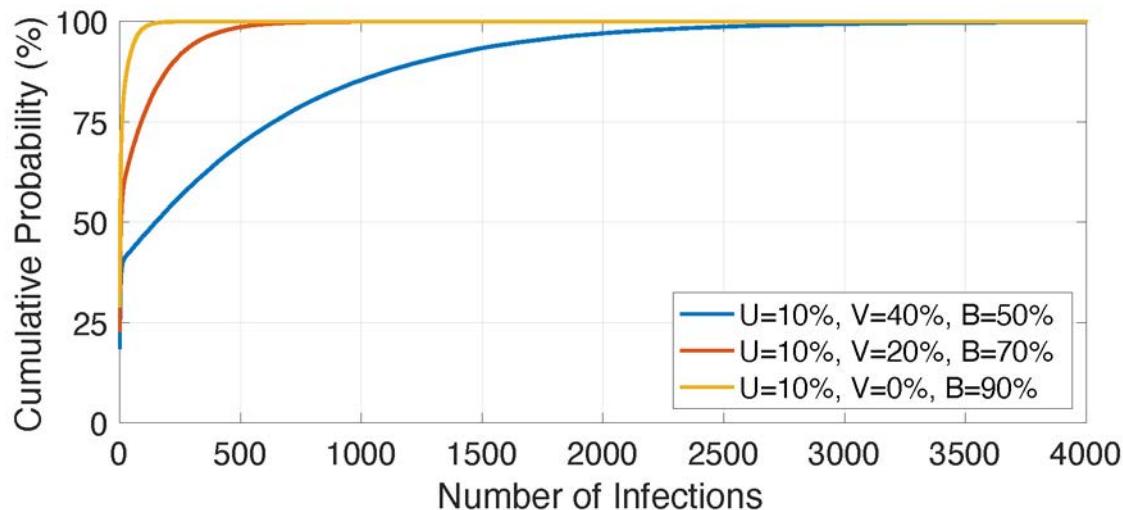
shown in Figure 2 for the Delta variant, I calculate the probability of infection based on the vaccination status of the infecting and infected individuals. The results are shown in Figure 5 and are calculated from the mean of the 100,000 realisations for an outbreak seeded with one unvaccinated individual, one vaccinated, and one boosted.

Figure 5a shows the result for when there are an equal number of unvaccinated, vaccinated and boosted individuals in the population. This is also the result expected when normalized for population (dividing the number of infections by the number of people in each category). Unvaccinated individuals are responsible for 46% of infections compared to 39% for vaccinated and 15% for boosted. Of the new infections, unvaccinated individuals make up 44% of new cases while vaccinated are 38% and boosted are 18%. Unvaccinated individuals are 3.1x more likely to infected others and 2.4x more likely to be infected than boosted

**Figure 3:** Omicron variant. (a) Histograms showing probability of number of infections 31 days into an outbreak and (b) cumulative probabilities for an outbreak seeded by (blue) one unvaccinated, (red) one vaccinated, and (yellow) one boosted individual.



**Figure 4:** Cumulative probability for number of infections 31 days after seeding an outbreak with an unvaccinated seed infection for booster vaccination rate of (blue) 50%, (red) 70%, and (yellow) 90%.



individuals. This supports the rationale of using the COVID-19 Protection Framework to restrict unvaccinated individuals from high-risk settings, although the definition of “fully vaccinated” should be updated to distinguish between individuals who have had two or three primary doses of the vaccine. When normalised by population (as shown in Figure 5a), transmission from boosted-to-boosted individuals is only responsible for 3% of infections. These results are sensitive to the model assumptions about vaccine effectiveness, but nonetheless show that even through the Pfizer-BioNTech vaccine is less effective against Omicron than Delta (particularly for two doses), boosted individuals are much less likely to spread or be infected with COVID-19. Vaccinated individuals are only slightly less likely to spread COVID-19 or get infected when compared to unvaccinated individuals, demonstrating the need to get boosted to protect against Omicron infections and prevent onward transmission.

Figure 5b shows the result for realistic vaccination rates of 10% unvaccinated, 40% vaccinated, and 50% boosted. In this situation unvaccinated individuals are responsible for 17% of infections compared to boosted individuals who are responsible for 27% of infections. 15% of new infections occur in unvaccinated individuals compared to 32% in boosted individuals. The boosted population is 5x larger than the number of unvaccinated individuals, but only responsible for causing 1.6x as many infections and receiving 2.1x as many (much less than the 5x as many that would be expected if the vaccine did not offer any protection). This illustrates that three doses of the Pfizer-BioNTech vaccine can be effective at preventing infection and transmission.

## Conclusions

The New Zealand Government has transitioned from the Alert Level system to the COVID-19 Protection Framework that replaces population level controls with vaccination certificates. As a result, there is a need to better understand the risk posed by unvaccinated versus vaccinated and boosted individuals. Here, I use a stochastic model to simulate the potential numbers of infections in an outbreak seeded by a unvaccinated individual versus a vaccinated individual (for Delta) and a boosted individual (for Omicron). For Delta, unvaccinated individuals are much more likely to seed an outbreak with a 54% chance of causing an outbreak with over 107 cases after 31 days. By contrast, for a vaccinated seed infection, there is a 54% chance that the outbreak does not spread beyond the initial seed. Vaccinated travellers are 9x less likely to seed an infection than unvaccinated travellers. For Omicron, there is little difference between unvaccinated and vaccinated seed infections, but boosted individuals are slightly more likely to result in small outbreaks that self-extinguish. Increasing booster coverage can significantly slow the growth of an outbreak, making it much more likely that outbreaks will self-extinguish after a small number of cases.

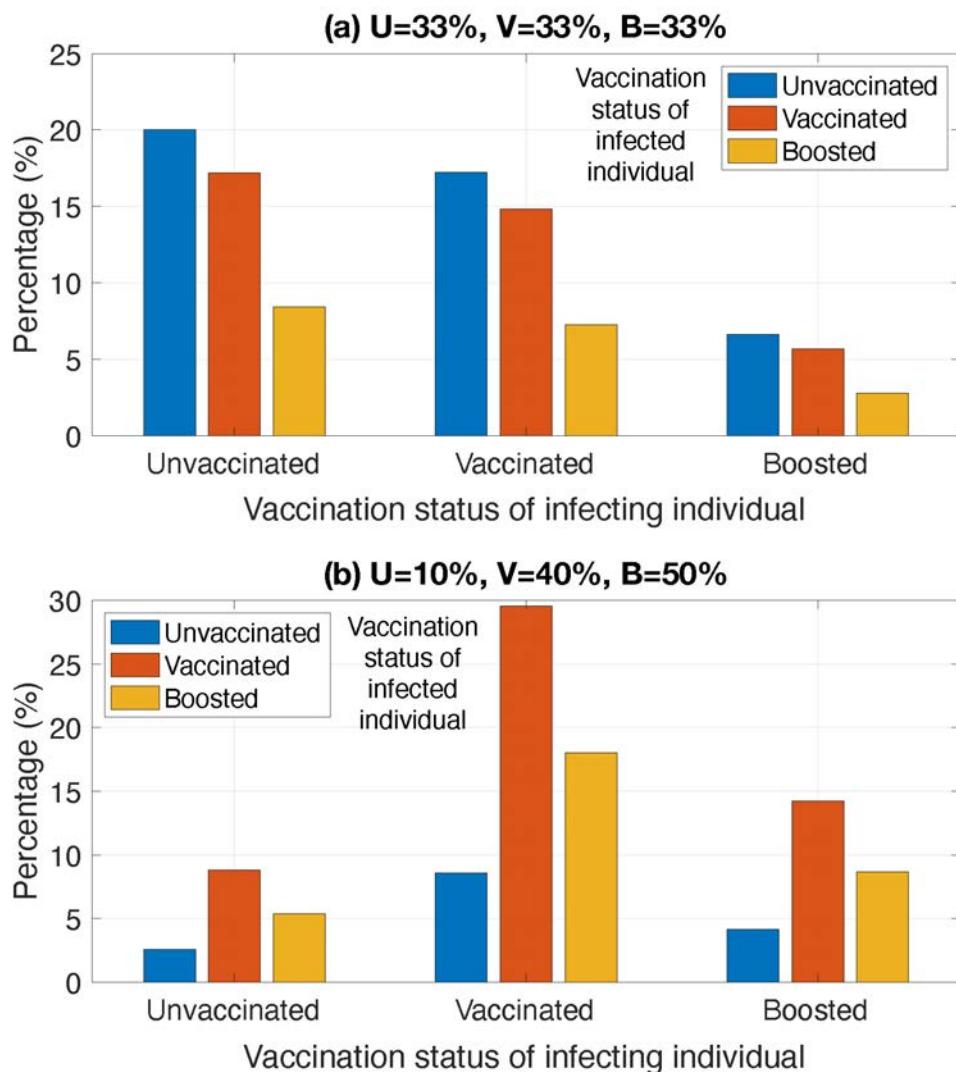
I also calculate the likelihood of getting infected and of infecting others based on vaccination status for Delta and Omicron variants. For Delta, unvaccinated individuals are much more likely to spread the virus and, when normalised by population, are responsible for 87% of all. Transmission between vaccinated individuals is rare, and responsible for only 3% of all infections when normalised by pop-

ulation. The Pfizer-BioNTech vaccine is less effective against Omicron. Nonetheless, unvaccinated individuals are more likely to spread the virus, and are responsible for 46% of new infections compared to 39% for vaccinated individuals (two doses) and 15% for boosted individuals (three doses), when normalised by population. Despite three doses of the vaccine having limited effectiveness against breakthrough transmission (26%), transmission between boosted individuals is rare accounting for only 3% of all infections when normalised by population. This illustrates that COVID-19 is becoming a pandemic of the unvaccinated and is predominantly spread by the unvaccinated, especially for

the Delta variant. For Omicron, two-dose vaccinated individuals are only slightly less likely to be infected and infect others than the unvaccinated are, but those who are boosted (three doses) are much less likely to be infected or infect others.

The COVID-19 Protection Framework and associated vaccine certificates distinguish between unvaccinated and vaccinated individuals. This work suggests that for the current Omicron outbreak, we should also distinguish between those who have received two primary doses of the Pfizer-BioNTech vaccine (vaccinated individuals) and those who have received three doses (boosted individuals).

**Figure 5:** Omicron variant. Likelihood of new infections as a function of vaccination status of the infecting and infected individuals. (a) Vaccination rates of U=33% (unvaccinated), V=33% (vaccinated), and B=33% (boosted). This shows the expected result when normalising by population. (b) Vaccination rates of U=10% (unvaccinated), V=40% (vaccinated), and B=50% (boosted).



The latest version of the code is hosted at GitHub (<https://github.com/leighton-watson/COVID>) and the version used in this manuscript is archived at <https://doi.org/10.5281/zenodo.6361172>.

**COMPETING INTERESTS**

Nil.

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**URL**

[www.nzma.org.nz/journal-articles/likelihood-of-infecting-or-getting-infected-with-covid-19-as-a-function-of-vaccination-status-as-investigated-with-a-stochastic-model-for-aotearoa-new-zealand-for-delta-and-omicron-variants-open-access](https://www.nzma.org.nz/journal-articles/likelihood-of-infecting-or-getting-infected-with-covid-19-as-a-function-of-vaccination-status-as-investigated-with-a-stochastic-model-for-aotearoa-new-zealand-for-delta-and-omicron-variants-open-access)

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# Perioperative leaders' experience of COVID-19 in Aotearoa: a qualitative interview study

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## ABSTRACT

**AIMS:** Once it became apparent that COVID-19 would reach Aotearoa New Zealand, perioperative services responded urgently to contain viral spread, keep staff safe and maintain patient care. We aimed to understand how perioperative leaders around the country responded to the pandemic, their experiences, reflections and the lessons learnt. Our goal is to inform future pandemic responses.

**METHODS:** We undertook a qualitative study with thematic analysis of semi-structured interviews. We recruited perioperative leads involved in the COVID-19 response using snowball sampling, following initial contact with anaesthetic and surgical department heads.

**RESULTS:** We interviewed 33 perioperative leads from 16 of the country's 20 district health boards, with representation across hospitals of different sizes and the professional groups working in operating theatres. Four main themes were identified from data. These were: "no one source of truth," with prolific, constantly changing information, limited initial support from hospital senior executives, and siloed approaches and tensions between departments and professional groups; resourcing challenges attributed to limited baseline preparedness and increased workload; deficiencies in PPE and physical facilities; staff stress and anxiety, and the impact this had on workforce capacity; ongoing preparedness for future waves; and reflections on "lessons learnt". These lessons focused strongly on communication, caring for staff, collaboration, downtime to enable preparation, and a need for external, potentially national co-ordination and resources to facilitate planning.

**CONCLUSIONS:** Perioperative leaders' experiences and reflections of COVID-19 paint a picture of limited prior preparation or planning for a pandemic, requiring an immediate pivot from routine care to emergency response. In an environment of uncertainty, information overload and staff stress hospital leaders worked to obtain resources, maintain staff safety and engagement, develop new systems and in some cases, create new facilities. Sharing the experiences and lessons learned about communication and collaboration, policy development and staff training may go some way to facilitate a smoother implementation of a pandemic response the next time around.

The COVID-19 pandemic has had an extraordinary effect on hospital staff. From a "standing start", each hospital has dealt with uncertainty and fear to create new processes to limit the spread of the disease, care for patients, and ensure the wellbeing of staff. Health leaders, managers and frontline staff have developed a wealth of experience from what has been for many the most challenging event in their clinical experience to date.

The patient journey through the operating theatre is complex, involving multiple safety checks, and interactions with staff from many different departments and professional groups. The risk of staff infection in operating theatres is markedly

increased due to aerosol generating procedures during airway manoeuvres, moving contaminated bedding or surgical drapes, and any surgery involving the airway. At each point on the journey, a detailed process is required to manage the risk of droplets and aerosols infecting staff.<sup>1</sup>

Perioperative services were faced with the urgent task of creating new protocols and processes, sourcing PPE equipment and training staff. New protocols and training were developed for limiting staff exposure, donning and doffing, patient transfers, aerosol generating procedures, team communication and managing potential in-theatre emergencies. The literature to inform these infection prevention protocols is vast and

continues to evolve.<sup>2–5</sup> The safety and wellbeing of healthcare workers became a priority, both to protect staff from infection with a potentially fatal disease, and to maintain a functioning healthcare system. International reports speak to high rates of psychological stress and burnout among operating room staff during the pandemic, and concerns about the increased cognitive load on work performance, fewer opportunities for trainees to develop skills, difficult communication associated with PPE, and absenteeism.<sup>6–12</sup>

To understand how perioperative services responded to the emergence of COVID-19 and the lessons learnt we explored the experiences and perspectives of perioperative leads from hospitals around the country. The objective of this study is to share these experiences and learn from them.

## Method

The Auckland Health Research Ethics Committee approved this study (AH3336). Informed consent was obtained from all participants.

### Context

The public health system in Aotearoa is divided into 20 district health boards (DHBs) responsible for the population in their region. The study took place after the first wave of the COVID-19 pandemic, during a period when elimination had been (temporarily) achieved in the community.

### Study design

We undertook a qualitative study with thematic analysis of semi-structured interviews.

### Sample and sampling

We used a snowballing sampling strategy to identify and recruit perioperative services clinical leaders, managers and key planning personnel, initially contacting anaesthetic and surgical department heads, asked for referrals to relevant nursing, anaesthetic technician, anaesthesia and surgical leaders and advertising the study in a surgical newsletter.

### Reflexive statement

JW is a clinical academic and anaesthetist, with expertise in patient safety, teamwork and simulation-based education. VB is an anaesthetist, former perioperative lead and President of the Australian and New Zealand college of Anaesthetists. KJ is an anaesthetist involved in hospital disaster response planning. JL is a research fel-

low with a psychology background. ML is a public health clinician and clinical academic with expertise in Māori health.

### Data collection and management

The semi-structured interview question guide was developed through discussion within the research team and informed by the literature on hospital responses to COVID-19 overseas. The question guide explored participant experiences of, and reflections on, planning for the pandemic (Interview guide Supplement 1).

Interviews were conducted via video conference or telephone or face-to-face by JL, JW, VB and ML. Recruitment continued until a representative sample across hospitals and professional groups was obtained and we reached data sufficiency, in that additional interviews were not adding new information. Interviews were audio-recorded, transcribed by an independent transcriber, de-identified, and entered into NVivo software.

### Data analysis

Thematic analysis followed the six-step approach described by Braun and Clarke.<sup>13</sup> (See Table 1)

## Results

Thirty-three perioperative leaders, managers or core planning personnel from 16 DHBs participated in interviews, which was 72% of those we invited. Interview duration was 20 to 60 minutes. Participants were from small (7), medium (12) and large (14) DHBs, comprising 17 anaesthetists, six surgeons, six nurses and one anaesthetic technician. Of these, 91% held a formal management or educator role and 9% identified as Māori.

We identified three interrelated themes describing the main issues for participants: “no one source of truth”, “resourcing challenges” and “staff stress and anxiety”. A fourth theme, “lessons learnt”, captures participant reflections what worked, and recommendations for the future.

### Theme 1: no one source of truth

Participants described prolific, constantly changing information, limited initial support and siloed approaches to planning with tensions between departments and professional groups.

### Prolific, constantly changing information

Participants experienced an overload of constantly changing information including scientific advice, international experiences, and recom-

mendations, circulated by colleagues or leaders or accessed via the internet. “Facts” and recommendations often conflicted between sources, and between professional bodies. This in turn hindered development of protocols, staff trust and inter-department consensus on core issues, such as the PPE precautions needed in different circumstances.

*There was so much information and every day it was changing—by the time you—disseminated all the information to everyone—the next day, it all [...] changed again. (Participant (P) 25, Nurse Educator, medium DHB)*

*There were hundreds of articles coming out every day from all across the world that people would just send around, you know. It was like complete information overload (P8, Anaesthesia HoD, small DHB)*

### Limited initial support for department leaders

Participants recounted receiving minimal guidance from senior hospital management and the Ministry of Health (MoH) in the initial stages of the pandemic. In the face of urgent need for action, many found hospital management slow to make decisions, answer queries or approve proposed policies. Similarly, national guidance emerged after many departments or hospitals had done their own initial planning. National and hospital level plans were often described as being focused on “bigger picture” issues as community spread or visitor procedures, leaving perioperative teams to develop their own plans for conducting surgery safely.

*A lot of the work here was not sanctioned by the ministry or sanctioned by the DHB. A lot of scared staff members decided to do it on their own and were supported by the managers (P14, Anaesthesia HOD, medium DHB)*

**Table 1:** Steps in thematic analysis.

Step	Description
Familiarisation	One researcher (JL) read and re-read all transcripts and kept memos. JW read three transcripts to build familiarisation.
Generating initial codes	JL coded ten transcripts line by line, reorganised, clustered codes and proceeded with the remaining transcripts, collating data relevant to each code. The initial ten transcripts were later recoded to ensure consistency in the application of the coding framework.
Theme development	Candidate themes were developed by collating codes, mapping relationships between codes, and summarising data relevant to each potential theme. Codes were again reorganised and re-clustered.
Reviewing themes	Codes and themes were discussed and agreed by members of the research team, with attention to the research question and the full set of participant data. Topics where there was little consistency were discarded from the final set of themes.
Defining themes	JL and JW met to define the themes and their relationships to each other, referring back to the coded data and the research team.
Generating the report	Using the final themes and coding framework, the data was collated, compelling or representative quotes identified, and the final analysis completed.*

\* Quotes included in this manuscript were then modified for brevity and to remove identifying information. Verbatim quotes are available on request.

*It felt like they [MoH] were very much focused on what we're going to do as a country. Fair enough, because there's a huge amount of work to be done there. But in terms of what are we going to do as a health service and how are we going to do this in ICU, actually manage people. It felt like that [actual management of ICU patients] was initially very driven at an individual level.* (P10, Anaesthesia HOD, large DHB)

### Confused messages and distrust about PPE stock and protection

Participants struggled to get an accurate picture about PPE requirements, and many distrusted the information provided by their hospital or the MoH about PPE stock levels and the protective adequacy of the available PPE and protocols.

*One of our biggest concerns initially was the very mixed and confused messages around the requirement for N95 masks and low-level PPE.* (P30, Surgical HOD, large DHB)

*That was a source of constant frustration, you know, seeing pictures from people in other countries with completely different PPE to what we were expected to use... is that because we didn't have anything better, is that because there was nothing better available, you know, and those are big questions that I couldn't answer at any stage.* (P15, Anaesthesia HOD, medium DHB)

### Siloed approaches and tensions between departments

Some perioperative services had limited collaborative planning between professional groups and departments, and many had different solutions to issues such as screening and PPE. These differences were often attributed to varying perceptions of risk or conflicting guidance from professional colleges. Within many perioperative services, surgeons were not well integrated into the initial planning and staff training. Some perioperative clinicians took it upon themselves to run joint training, sometimes involving ED or ICU, but without senior management support. In other hospitals, planning was collaborative across departments from the outset.

*Everyone was just in such a hurry and so every kind of silo had to sort their own area out. We did drills [with ICU, ED and theatre] but that was the clinicians working together. There wasn't any kind of hospital oversight.* (P17, Anaesthesia HOD, large DHB)

*There was a lot of conflict between specialities about how they wanted their patients brought into theatre. And in the end, we had to say, no we're having one journey for the patient. If we have one for obstetrics and then we have one for gen. surg. etc – nobody's going to get it right, we're going to forget and get it all wrong.* (P2, Nurse Manager, large DHB)

## Theme 2: Resourcing challenges

Staff described resourcing challenges to prepare for a potential influx of COVID-19 patients due to limited baseline preparedness, increased workload, access to PPE, deficient physical facilities, and limited ongoing preparedness for a second wave.

### Limited baseline preparation

Participants described essentially starting from scratch in their preparations for COVID-19. Disaster response plans provided little relevant guidance, while participants were either unaware of existing pandemic plans or found that substantial work was needed to translate the high-level pandemic plans into department-level plans applicable to COVID-19. IT systems or hardware needed to be upgraded to enable Zoom and remote work. Protocols, plans, training and equipment upgrades needed to be established urgently, and many described being caught out by the speed at which COVID-19 became an imminent threat in New Zealand.

*I guess ideally, we would have done that work in January. But I guess, how fast COVID moved and our lack of understanding meant that we didn't really do that work until quite late in the piece.* (P15, Anaesthesia HOD, medium DHB)

### Workload

Participants recounted the huge volume of work involved in planning and preparing to conduct surgery in the context of potential COVID-19 cases, with some working "80 to 100 hours a week", or "every day during the six-seven-week period".

In addition to the work involved in reviewing literature and developing protocols and education communications with staff, supporting staff well-being took up large amounts of time that limited their capacity for other planning and management tasks. Many of those interviewed had responsibilities not only for their own department, but also supporting other departments including ICU, or wider Māori and Pacific networks.

*[The] time you spend managing your staff probably tripled overnight because of the stress, anxiety (P12, Nurse Manager, medium DHB)*

*I'm very strong with [supporting] all my Māori and Pacific nursing groups, PPNA [Pan Pacific Nurses Association], the Pacific Medical Association, Nursing, Māori Nurses, Niuean Nurses. So, we all had things that were asked of us (P26, Nurse Consultant, large DHB)*

Participants emphasised the additional time and staffing required for surgery on patients who might, or did, have COVID-19. In some cases this doubled staff numbers, or quadrupled the time needed for the surgery. Additional resources for potential COVID-19 patients limited the resources available to treat other patients.

*When you take a patient through [theatre] and you treat them as if they're COVID [positive]—it's just enormously time consuming and that has a big impact obviously—the quantity and the work that you can do for all the other patients so there's lost opportunity cost and it's exhausting for the staff as well. (P1, Anaesthesia HOD, large DHB)*

### Real or perceived PPE shortages

Most participants were initially worried that the local or national stock of PPE would run out, and these fears in turn led to rationing of PPE, tensions between individuals and departments, and staff stress. Some DHBs found that their existing pandemic stocks were out of date or perished, and new stocks were sometimes unsuitable.

*Early on [DHB name] had very little [PPE]. I mean, it was terrifying and we were*

*very mindful of the fact that we couldn't afford to waste it.... I think also just the reliability of the information, you know, the minister was up there saying there'll be enough PPE but it didn't feel like that was based on any great factual information. (P2, Anaesthesia HOD, medium DHB)*

### Challenges caused by local physical facilities

Local physical facilities generated challenges with isolating and caring for patients, often related to lack of appropriate spaces or negative pressure rooms. Challenges were difficult to address within the constraints of existing, sometimes ageing and outdated, hospital buildings although some hospitals had new walls built or used plastic sheeting to create isolation areas.

*Our hospital is so old, and our facilities are so outdated. So a lot of the wards would have struggled. We have maybe two negative pressure rooms in our wards in total and one in ED. (P5, Anaesthetist, large DHB)*

### Concerns about existing workforce capacity

Many recounted concerns about insufficient staff numbers and inadequate numbers of staffed ICU beds to respond to large numbers of COVID-19 cases. This would be exacerbated by staff exposure to the virus contributing to stand downs and sickness.

*We struggle with ICU capacity on a day-to-day basis—we would not have had the staff to care for patients and we would not have had the space to keep patients. That is admittedly our weakness. We have the skills—we just don't have enough people. (P10, Anaesthetic HOD, Large DHB)*

*We're chronically understaffed and that's not just specialists.... it simply would not be possible to deal with a pandemic with that amount of staff. (P16, Anaesthesia HOD, medium DHB)*

### Limited ongoing planning and training

Limited planning or training had occurred between the initial lockdown period and the time of their interview. Ongoing planning and training were described as difficult to resource when people already had high workloads trying to catch up on missed surgeries from the initial lockdown.

*We've already lost a bit of that institutional knowledge, the match readiness[for COVID-19]. And we've been slain by business as usual because everybody's in catch-up. Every hospital I visited this year has been overwhelmed by acute caseloads... it's very hard for us to get people out to train. (P6, Anaesthesia HOD, large DHB)*

*They've got so many surgeries to do but I think sometimes they put those as [ahead of] actually getting the staff prepped up to be able to do the mahi effectively and in a positive way. (P26, Nurse Consultant, large DHB)*

### Theme 3: Staff stress and anxiety

Participants described unprecedented staff stress and anxiety and the impact this had on workforce capacity.

#### High stress and anxiety

Most participants described high levels of staff stress or anxiety, which extended to large portions of the workforce in some departments. Staff stress was described in all professional groups, but most commonly among nurses. Fear was perceived to be largely driven by concerns about catching COVID-19 or passing it to their families. Fears also related to the ability of services and PPE stocks to cope with an influx of patients, and challenges associated with childcare, lost income or concern for family members overseas.

*I've never seen fear like it—I've been through Swine Flu, I went through bird flu, I went through HIV—I have never seen such a level of fear as I did last year. (P22, Nurse Manager, large DHB)*

#### Staff stress impacted workforce capacity

Participants described instances where stress and anxiety led to absenteeism, unnecessary PPE use for COVID-negative patients, impaired decision-making and unwillingness to be involved in the treatment of COVID-19 patients. A number indicated that there remained a general sense of burnout among staff, following the initial 2020 response and the subsequent attempt to catch up on missed elective surgery procedures. The impact on staff wellbeing and turnover in turn had the potential to impact on the workforce's capacity to care for patients.

*There was a mass exodus of large portions of the staff—there were nursing staff—who point blank refused to nurse patients who were query COVID. (P7, Anaesthesia HOD, small DHB)*

*And the recovery nurses... about 90 percent have now resigned from the DHB... they were put under quite a lot of pressure to upskill to ICU, which is a completely different specialty for them and they felt very uncomfortable. (P16, Anaesthesia HOD, medium DHB)*

### Theme 4: Lessons learnt

Participants identified numerous ways they had—or planned to—address the challenges described above. These “lessons learnt” had a strong focus on communication, caring for staff, collaboration, leadership style, downtime to enable preparation, and support for external, or national resources to help with planning.

#### Communication

Participants described the importance of communicating with staff early and regularly, and structuring information so staff could easily navigate to the latest, most relevant information. They also described the importance of expressing empathy for staff anxiety, ensuring avenues for reciprocal communication, being honest and acknowledging uncertainty. There was no single best option for communication format; face-to-face and Zoom meetings could help with staff buy-in for decisions, while email was not helpful for staff with limited access or time to look at emails at work.

#### Collaboration

Identifying talented individuals within their departments added huge value to planning, education and preparing for COVID-19. Many noted that establishing interdisciplinary and interdepartmental collaboration at the outset through formal interdepartmental meetings and working groups, and personal relationships or networks improved the quality and consistency of plans.

#### Invest in staff wellbeing

Participants emphasised the importance of listening to and acknowledging staff concerns and fears and described a range of helpful interventions designed to support staff wellbeing. One Māori participant emphasised the importance of

whanaungatanga and manaakitanga in both caring for patients with COVID-19 and looking after Māori staff and the wider workforce, as well as ensuring staff remained engaged and committed to working in perioperative services.

Well-articulated plans and associated training to protect staff from infection could help reduce staff anxiety. Simulation was a useful, though resource intensive training modality.

### **Leadership style**

Participants reflected that to be successful leaders, they needed to be adaptable to changing circumstances and information while acknowledging that their staff needed them to be decisive in their planning to booster confidence. One reflected on the need to acknowledge a range of staff perspectives on tolerance to personal risk which may differ from their own.

### **Enabling preparation**

Stopping services was described as critical to preparation; the Government lockdown freed up resources to enable services to develop plans and train staff. This work was difficult to achieve when services were working at full capacity and difficult to maintain once full operating lists resumed.

### **External resources**

External information sources including recommendations and resources from overseas colleagues, professional organisations other DHBs were instrumental in formulating plans. Many participants also looked for additional national guidance while acknowledging that guidelines may need local adaptations for physical layout and staffing resources.

Participant recommendations are outlined in Text Box 1.

**Text Box 1:** Recommendations drawn from the experiences of our participants.

<p><i>Staff communication</i></p> <ul style="list-style-type: none"><li>• Dedicate substantial resource to communication to improve staff wellbeing and buy-in.</li><li>• Communication should be regular, empathetic, transparent with well-structured key messages.</li><li>• Incorporate face-to-face or online meetings enhance team cohesion and sharing of ideas.</li></ul>
<p><i>Staff wellbeing and training</i></p> <ul style="list-style-type: none"><li>• Invest in a range of initiatives to support staff well-being, eg psychologist-led resilience workshops, drop-in sessions, practical support.</li><li>• Support leaders and managers so they can in turn continue to support their staff.</li><li>• Continue to simulate, test and revise plans</li></ul>
<p><i>Systems and collaboration</i></p> <ul style="list-style-type: none"><li>• Resource teams to support key tasks (comms., staff wellbeing, protocol development, keeping on top of the literature, training).</li><li>• Pool resources between professional groups and hospitals, consider planning at a national level.</li><li>• Build perioperative multidisciplinary leadership teams co-ordinate planning and workforce support.</li><li>• Support perioperative staff in smaller hospitals who may have unique needs but limited capacity to respond.</li></ul>
<p><i>Structures</i></p> <ul style="list-style-type: none"><li>• Incorporate isolation and infection considerations into future hospital builds and rebuilds.</li></ul>

## Discussion

Perioperative leaders and managers responding to the first wave of COVID-19 described a sense of urgency and previously unseen levels of staff stress in the face of prolific, and constantly changing information. Like others, participants described COVID-19 as a “disaster of uncertainty”.<sup>14</sup> Despite the existence of national pandemic response plans, participants described limited preparedness and increased workload due to the need to rapidly make plans for the response. There were concerns around PPE and the suitability of their facilities. There was an impact on workforce capacity through absenteeism, stand-downs and sickness. Pre-existing perioperative management structures and processes were not always configured to facilitate collaboration between professional groups, between departments and with senior management. All this led to increased tensions and confusion in planning.

Participating perioperative leaders expressed concern about preparedness for future waves. From their experiences, they recommended investment in staff communication and wellbeing, improved systems and collaboration, and consideration of new facilities (See Text Box 1).

Health leaders had a large role to play in the COVID-19 response. There were calls for leaders to be transparent, agile, responsive and empathetic, all whilst themselves dealing with uncertainty and a large workload. Caring for staff wellbeing is critical, but managers also need to be supported to manage their own stress and exhaustion.<sup>15</sup> Many of our leaders in this study described behaviours considered important for fostering work engagement and reducing psychological distress.<sup>14,16</sup> This included empathetic listening to staff, communicating information in a transparent, timely, regular and structured manner, and being accessible and open toward their staff.<sup>13</sup>

### Surge capacity of health services

A feature of this pandemic, taken from the literature on mass casualties, is the need for “surge capacity” or ability to expand a service in response to non-routine demands. Surge capacity has been described in terms of “stuff” (sufficient supplies and equipment), “staff” (adequate and appropriately trained workforce), “structure” (facilities) and “systems” (integrated policies and procedures).<sup>17</sup> The experiences our interviewees

could usefully be considered within this framework: “stuff” is most obviously PPE, guidelines and policy documents; “staff” includes training and retaining the workforce; “structure” in the context of a pandemic alludes to appropriate spaces for clinical care of infectious patients; and “systems” could be those mechanisms to enable collaboration, planning and communication. These categories could be usefully applied for planning future local responses.

### Complex adaptive systems

Our hospitals can each be considered as a complex adaptive system within the larger national healthcare system. Complex adaptive systems have multiple interdependent parts. They interact with the environment and learn and adapt to changes through feedback loops.<sup>18</sup> While broad guidelines can be helpful, agents and units within these systems require autonomy to respond as local conditions dictate<sup>18</sup>—which suggests that detailed government or even senior hospital management guidelines may both help or hinder planning for our perioperative departments depending on the degree to which they allow for adaptation to local circumstances. Leaders on the ground, and those who emerged as new leaders, required autonomy to adapt plans to local context.

Furthermore, complex adaptive systems depend on multiple internal connections to communicate and share resources, and in some hospitals it seemed these connections needed new work. Guidelines from the United States Institute of Medicine<sup>19</sup> emphasise building connections to accelerate the flow of information and share resources in times of surprise. Communication and collaboration featured as lessons learnt by our interviewees. Many connections have now been built—between the different services involved in perioperative care, and between hospitals. Maintaining them when the dust settles will be important.

The shift to a single nationwide health service under Health New Zealand in partnership with the Māori Health Authority will include regional networks of hospital and specialist services,<sup>20</sup> with the potential to support improved surge capacity planning. Embedded regional planning was proposed within the Health and Disability System Review to enable population health analysis, guidance and coordination, and shared expertise in planning, guidance, and other operational functions.<sup>20</sup>

## Looking to the future

In early 2020, there was hope, almost an expectation, that COVID-19 could be eliminated or kept out of New Zealand, as had been the case with SARS-CoV-1 and Ebola. At the time of our interviews there was a feeling that we were done with COVID-19, and were left with large surgical waiting lists, staff losses, and a degree of workforce burnout. Identified challenges in physical facilities were yet to be resolved and future planning had been subsumed into catching up with the backlog of work.

In late 2021, we had a much better understanding of the virus, improved access to PPE, a largely vaccinated population and new technologies for detection and treatment. However, we are now faced with the prospect of endemic COVID-19 and its variants, and many of the challenges for surge capacity in perioperative services remain. We still have workforce vacancies, many ageing and out-dated hospital facilities, and our healthcare systems continue to present barriers to collaboration between departments, professional groups and between hospitals. Our study identified differences in access to resources and/or planning capacity between small and large hospitals, in part due to the size of their workforce and physical infrastructure. Smaller, rural hospitals may struggle more in the event of a surge of COVID-19 patients, and many of these have high Māori populations. Māori, including Māori staff, are more likely to get sick or die from COVID-19 than Non-Māori.<sup>21,22</sup> Inequities in our health system require a “whole of nation” systems response.

While each new virus, or other “surprise” event will bring its own unique challenges, lessons learnt can inform the fundamental requirements of our complex hospital systems and their ability to surge in response to the next challenge. Hospital staff move on, and institutional knowledge is

lost. Lessons from the current pandemic need to be captured for future generations. We hope the present paper goes some way towards this.

## Limitations and future research

This study presents a snapshot in time and the extent to which our pandemic response, including changes in leadership style, has changed following the “practice run” with COVID-19 in early 2020 remains to be tested. Our study included a good spread of DHBs around the country, and professional roles within perioperative services, but our findings may not be generalisable to other hospital services or other countries.

We recruited only three Māori participants. Further research could explore the values and leadership behaviours that enable and empower Māori staff during challenging times. Supporting and retaining this workforce will be critical for Māori health equity, and in response to future pandemic threats.<sup>23</sup>

## Conclusion

The experiences and reflections of perioperative leaders from hospitals around Aotearoa New Zealand to the COVID-19 pandemic paint a picture of limited prior preparation or planning for a pandemic, requiring an immediate pivot from routine care to emergency response. In an environment of uncertainty, information overload and staff stress, hospital leaders worked to obtain resources, maintain staff safety and engagement, develop new systems and in some cases, create new facilities. Sharing the experiences and lessons learned about communication and collaboration, policy development and staff training may go some way to facilitate a smoother implementation of a pandemic response the next time around.

**COMPETING INTERESTS**

Nil.

**ACKNOWLEDGEMENTS**

We would like to thank the participants who kindly shared their time, experience and wisdom with the research team.

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# Reducing healthcare inequities for Māori using Telehealth during COVID-19

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## ABSTRACT

**AIM:** Māori experience barriers to accessing timely, quality healthcare. The March 2020 COVID-19 lockdown in New Zealand required provision of Telehealth consultation options in primary care. Telehealth consultations have the potential to improve access to healthcare for Māori, and thereby reduce health inequities. Conversely, Telehealth may present additional barriers that contribute to inequities overall. This scoping project investigated Māori experiences of Telehealth consultations during the March 2020 COVID-19 lockdown.

**METHOD:** Semi-structured key informant interviews were completed with five Māori health professionals, six Māori Telehealth patients, and six Māori in-clinic patients, about their healthcare consultation experiences during COVID-19 lockdown. Participants were asked about what worked, what did not work, and for suggestions to improve future Telehealth provision to Māori whānau. Kaupapa Māori methodology underpinned thematic analysis of the interviews.

**RESULTS:** Key findings are presented in three overarching themes: benefits (safety, cost, time, options); challenges (health literacy, access to Information Technology (IT), supply and demand, limited physical assessment); and suggested improvements (systems fit for purpose, supporting IT and health literacy, Telehealth as a routine option, rapport building, and cross system efficiency and information sharing).

**CONCLUSION:** Telehealth is a viable long-term option that can support Māori whānau access to healthcare.

In Aotearoa New Zealand, Māori (the Indigenous peoples of New Zealand) experience significant ongoing health inequities compared to non-Māori<sup>1-3</sup> including higher mortality and morbidity rates across most health conditions.<sup>1,3</sup> Health inequities between Māori and non-Māori are due to differential access to the determinants of wellbeing including timely healthcare and differences in the quality of healthcare.<sup>3,4</sup> Despite the overwhelming need for quality healthcare to address these inequities, Māori access to culturally safe health services is limited.<sup>5</sup>

Māori whānau have previously described healthcare as inaccessible due to financial cost, transportation issues and other obstacles such as finding childcare. Travel barriers for rural patients to attend GP appointments are significant, and for working families there is difficulty in organising appointments around clinic hours, with families required to negotiate employer expectations and leave entitlements.<sup>6</sup> Additionally, the 2020 New Zealand Health Survey revealed significant differences by ethnicity, and these were even more stark for Māori wahine (females)<sup>7</sup> who report high cost,

no transport, prioritising childcare and experiencing discrimination, all as factors affecting access options and health outcomes.<sup>8</sup> In contrast, healthcare was more accessible when it included practical whānau support in the form of time, money and transport to attend appointments.<sup>6</sup> These barriers contribute to higher amenable morbidity and mortality rates for Māori, which in 2018 were 192.2 per 100,000 peoples compared to 77.7 per 100,000 for non-Māori non-Pacific peoples.<sup>9</sup>

The March 2020 COVID-19 Level 4 lockdown significantly influenced the patient-health professional interaction interface, requiring Telehealth (phone and online video) consultations almost overnight.<sup>10</sup> Telehealth utilises “information and communication technologies to deliver health care when patients and care providers are not in the same physical location”.<sup>11</sup> Provision of Telehealth GP clinics therefore has the potential to reduce, if not eliminate, the practical (eg travel) barriers for whānau.<sup>6</sup> Previous qualitative research with young, pregnant Māori women demonstrated how Telehealth-based antenatal care services promoted engagement and reduced

access barriers.<sup>12</sup> Importantly, whānau also noted the positive influence of health professionals who take time to build rapport and develop continuity of care with patients,<sup>6</sup> a factor that may be impacted by Telehealth delivery. Hence, robust research is required that unpacks both the positive and mitigating potential of Telehealth delivery to Māori whānau.

This research aimed to investigate and inform the use of Telehealth with Māori. We sought to understand the experiences of Telehealth (phone and online video) versus in-clinic healthcare in primary care settings during COVID-19 lockdown in March 2020, from both patients and Māori provider perspectives.

## Methods

A Kaupapa Māori research methodology was used.<sup>13,14</sup> This methodology operates using a Māori world view and takes on Māori ways of knowing, being and doing.<sup>15</sup> Māori aspirations for reducing inequities and attaining improved wellbeing are prioritised. The research is led and carried out by Māori health researchers and supports the ongoing professional development of the Māori health researcher workforce. A critical structural analysis was taken that contextualises data interpretations within historical and current influences on Māori health inequities, and ensures a non-victim blame, non-deficit analysis. Māori realities, in particular socioeconomic positions, are acknowledged.<sup>13-16</sup>

Fourteen qualitative semi-structured interviews occurred with participants who self-identified as Māori, lived in Auckland or Northland, and who fit one or more of the research criteria. The criteria included: 1) Māori health professionals 2) Māori patients/whānau who experienced at least one GP consultation using Telehealth during the COVID-19 lockdown period; and 3) Māori patients who opted for an in-clinic GP consultation (over Telehealth) during the COVID-19 lockdown period.

Purposive sampling was used to identify potential participants through the National Hauora Coalition Primary Health Organisation (PHO) and the research team's networks—potential participants were then invited to participate. Information sheets were provided, and participants completed consent forms prior to interviews. Interviews occurred via phone call or online video call (Zoom) and followed a schedule. Interview questions included: what worked about providing telehealth consultations; why patients

chose the Telehealth, or an in-clinic consultation option; what health providers or patients did not like about Telehealth consults; and how could Telehealth consultations be improved for Māori. Questions were explored in terms of access, barriers, and quality healthcare treatment for Māori.

A Māori interviewer employed te reo (Māori language), tikanga (Māori protocols) and whanaungatanga (Māori customary engagement rituals) to facilitate the interview process. Interviews ranged from 15 to 60 minutes in duration, were audio recorded and transcribed verbatim by a Māori researcher. A Kaupapa Māori thematic analysis was carried out by experienced Kaupapa Māori researchers to ensure that known Māori world views and realities were foregrounded, and a non-deficit approach was taken.<sup>17</sup> Researchers read and re-read transcripts and held in-depth discussions to identify, understand and refine results into themes. Data was collated into common themes and presented to the wider research team for review. The final themes were a consensus decision. Illustrative quotes are reported verbatim.

This study was categorised as low-risk (ie did not require full approval) by the New Zealand Health and Disability Ethics Committee review process. Additional ethical review was then completed and granted by the New Zealand Ethics Committee (NZEC)<sup>18</sup> on 20 November 2020.

## Results

Fourteen participants including five Māori health professionals, six Māori telehealth patients, and six Māori in-clinic patients agreed to take part in the study. Note that three participants were eligible for more than one category (eg health professional and Telehealth patient). The results were categorised into three main themes: 1) benefits; 2) challenges; and 3) suggested improvements.

### Benefits—Rangatiratanga (weaving components that benefit all)

Key benefits of Telehealth were identified by all participants and included time and economic savings, enabling of tino rangatiratanga and improved safety.

Health professionals and patients noted that Telehealth consultations minimised time needed to travel, to wait and to be seen at the clinic, and to process prescriptions, which was particularly useful for people who were working long hours, had lengthy travel or had young children to mind.

*It was very efficient, it saved me a whole lot of time, and all of that [Telehealth consultation] took like half an hour. (Telehealth patient\_10)*

*For some patients this [telehealth consultation] was great, this was easier, this was faster, this was better. (Health professional\_4)*

All patients described Telehealth consultations as cost-effective because they were cheaper than in-person visits and reduced time off work. For example, some patients use Telehealth consultations during their lunch break at work. In addition, patients noted that there were no transport costs.

*You definitely save time and effort and it's cheaper, so I usually pay \$18.00 to go in and that's an enrolled patient but it was \$10 over the phone... it saved time, saved energy, saved petrol, saved money. (Telehealth patient\_6)*

*I'd recommend the phone consultations. It's simple so it gets all the waiting and all that sort of stuff... out of the way. I could see it being really beneficial. (Telehealth patient\_14)*

Patients and health professionals described virtual consultations as a means for exercising tino rangatiratanga. The ability to self-determine aspects of the appointment, in ways that met their needs and made them feel in-charge.

*You could go online on the website and then book in your appointment, but you could also select who you wanted to see ... It was all very self-driven, so I didn't have to ring anyone. I like that because I hate ringing people ... you just book it in, you can see when you're available ... when they're available ... then she just called my phone. (Telehealth patient\_10)*

The de-centralisation of health clinics (ie no longer requiring patients to physically attend appointments at health clinics) resulted in improved flexibility of health service delivery. Patients were able to access doctors on their own terms, as well as increasing access to services and Māori health professionals who are otherwise inaccessible through their usual GP practice and local regions.

*We could live wherever we wanted but we could still actually get consults from people [Māori doctors] we want to. (Telehealth patient\_10)*

*My Kōhanga māmā ... they've got multiple kids ... trying to get one to the doctors and worry about the others is always a mission ... having online or phone consultations can help counter those access barriers. (In-clinic patient\_6)*

*I've already been back to the doctors ... five times ... had to tell [my] story to four men [doctors] ... then this woman rang back [during COVID] ... she's the only ... wāhine Māori doctor ... in the area that I live in ... I've never seen her ... and I've been there for years ... that was the point of difference ... she was Māori, she was caring, there was aroha in her tone ... it was the first time I think someone heard me and it was on the phone." (Telehealth patient\_11)*

The provision of telehealth platforms enabled patients and their whānau to stay safe in their homes from COVID-19. In addition, patients and health professionals noted that Telehealth mediums at times enabled an increased level of privacy and confidentiality, a concern in smaller communities.

*I just thought the [clinic] was the most unsafe space [for COVID-19 exposure]. (In-clinic patient\_5)*

*In... a small community, they're worried about... the word going around, so actually being able to offer that [Telehealth], where they don't actually have to walk through the front door and go report to their cousins that are on reception. So being able to provide that [Telehealth] for that particular community. (Health professional\_1)*

### Challenges–Tikanga Aukati (unfair practices)

Whilst multiple benefits of Telehealth consultations were identified, a number of challenges were also highlighted including access to the necessary resources (eg Telehealth software, internet capable devices and internet data) and unmet health needs (eg physical assessment)

due to prioritisation of COVID-focussed care.

When the call came to deliver the majority of primary care consultations virtually, health providers scrambled to obtain the necessary equipment and training (eg Telehealth software, operational processes). Patients and whānau also had to adapt quickly, however; their support to access resources and information was limited.

*The Kuia and Kaumātua (elders) that we were trying to screen [for health concerns during COVID-19 lockdown]. We literally phoned everybody... [but] some of them don't even have mobile phones. (Health professional\_2)*

*[We were having] a tutu [play] around with the internet [website of healthcare provider]... [so that we were prepared] if we needed to get in touch with somebody through that lockdown; because it [accessing healthcare online] was just something totally new to us. (Telehealth patient\_8)*

Health professionals reported that the health system did not provide funding for patients and whānau to access Telehealth. Insufficient provision of Telehealth system infrastructure meant that many patients were not yet familiar with using technology to access Telehealth. Further, health systems were not meeting the financial costs associated with whānau accessing telehealth, eg paying for IT devices and internet data.

*We're moving to a digital space; how do we cater for that? ... If you go into a clinic there's usually a Samoan or Tongan nurse or someone that can translate at the clinic but ... a whole lot of our people... they're not... computer literate or savvy. (Health professional\_6)*

*I think we have to breakthrough on some of the digital technology stuff, so having access to devices and spaces and places where you can do [a Telehealth consultation], and the data requirements to be able to do it. (Health professional\_4)*

New communication and literacy barriers arose between whānau and health professionals when using Telehealth compared with face-to-face consultations. For example, participants often reported

that doctor's 'terms' were difficult to follow and understand without non-verbal communication. Accordingly, the need for both whānau and health professionals' health literacy development in a Telehealth-specific context was evident.

*Health literacy stuff ... how we talk to patients about digital health ... how we provide that information. Are we understandable to our patients? ... Doing some work on ourselves ... our community might benefit. (Health professional\_4)*

Particularly challenging communication and literacy barriers surfaced when health professionals asked questions about symptoms. For example, when health professionals asked whānau to assess basic health symptoms such as 'temperature', whānau often did not have a thermometer at home, and were not trained to 'read their temperature'.

Health professional communication and interpretation of health needs via Telehealth at times seemed to require patients and whānau to have the ability to complete physical examinations, as articulated here:

*For instance, if they say to you over the phone 'have you got a fever, are you hot?' Well yeah, I'm hot, but, like, is it because I've got a fever or because it's a hot day? ... Just sort of figuring out, would they be able to diagnose it just like that? Whether I've got a fever or not? (In-clinic patient\_12)*

At times, choosing between Telehealth and in-clinic options, whilst prioritising COVID-19 versus other health needs, was challenging for health professionals, patients and whānau. Despite needing in-clinic healthcare, some patients chose to stay home and self-administer medical procedures rather than prioritise their health needs over others during the COVID-19 pandemic. When patients did seek in-clinic consultations during lockdown, health professionals were focussed on COVID-19 testing, leaving other health needs unmet.

*I just phoned up ... I have an abscess growing up the back of my mouth. It's quite swollen ... What do I do? Do I pop it? Do I cut it? Do I cause I can't come in there ... so they gave me antibiotics ... it did nothing for the pain, so I ended up popping it myself ... I just got a really*

*big needle and ... cracked it and squirted it all out. (Telehealth patient\_9)*

*[During in-clinic consultation] there was no focus on my actual sickness. All he wanted to know was, do you have COVID and how far away can you stay from me? ... All I wanted was my antibiotics ... what about my body aches? He didn't, I remember, he didn't actually ask what my other symptoms are, all he asked was three COVID questions. (In-clinic patient\_13)*

### Suggested improvements–Mana enhancing

Building on the identified benefits and challenges of Telehealth provision, and the immediacy of COVID-19, suggested improvements for long-term delivery were made.

Telehealth systems that were more user-friendly with language options were recommended.

*I think having forms in different languages, or websites that talk, so you can just push a button and then someone talks to you saying in the different language you know 'push here if you need a doctor' ... we could streamline it that way... or you can touch the screen, 'press here for the receptionist' or 'for Samoan press here.' (Health professional\_6)*

Some healthcare organisation Telehealth systems involved the of sharing whānau health information between and across health system organisations. This was seen as a key highlight of moving consultations online. Sharing of key information in real time across the health system inevitably removed barriers that were previously created by organisational healthcare silos.

*One of the things that happened in our system is barriers fell away between different organisations, everybody would share anything that was needed... if you had some information, research ... everybody consistently made that available across networks, different Primary Health Organisations were sharing. (Health professional\_4)*

Participants appreciated the ‘options’ to attend an in-clinic, online or phone call consultation and

wanted to see these continued. In addition, health professional utilisation of cultural competencies remains essential in Telehealth settings.

*Giving [the patient] the option to choose which one was better, and quite a few went for the video call. Just that kanohi ki te kanohi stuff. Even though some of them called it fake kanohi ki te kanohi, for some it was still powerful enough to be able to give the same mana they get from being in-person kanohi ki te kanohi. (Health professional\_1)*

Educating healthcare service staff around the communication and delivery of information digitally (ie understanding Māori patient health literacy, realities and experiences when accessing Telehealth, and learning how to assess patients online) would improve Telehealth services.

*I think we should do better in some of our information health literacy stuff... health literacy in terms of how we talk to patients about digital health. (Health professional\_4)*

Health professionals and patients clearly noted that access to technology, devices, and knowledge around their use were critical components of a successful Telehealth system for whānau.

*For me the important things were... ensuring that our patients had access to that ... a lot of whānau we serve don't actually have that sort of technology available to them... that's why they'd come into the clinic because they couldn't talk over the phone. (Health professional\_1)*

A sense of connection with their health providers was essential to fully engage and benefit from the Telehealth consultation and therefore patients recommended training in ‘building online rapport’ for providers.

*It does take a bit of time to develop that trust because whānau aren't just going to say, 'hey this is my problem, and this is what I need', right. (Health professional\_3)*

*It wasn't easy, and she had to try and earn that trust from me over a telephone. (Telehealth patient\_11)*

## Discussion

This article presents a qualitative scoping investigation of the experiences of Māori whānau and health professionals' provision and use of Telehealth during the 2020 COVID-19 lockdown. Participants represented a range of experiences: use of Telehealth, opting for in-clinic consultation, and design and provision of Telehealth services. Given the barriers Māori whānau face when accessing primary healthcare, and the impacts of these barriers on increasing inequities, this Kaupapa Māori study explored how a culturally appropriate Telehealth system might mitigate access barriers for Māori whānau, and thereby reduce health inequities.

Māori participants in this study described multiple benefits to Telehealth consultations during the 2020 COVID-19 lockdown. Telehealth consultations were introduced in Aotearoa based on international pre-COVID-19 studies confirming their feasibility, safety, effectiveness and accessibility in general practice,<sup>19</sup> in adults with diabetes<sup>20,21</sup> and in mental health.<sup>22</sup> Some studies suggest that Telehealth clinics have the potential to keep important care pathways, particularly for cancer, moving during lockdowns.<sup>23</sup> Telehealth is therefore likely to be beneficial to Māori who experience higher rates of chronic conditions, cancer and mental illness.<sup>24</sup> Knowing that international research supports the use of Telehealth consultations in these key Māori health areas is important, but prior to this study, there was limited evidence of Māori experiences.

The patients and providers described 'reduced cost' as a reason for choosing Telehealth over face-to-face consultations, confirming previous research on the cost-benefits of Telehealth consultations.<sup>25</sup> Wider benefits identified in this study,

such as savings on transport and improved waiting times have also been reported internationally.<sup>26</sup> In addition, having access to a wider range of Māori health professionals (without geographic barriers) aligns with whānau preferences for cultural concordance.<sup>27</sup> However, the participants also described hidden costs and barriers, particularly with regard to digital access (equipment and broadband availability). Such barriers have the potential to widen disparities, as demonstrated in studies with peoples living with social deprivation, limited digital access<sup>28,29</sup> and disabilities.<sup>30</sup>

Therefore, the introduction of Telehealth consultations requires a comprehensive approach that ensures equity in broadband coverage across New Zealand,<sup>31</sup> access to equipment similar to the way education providers have delivered devices to students<sup>10</sup> and culturally safe 'Telehealth literacy'<sup>32</sup> for both providers and patients. Of considerable concern were descriptions of unmet need when providers prioritised COVID-19 in the consultation over other health issues. This may be true for both Telehealth and in-person consultations. Clear processes are required to ensure that Telehealth during COVID-19 lockdowns does not result in poorer care despite the convenience.

This Kaupapa Māori study investigated experiences of Māori within the Telehealth context during the 2020 COVID-19 lockdown. The findings indicate Telehealth is a viable long-term option that with additional resourcing can support Māori whānau access to healthcare. Telehealth removes practical barriers as well as providing reasonably safe access to health services when there is high COVID-19 risk in the community. Future provision of Telehealth requires robust investment in necessary resources, systems and capabilities for both patients and health providers.

**COMPETING INTERESTS**

Nil.

**ACKNOWLEDGEMENTS**

The authors thank the Māori whānau and health professionals who shared their experiences, Mary-Kaye Wharakura for conducting the interviews, National Hauora Coalition for hosting the study, and MAS foundation for providing support via a MAS foundation grant.

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[www.nzma.org.nz/journal-articles/reducing-healthcare-inequities-for-maori-using-telehealth-during-covid-19-open-access](http://www.nzma.org.nz/journal-articles/reducing-healthcare-inequities-for-maori-using-telehealth-during-covid-19-open-access)

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# Clinical features of patients hospitalised with COVID-19 from February to October 2020, during the early waves of the pandemic in New Zealand

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## ABSTRACT

**AIM:** As New Zealand transitions towards endemic SARS-CoV-2, understanding patient factors predicting severity, as well as hospital resourcing requirements will be essential for future planning.

**METHODS:** We retrospectively enrolled patients hospitalised with COVID-19 from 26 February to 5 October 2020 as part of the *COVID-19 HospitalisEd Patient Severity Observational Study NZ* (COHESION). Data on demographics, clinical course and outcomes were collected and analysed as a descriptive case series.

**RESULTS:** Eighty-four patients were identified across eight district health boards. Forty-one (49%) were male. The median age was 58 years [IQR: 41.7–70.3 years]. By ethnicity, hospitalisations included 38 NZ European (45%), 19 Pasifika (23%), 13 Māori (15%), 12 Asian (14%) and 2 Other (2%). Pre-existing co-morbidities included hypertension (26/82, 32%), obesity (16/66, 24%) and diabetes (18/81, 22%). The median length of stay was four days [IQR: 2–15 days]. Twelve patients (12/83, 14%) were admitted to an intensive care unit or high dependency unit (ICU/HDU). Ten (10/83, 12%) patients died in hospital of whom seven (70%) were not admitted to ICU/HDU; the median age at death was 83 years.

**CONCLUSION:** Despite initially low case numbers in New Zealand during 2020, hospitalisation with COVID-19 was associated with a high mortality and hospital resource requirements.

**O**n 28 February 2020, Aotearoa New Zealand recorded its first case of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, causing coronavirus disease 2019 (COVID-19) in a traveller returned from the Middle East. A rapid and sustained public health response ensued, including contact tracing, countrywide lockdown and government-managed quarantine of international travellers.<sup>1,2</sup> New Zealand successfully eliminated community COVID-19 transmission by May 2020, diverging from most other OECD countries and resulting in both low case numbers and fatalities.<sup>1</sup> Further community outbreaks occurred August to September 2020 and in February 2021, again with successful elimination. However, in August 2021, the increased transmissibility of the COVID-19 Delta

variant resulted in total case notifications rising across the Auckland region, despite high vaccination rates.<sup>3</sup> With relaxation of public health measures, including travel restrictions, it is likely SARS-CoV-2 will eventually become endemic across New Zealand. Understanding patient characteristics, outcomes and resourcing during the early waves may help plan for future outbreaks and this transition to endemic disease.

Whilst knowledge regarding patient risk factors, clinical progression and treatments for COVID-19 in hospitalised patients has progressed rapidly from international large-scale studies,<sup>4</sup> there is a paucity of local data. Healthcare in New Zealand is predominately public-funded and is currently delivered by twenty district health boards (DHBs). Sixteen percent of the population

live rurally<sup>5</sup> and 10% are served by rural hospitals<sup>6</sup> which may have limited staffing and resourcing. New Zealand has a diverse ethnic make-up with its population identifying as NZ European (70.2%), Māori (Indigenous peoples) (16.5%), Asian (15.1%), Pasifika (8.1%) and Middle Eastern, Latin American and African (MELAA) (1.5%).<sup>5</sup> Global data have indicated disproportionate mortality amongst ethnic minority groups with COVID-19<sup>7,8</sup> and it is recognised that Māori and Pasifika are more likely to contract, and be hospitalised, with infectious diseases<sup>9</sup> including COVID-19.<sup>10</sup>

To characterise local factors associated with adverse outcomes in hospitalised COVID-19 patients in New Zealand, the multi-centre *COVID-19 HospitalisEd Patient Severity Observational Study NZ* (COHESION) study was established in April 2020. Additional study outcomes included an analysis of key hospital resources usage such as oxygen, length of stay (LOS) and requirement for intensive or high dependency care. The majority of data to date were collected from patients admitted to hospital during the early community waves, although further data collection and analyses are planned. Here, we present a descriptive review of patients hospitalised with COVID-19 in New Zealand from 26 February to 5 October 2020, encompassing from the first reported case in New Zealand until the end of the second wave of community transmission.

## Methods

We conducted a multi-centre retrospective cohort study. Eleven DHBs across New Zealand were enrolled including Auckland, Bay of Plenty, Canterbury, Capital and Coast, Counties Manukau, Hutt Valley, Lakes, MidCentral, Southern, Waikato and Waitematā. Patients of any age admitted to participating DHBs with a primary clinical diagnosis of COVID-19, based on contemporaneous Ministry of Health definitions,<sup>11</sup> were identified by site investigators and included for analysis. We enrolled both confirmed COVID-19 cases, i.e., those with symptomatology and positive SARS-CoV-2 polymerase chain reaction (PCR) testing and probable cases. Probable cases were defined as a symptomatic close contact of a confirmed case (epi-link), or a case that met the clinical criteria, in whom other aetiologies explaining the clinical presentation had been excluded, and where laboratory testing was either suggestive of SARS-CoV-2 or inconclusive. Patients with COVID-19 hospital-

ised for less than six hours or admitted primarily for an unrelated diagnosis were excluded.

Data were extracted from individual patient records by investigators. Patients identifying as more than one ethnic group were analysed as a single ethnicity, prioritised in the order of Māori, Pasifika, Asian then NZ European/Other.<sup>3</sup> A returned traveller was defined as having travelled internationally within the 14 days preceding symptom onset. Presenting symptoms related to self-reported symptomatology during or prior to hospital admission. Blood and biochemical results were obtained from the first laboratory tests taken during admission. LOS was calculated from the date of admission to the date of hospital discharge or death and included time spent in inpatient rehabilitation facilities. Inpatient mortality was defined as death during hospital admission. The presence or absence of some patient characteristics were variably documented in the clinical notes. Therefore, data are reported as the number of patients with a characteristic, over the denominator of patients for whom this information was available.

De-identified data were collected by investigators and uploaded to a secure online database. Descriptive analyses were performed using pooled data. We performed bivariate logistic regression of a composite "severe outcome", defined as admission to intensive/high dependency care (ICU/HDU) or inpatient death, against patient age, ethnicity and selected co-morbidities. Statistical analysis was performed in Stata 16.0 (StataCorp, College Station, TX, United States). Ethical approval for this study was obtained from the New Zealand Health and Disability Ethics Committee (reference: 20/NTB/72/AM02) and local approvals were obtained at each participating site.

## Results

Eighty-four patients were identified from the 26 February to 5 October 2020 with data submitted from eight of the eleven participating district health boards (DHBs). The majority were hospitalised in three Auckland DHBs, Auckland, Counties-Manukau and Waitemata (n=56, 67%) (Figure 1). Nine patients (11%) were healthcare workers and four (5%) were pregnant. Seventeen patients (20%) were returned travellers. A positive SARS-CoV-2 test was collected from 66/76 (87%) patients during admission. The remainder had either a positive community test prior to admission or fulfilled the 'probable' case criteria.

## Demographics and Co-morbidities

Forty-one patients (49%) were men, and the median age was 58 years [n=83, interquartile range [IQR] 41.7–70.3 years]. The most common age decile was 50–59 years (19/83, 23%) (Table 1). Sixteen patients (19%) were under 40 years. The only child in the cohort (<18 years old) was a 2-month-old infant. By ethnicity, 38 (45%) patients identified as NZ European; 19 (23%) Pasifika; 13 (15%) as Māori; 12 (14%) as Asian and 2 (2%) as Other (Table 2). Māori were the youngest group admitted, with a median age of 45 years [IQR: 42–58 years]. NZ European/Other were the oldest, median age 63 years [IQR: 51–78 years]. Forty-eight (57%) patients had at least one reported pre-existing co-morbidity. Metabolic co-morbidities included chronic cardiac disease (12/82, 15%), hypertension (26/82, 32%), diabetes (18/81, 22%) and obesity (16/66, 24%) (Table 1). Twenty-five (32%) of 79 patients were ex-smokers and 2 (3%) were current smokers.

A record of a composite severe outcome was available in 83/84 patients, with 19/83 (23%) dying or admitted to ICU/HDU. When correlated against a severe outcome of death or ICU/HDU admission, none of age, ethnicity or co-morbidities were shown to confer a worse outcome (Table 1). Māori had the highest proportion admitted to ICU/HDU (38%) (Table 2). Those identified as NZ European/Other had the highest in-hospital mortality (21%) but were also the oldest (mean=64 years

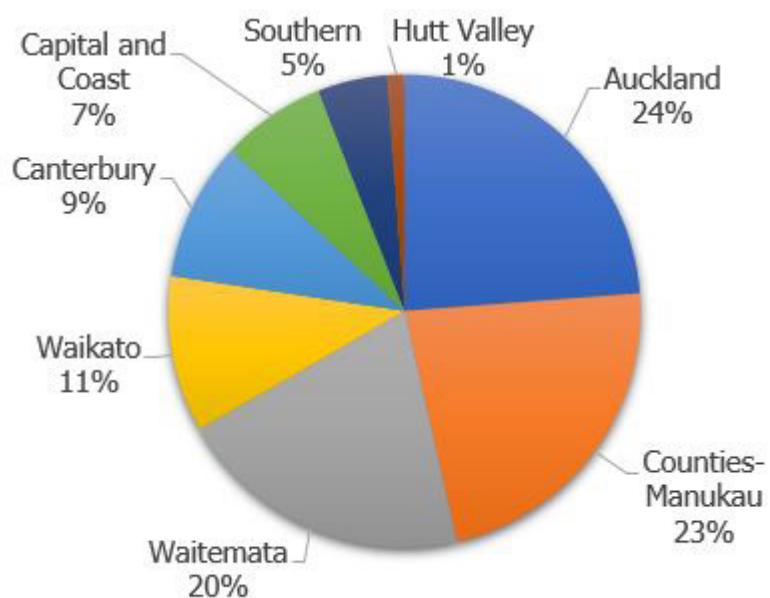
[IQR: 51–80 years]) with the lowest rate of ICU/HDU admission (8%). When adjusted for age, the adjusted odds ratio (aOR) of a composite severe outcome for Māori was 3.7 (95% Confidence Interval (CI): 0.93–14.7, p=0.06) when compared to Non-Māori/Non-Pasifika. For Pasifika the aOR was 0.58 (95% CI: 0.14–2.29, p=0.44).

## Clinical features

Patients reported a median of seven days of symptoms [IQR: 4–10 days] prior to presentation. The most common were cough (66/83, 80%) and shortness of breath (58/84, 69%). Systemic symptoms including fever (56/84, 67%), myalgia (28/66, 42%) and fatigue (48/75, 64%) were frequently described. Gastrointestinal symptoms including abdominal pain (9/73, 12%), nausea or vomiting (12/72, 17%) and diarrhoea (12/71, 17%) were also reported. On admission, 23/71 (32%) had a temperature ≥38°C. The median heart rate (90 beats per minute [IQR: 78–101bpm]), respiratory rate (20 respirations per minute [IQR: 18–25resps/min]) and oxygen saturations (96% [IQR: 94–98%]) on arrival were generally within normal ranges (Table 3). Oxygen saturations ≤92% were recorded in 10/81 (12%) patients on admission.

Median measurements of blood count parameters at admission, including liver function tests and electrolytes, were predominately in normal ranges although median lactate dehydrogenase (LDH) (360U/L [IQR: 313–471U/L]), C-reactive pro-

**Figure 1:** Proportion of patients admitted with COVID-19, by District Health Board, 2020.



**Table 1:** Risk factors for COVID-19 related severe outcomes, NZ hospitals, 2020.

<b>Variable</b>	<b>Total Number (%)</b>	<b>Non-severe Outcome</b>	<b>Severe Outcome</b>	<b>OR [95% CI]</b>	<b>P value</b>
<b>Age</b>					<b>0.09</b>
<40 years	16/83 (19%)	13	3	REF	
40–49 years	14/83 (17%)	11	3	1.2 [0.20–7.1]	
50–59 years	19/83 (23%)	16	3	0.81 [0.14–4.7]	
60–69 years	13/83 (16%)	10	2	0.97 [0.12–6.2]	
70–79 years	10/83 (12%)	7	3	1.9 [0.29–11.8]	
>80 years	11/83 (13%)	6	5	3.6 [0.64–20.3]	
<b>Ethnicity</b>					
Non-Māori/Non-Pasifika	52/84 (62%)	40	11	REF	N/A
Māori	13/84 (15%)	8	5	2.3 [0.61–8.4]	0.21
Pasifika	19/84 (23%)	16	3	0.7 [0.17–2.8]	0.59
<b>Co-morbidities / risk factors</b>					
Recent travel	17/84 (20%)	15/63	1/19	0.18 [0.00–1.35]	0.12
Healthcare worker	9/84 (11%)	6/64	3/19	1.8 [0.26–9.6]	0.67
Chronic cardiac disease	12/82 (15%)	7/62	5/19	2.8 [0.60–12.0]	0.22
Hypertension	26/82 (32%)	20/62	6/19	0.97 [0.26–3.2]	1.00
Chronic pulmonary disease	6/82 (7%)	5/62	1/19	0.64 [0.01–6.25]	1.00
Asthma	9/82 (11%)	4/62	5/19	5.0 [0.95–29.0]	0.06
Chronic neurologic disease	6/81 (7%)	3/61	3/16	3.6 [0.43–29.2]	0.28
Diabetes	18/81 (22%)	14/61	4/19	0.9 [0.19–3.4]	1.00
Smoking status (current/ex)	27/79 (34%)	17/61	9/17	2.9 [0.83–10.2]	0.10
Obesity	16/66 (24%)	11/48	5/17	1.4 [0.31–5.5]	0.82

Abbreviations: OR = odds ratio; CI = confidence interval.

Footnote: A severe outcome was defined as a composite measure of either in-hospital death or admitted to an intensive care or high dependency unit.

**Table 2:** Hospitalisations and outcomes by ethnicity.

	<b>Number of admissions</b>	<b>Age [IQR]</b>	<b>Length of stay [IQR]</b>	<b>ICU/HDU admission</b>	<b>In-hospital mortality</b>
<b>All groups</b>	84 (100%)	58 [42–70] years	4 [2–15] days	12/83 (14%)	10/83 (12%)
<b>Māori</b>	13 (15%)	45 [42–58] years	11 [5–22] days	5/13 (38%)	1/13 (8%)
<b>Pasifika</b>	19 (23%)	55 [40–70] years	4 [3–10] days	2/19 (11%)	1/19 (5%)
<b>Asian</b>	12 (14%)	51 [35–61] years	4 [1–8] days	2/12 (17%)	0/12 (0%)
<b>NZ European/Other</b>	40 (48%)	64 [51–80] years	3 [1–12] days	3/39 (8%)	8/39 (21%)

Abbreviations: IQR = interquartile range; ICU/HDU admission = admission to intensive care unit or high dependency unit.

**Table 3:** Selected clinical characteristics of patients admitted with COVID-19 in New Zealand 2020.

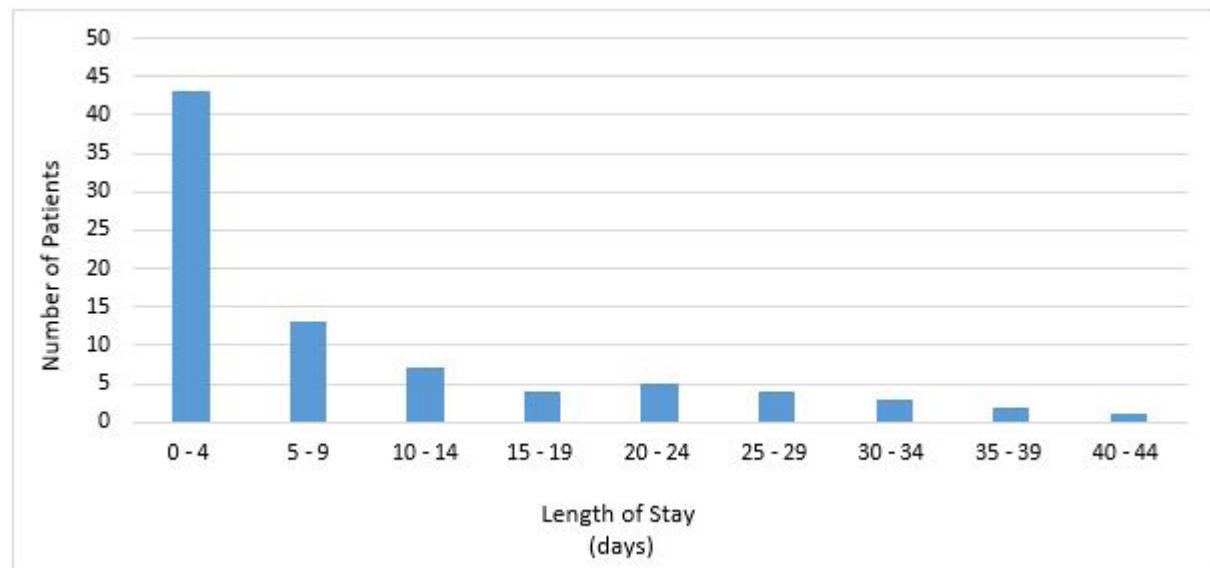
<b>Characteristic (n)</b>	<b>Median</b>	<b>[IQR]</b>
<b>Examination findings</b>		
Heart rate (n=76)	90 beats/min	[78–101]
Respiratory rate (n=76)	20 breaths/min	[18–25]
Systolic blood pressure (n=77)	130 mmHg	[115–147]
Diastolic blood pressure (n=75)	78 mmHg	[70–85]
Oxygen saturation on admission (n=81)	96%	[94–98]
Weight (n=42)	82kg	[70–98]
<b>Investigation</b>	<b>n/N</b>	<b>(%)</b>
Positive COVID-19 test during admission	66/76	(87%)
Infiltrates on CXR or CT chest	46/76	(61%)
2–3 quadrants with infiltrates	27/76	(36%)
4 quadrants with infiltrates	10/76	(13.2%)
Cavitation	1/46	(2%)
<b>Laboratory parameters (n)</b>	<b>Median</b>	<b>[IQR]</b>
White blood cell count (n=74)	$6.8 \times 10^9/L$	[5.3–9.0]
Neutrophil count (n=74)	$4.6 \times 10^9/L$	[3.3–6.2]
Lymphocyte count (n=74)	$1.3 \times 10^9/L$	[1.0–1.7]
Sodium (n=76)	136 mmol/L	[134–139]
Potassium (n=73)	4.0 mmol/L	[3.7–4.3]
Creatinine (n=74)	78 µmol/L	[64–95]
Albumin (n=54)	33 g/L	[30–37]
C-reactive protein (n=64)	42 µg/mL	[12–97]
D-dimer (n=26)	670 mg/L	[300–950]
Troponin (n=28)	6 ng/L	[4–12]
Ferritin (n=19)	925 µmol/L	[304–1394]
Lactate dehydrogenase (n=21)	360 U/L	[268–483]
Procalcitonin (n=7)	0.12 ng/mL	[0.10–0.12]

Abbreviations: IQR – interquartile range; CXR – chest x-ray; CT – computed tomography scan; min – minute; n/N – number of patients with a characteristic, over the denominator of patients for whom this information was available.

**Table 4:** Selected documented complications amongst patients admitted with COVID-19, 2020.

<b>Complication</b>	<b>n/N (%)</b>	<b>Complication</b>	<b>n/N (%)</b>
Any complication	46/83 (55%)	Thrombosis (pulmonary embolus)	1/82 (1%)
Shock	9/83 (11%)	Bleeding	3/83 (4%)
Acute renal injury	9/81 (11%)	Anaemia	7/81 (9%)
Cardiac arrhythmia	6/80 (8%)	Liver dysfunction	5/80 (6%)
Myocarditis/pericarditis	1/80 (1%)	Pancreatitis	3/80 (4%)
Bacteraemia	6/82 (7%)	Delirium	4/83 (5%)

Abbreviations: n/N – number of patients with a characteristic, over the denominator of patients for whom this information was available.

**Figure 2:** Length of stay of patients hospitalised with COVID-19 February to October, 2020.

tein (41mg/L [IQR: 8–96mg/L]), D-dimer (670ng/mL [IQR: 300–950ng/mL]) and ferritin (925ug/L [IQR: 304–1394ug/L]) were noted as being elevated (Table 3). Admission chest x-rays showed infiltrates in 46/76 (61%) patients.

More than half of patients (46/83, 55%) hospitalised with COVID-19 experienced a complication of their illness (Table 4). A cardiac arrhythmia was documented in 6/80 patients (8%); 6/82 patients (7%) developed bacteraemia, 3/83 patients (4%) had bleeding complications, and 1/83 (1%) had a pulmonary embolus. Regarding therapeutics, 18/82 (22%) patients received oral or intravenous (IV) corticosteroids during admission, 48/82 (59%) received an antibiotic and 2/83 (2%) an antiviral (1 entecavir, 1 unknown). During hospital admission, 42/82 patients (51%) required oxygen with 18/82 (22%) requiring high-flow ( $\geq 5\text{L}/\text{min}$ ). The median duration of oxygen usage was five days [IQR: 2–9 days].

## Outcomes

The median length of hospital stay (LOS) was four days [IQR: 2–15 days]. The mean LOS was nine days [standard deviation=11 days]. Nineteen patients (19/82, 23%) were admitted for more than 14 days (Figure 2). Twelve patients (12/83, 14%) were admitted to ICU/HDU. Six (7%) required invasive ventilation for a median duration of 15 days [IQR: 13–15 days]. No patients required extracorporeal support. Two (2%) underwent haemodialysis. The median duration of ICU/HDU admission was 10 days [IQR: 2–15 days].

In-hospital death occurred in 10 patients (10/83, 12%). The median age at death was 82.9 years [IQR: 72.8–94.4 years] and the median admission length prior to death was 14 days [IQR: 7–21 days]. Seven (70%) of these deaths occurred in patients not admitted to ICU/HDU.

## Discussion

Here we present early data from the COHESION study: a retrospective, multi-centre study reviewing the demographics and outcomes of patients hospitalised with COVID-19 in New Zealand from the early waves of the pandemic. Despite a comparatively low population prevalence of COVID-19, hospitalised patients still required significant healthcare resourcing with high rates of oxygen use, prolonged admissions and multiple inpatient complications. In-hospital mortality was considerable. Deceased patients were elderly and most died without admission to ICU/HDU; however, severe outcomes occurred across the age spectrum.

During the time period studied, 1866 COVID-19 cases (38 per 100,000 population) and around 120 hospitalisations were reported in New Zealand.<sup>10</sup> Therefore, our study captured 70% of those admitted with COVID-19 and can be considered a good representation of hospitalisations nationally. Similar to international findings, many hospitalised patients were elderly,<sup>4, 12</sup> however, the median age of our cohort was younger than comparable studies.<sup>12</sup> This may reflect many of New Zealand's early COVID-19 cases occurring as imported infections in returned travellers who tended to be younger, predominately European and of high socioeconomic status.<sup>1, 13</sup> Co-morbidities were common among those hospitalised. Although we did not collect data on the effect of COVID-19 on control of co-morbidities such as diabetes, our study emphasises the complex healthcare needs of COVID-19 patients that extend beyond direct effects of the virus.

Patients hospitalised with COVID-19 in New Zealand experienced a high prevalence of complications, notably acute kidney injury, delirium and cardiac arrhythmia. There was a discrepancy between the prescription of antibacterial medication and the prevalence of bacteraemia. While bacteraemia is present in only a minority of bacterial infections that require treatment, current literature suggests that super-added bacterial infection with COVID-19 is probably less common than in other viral pandemics.<sup>14</sup> Due to the importance of antimicrobial stewardship in combatting bacterial antimicrobial resistance, ongoing work to identify which patients with COVID-19 also have bacterial superinfection is critical.

The proportion of patients who died in our study was approximately half that reported in the United Kingdom (26%),<sup>4</sup> but comparable to a large multi-centre study in the USA (14% with a further 3% discharged to hospice).<sup>15</sup> Of note, both these and our study were conducted prior to vaccination and the widespread usage of dexamethasone, remdesivir and tocilizumab, repurposed agents which have been shown to improve outcomes in hospitalised patients with COVID-19. Only small numbers in our cohort received anti-viral agents, immune modulators or corticosteroids, in keeping with international practice at the time. It is notable that only a minority of patients who died during hospital admission received ICU/HDU treatment suggesting either that they died rapidly, or would not have benefited from more invasive interventions offered by ICU/HDU such as ventilation, inotrope support or renal replacement therapy. The older age of this cohort, and duration of

hospital stay prior to death appears to suggest the latter. An important implication of this finding is that planning and resources are needed to provide palliative care for patients dying of COVID-19.

Despite low case numbers in the early waves of the pandemic, COVID-19 hospitalisations absorbed substantial healthcare resources with healthcare workers being a high proportion of those hospitalised. There was significant variability between individual patient's lengths of hospital stay, with prolonged admissions in a substantial minority. This is comparable to the international literature<sup>16</sup> and highlights the importance of structures to support holistic care for those with long hospital stays. The proportion of patients admitted to ICU/HCU (14%) was similar to that reported from the UK (17%),<sup>4</sup> with many requiring invasive ventilation and resource-intensive proning. The ICU bed capacity of New Zealand is 4.6/100,000 people, lower than comparable healthcare systems,<sup>17</sup> with further addition of bed capacity likely limited by the availability of trained nursing staff.<sup>18</sup> If a similar proportion of hospitalised cases require ICU admission in future waves of the pandemic, there is a risk the ICU capacity of New Zealand would be exceeded. Strategies to mitigate this could include increasing ICU staffing and bed capacity, and optimising community and ward-based care.

This analysis has not identified any risk factors for death or ICU/HCU admission among those admitted to hospital but are compatible with international studies identifying age as the most important risk factor.<sup>4</sup> The small sample size of our study means it is underpowered to detect all but the largest risk factors. Although we did not identify Māori or Pasifika ethnicity as being associated with an increased risk of death or ICU/HCU admission in our analysis, this remains an important association to monitor. We used a prioritised ethnic system, assigning a single ethnicity for the purpose of analysis. It is therefore possible that the impact on certain groups, particularly Pasifika, may have been underestimated. Previous work by Steyn et al over a time period similar to our study, identified Māori and Pasifika with COVID-19 were at 2.5–3 times the risk of hospitalisation when compared to NZ European/Other ethnic groups.<sup>10</sup> The authors also noted a younger

age at admission and longer lengths of hospital stay in Māori and Pasifika, which is consistent with our findings.

Our study does have limitations that influence interpretation. As a retrospective study, complete data could not be obtained for all patients. Data collection was concentrated in tertiary urban centres and caution should be used when generalising to smaller or rural hospitals. The study was not adequately powered to assess risk factors for severe outcomes, however the absence of statistically significant risk associated with ethnicity, age or co-morbidities does not preclude an important relationship. Data collection is ongoing and we hope this will be addressed in future analyses. Finally, since the study end date, there has been considerable progression of knowledge regarding transmission, treatment and progression of COVID-19, as well as emergent viral strains and the development of effective vaccines. Whilst these factors will inevitably alter the demographics and outcomes of those affected, we have identified signals for ongoing research. Further data collection for COHESION will be able to utilise our findings to develop a comparison of the demographics and clinical progression of those affected in early and later outbreaks.

## Conclusion

This observational study describes the demographics, clinical course and outcomes of patients hospitalised with COVID-19 in New Zealand during 2020. There was a high proportion of patients who died, particularly while receiving ward-based care, as well as substantial utilisation of ward beds, ICU/HCU beds and oxygen. Our study highlights the high prevalence of co-morbidities that increase complexity of care, and diversity of age and ethnicity. This emphasises not only the need for care which is person- and whānau-centred and culturally safe during hospitalisation, but also in the community. Whilst further work is required to identify local patient risk factors for progression to severe COVID-19, our preliminary data identify areas of priority for healthcare resourcing to optimise resilience of the New Zealand healthcare system in preparation for endemic COVID-19.

**COMPETING INTERESTS**

Nil.

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# Musty Records: The Story of the New Zealand Obstetrical and Gynaecological Society

Ronald W Jones

The 1928 bimonthly *New Zealand Medical Journal Report*, commenting on the recently formed NZ Obstetrical Society, noted that “the obstetricians of New Zealand even by the year 1950 may find perusal of our musty records interesting and enlightening. Many present day problems should then be simplified, and adoption of surgical measures like caesarean section should by then have found their rightful place... Our children in 1950 will not benefit by perusal of the scientific records we are now compiling unless we perfect our gift to posterity and write each history up in ink”.<sup>1</sup>

The first Minutes record the “Aims of the Society should be the scientific study of obstetrical work in NZ and to give the art of obstetrical practice the dignity and status it rightly deserved, but at present lacked”.<sup>2</sup> Membership was open to any member of the New Zealand Branch of the British Medical Association, which was affiliated with the *New Zealand Medical Journal*. The latter proved to be one of its greatest strengths, and in 1932 a “Special Section” of the *Journal* was devoted to the Obstetrical and (later) Gynaecological Society. Not infrequently, there were 50–100 pages in the bimonthly *Journal* devoted to the Society. No other branch of medicine was treated this way. Thirteen provisional district committees were also established at the inaugural meeting.

Like many other medical societies, the Obstetrical Society has faded away, taking with it the wisdom of a former age. An age yet to have the benefits of today’s scientific advances, the benefits of our social security system and, importantly, no formally trained obstetricians. (The British College of Obstetricians and Gynaecologists was only inaugurated in 1929). The material in this paper has been taken mainly from the two almost centuries-old, very large and musty original Minute Books of the Society, written in fading ink. These extend from its inception in 1927 through to 1943. From this time, there are no known Society records. However, reports in the *New Zealand*

*Medical Journal* continued to provide some record of the Society activities.

What have we learned from the New Zealand Obstetrical Society? The importance of strong, visionary leadership committed to a common cause—improvements in maternity care in New Zealand. In this case, the Society was well served in its long-term Honorary Secretary, Dr Doris Gordon. She knew that if she could carry through her vision of an improved maternity system for all New Zealand women, she needed a strong team to support her. To this end, in 1926, she proposed the formation of a New Zealand Obstetrical Society.<sup>3</sup> Gordon also knew that to achieve her long-term goals, she needed to have firm control over the Society’s destiny. As she would later write: “The assemblage took for granted that my husband Bill would be the Honorary Treasurer and I would be the pen-driving Honorary Secretary”.<sup>4</sup> Coincident with the birth of the Society, the great English gynaecologist, Victor Bonney, made a lecture tour of New Zealand. Gordon reported that since his visit, she had maintained extensive “press agitation” throughout the Dominion, keeping public opinion alive to the needs of an obstetric department in Dunedin.

While having strong support from her executive, she was fortunate to have Dr Henry Jellett, a former Master of the Rotunda Hospital in Dublin, by now Consulting Obstetrician to the New Zealand Government, and Dr Watt, Director General of the Health Department, promoting her cause. Dr Watt described obstetrics as the “Cinderella” amongst medical services, often “unwanted and neglected”.<sup>5</sup> While Health Department officers, Drs Watt and Paget, were strongly in favour of the Society, there was occasional tension between them when the Department made inquiries to nurses about medical matters, without first seeking the opinion of the doctor in charge.

The recurring themes of early executive meetings were the frequent remits and deputations to the Government, Otago Hospital Board and

Otago University advocating a Chair of Obstetrics, together with a new maternity hospital in Dunedin. The birth of the Society also coincided with the Great Depression, providing the authorities with an excuse that they did not have sufficient money. Not only was there insufficient money, but the matter of a power imbalance between the academic departments. Lindo Ferguson, the Dean, wrote: "Some are insisting that midwifery and gynaecology should have as much time as medicine and surgery—I shall have to keep out of the clutches of the obstetricians who are anxious to reform us violently."<sup>5</sup> The executive also discussed "immersion bathing", clinical record forms for research, and the "desirability of having a post graduate school of obstetrics in New Zealand... though the time was not yet ripe".<sup>6</sup>

At the Executive Meeting of the Society on 13 September 1929, several important issues were discussed. Despite early resistance, Ferguson finally agreed to an approach from Gordon indicating that the Society would endow a full-time Chair of Obstetrics (unlike the part-time Chairs in Medicine and Surgery which had been in existence for some time).<sup>7</sup> Doris Gordon volunteered to make an "extensive personal canvas for £25,000 on behalf of the Society" on the basis of a pound-for-pound Government subsidy. At the same meeting, it was reported the Government had sanctioned the building of a new obstetric hospital in Dunedin. The National Council of Women and the Women's Division of the Federated Farmers had each donated £50 for a New Zealand graduate to spend six months on an obstetrical scholarship in Melbourne. Thereafter, the National Council of Women established a strong and lasting relationship with the Society. This young Society had achieved much for New Zealand women in its first two years "assisted in large part by the Obstetrical Society deputations to the Minister of Health".

Doris Gordon relished the challenge of raising the money "to enlist the help of multiple women's committees all over the Dominion"—for an Obstetrical Endowment Fund. She enlisted the help of powerful women, including a supportive letter from the wife of the Governor General, Lady Bledisloe.<sup>7</sup> Men's groups, in particular Rotary, were supportive. She "criss-crossed the length and breadth of NZ-prospecting". The national appeal was carefully organised, and the tour began on 25 January 1930 and concluded on 25 March 1931, raising £31,000. In May 1931, £25,000 was given to the University of Otago, with £6,000 available for a second travelling scholarship. A Recommen-

dation Committee was appointed in Great Britain (professors from London, Belfast, Edinburgh, and Dr Victor Bonney) to make the new professorial appointment. As soon as the appointment was concluded the successful applicant, Professor J B Dawson, was instructed to travel around Great Britain, to the Continent, the US and Canada to study comparative methods of teaching Obstetrics and Gynaecology. He was specifically asked to investigate maternal mortality in these countries because this was the most pressing issue in New Zealand. The Dean noted "that for the next 10 to 20 years the production of highly trained specialists was more important than research work in obstetrics".<sup>8</sup>

In 1921, James Parr, the Minister of Health learned that more New Zealand women died in childbirth, principally from sepsis, than any other developed country apart from the United States of America. There was a public outcry when it was learned the Department had known about this for some years. Truby King, the well-known infant health crusader (and eugenicist) and Director of Child Welfare, dealt with the problem.<sup>9</sup> King met the challenge of the maternal mortality scare by intensifying Plunket criticism against meddlesome midwifery, and advising women not to have doctors at their confinements and do without anaesthetics and forceps. This led to a further outcry, and fortunately, a special committee on Maternity Mortality saved the day by appointing Jellett and Gordon to deal with the problem.<sup>9</sup>

Around this time, "the matter of a projected Maori Hospital was left to Dr Doris Gordon to confer with Dr Ropa and Sir Maui Pomare". Sir Apirana Ngata stated: "the monetary grant to the Taranaki natives had not yet reached a degree of finality to progress the matter".<sup>10</sup>

In 1933, the indefatigable Secretary, Doris Gordon, noted the Society was in "quiet consolidation in the face of economic depression", although there had been only a slight fall in membership. Professor Dawson fulfilled the Society's expectations, travelling widely and fraternising with his new colleagues, lecturing, writing for the *New Zealand Medical Journal*, and becoming an *ex-oficio* member of the Society. Dawson raised the vexed issue of the place of midwives—"Doctor and Midwife, Colleagues or Rivals?" He proposed: "the ideal obstetric service for every confinement in the Dominion was a doctor and a midwife, or a doctor and maternity nurse attending."<sup>11</sup> Dawson also increased interest in research within the Society, being a prolific contributor to the *New Zealand Medical Journal*. He reported there were

now 20,000 maternity records collected by Society members worthy of study. Dawson bemoaned the continuing “haggle” between the Dunedin Hospital and the Government over the £50,000 for the new maternity hospital, frustrating teaching opportunities. The Society took an active role in promoting Society values—offering to be available to broadcast matters of maternal welfare, and assistance on questions related to the new National Health Insurance scheme. Interestingly, the increasing frequency of Caesarean sections over the years does not appear in the Society records.

A feature of the Society, and fulfilling its original aims, was the establishment of subcommittees, such as ‘Doctor and Midwife’, ‘Eclampsia’, ‘Maternal Mortality’, ‘Puerperal Sepsis’, ‘Toxaemia’, ‘Pain Relief in Labour’, ‘Stillbirth and Neonatal Death’, ‘Birth Control’ and ‘Criminal Abortion’. Responses from six divisions of the Society in 1932 recorded: “the increasing numbers of abortions, mainly ‘induced’ by self-administration of emmenagogues and in the later months by the intervention of a second person. Surgical curettage of a pregnant uterus occurs only where medical complications render the pregnancy inimical to the mother’s health or life and more use of tubal ligation during routine laparotomies of worn-out mothers of five or more children or for prolific mothers of the degenerate class.” Dr Watt, the Director General of Health said: “it was inconceivable that British public opinion would consent to legalised abortion”.<sup>12</sup> Writing on the Ethics of Birth Control the same year, a Nelson doctor supported contraception “to anyone who asks for it”, praising Dr Marie Stopes, and then stating: “the sooner that the lazy, idle, drunken and incompetents of all sorts learn and practice how to avoid having families the better”.

In 1935, 42 women died from septic abortion, leaving 338 children motherless with “the bulk of evidence suggesting that it was the married women with relatively large families on the bread line” and “while the Society had endorsed the principle of birth control for certain types of people” (married couples), septic abortion deaths had risen markedly. The Society could not at present advocate birth control knowledge to the adolescent and younger section of the community: “It would alienate valuable public support of our Society by antagonising the Roman Catholic Church and that section of the community now seriously concerned at our alarmingly low birth rate”. Nonetheless, the Society “viewed with alarm the grave increase in maternal deaths due

to abortion”. Professor Dawson advised setting up a Commission to investigate the matter.<sup>13</sup> Pressure by the Society and Women’s groups led to a commission of Inquiry into Abortion in 1936.

Gordon was planning an overseas sabbatical to attend a meeting of the British College of Obstetricians and Gynaecologists in 1939. The Executive of the New Zealand Society asked her to investigate why the “overseas” scholars, who had benefitted from the Society’s scholarships, were not returning to New Zealand. At that time, only one of nine scholars had returned. Never afraid to approach “big names”, she asked the College President Professor (later Sir) William Fletcher Shaw to chair a small committee. The committee included Professor Lowry from Belfast, a former scholar, John (later Sir) Stallworthy, and Dr (later Sir) Robert Macintosh, a New Zealand born anaesthetist at Oxford, to resolve why scholars were not returning. Fletcher Shaw was blunt. It was the attitude of the New Zealand hospital boards—“controlled by laymen”.<sup>14</sup> Late in 1940, the Society convened a meeting which unanimously approved the idea of establishing a postgraduate school and hospital in Auckland.<sup>15,16</sup>

Gordon visited Auckland and addressed meetings of professionals and laypeople interested in the project. This led to a group of businessmen launching an appeal which resulted three years later in the investment of £100,000, the interest enabling a Post Graduate Chair in Obstetrics and Gynaecology in the University of Auckland. Sadly, Doris Gordon died in 1956, a few years before the new National Women’s Hospital opened.

Maternal deaths were always a concern for the Society. While many factors contribute to the overall measures of feto-maternal outcome, the advent of the Society played an important role in addressing preventable factors. Maternal mortality fell from 5 per thousand when the Society was established, to 0.5 per thousand at the time of Doris Gordon’s death 20 years later. Over the same period, the stillbirth rate halved and deaths from puerperal sepsis from 2 per thousand to 0.1 per thousand (reflecting the advent of antibiotics). Eclampsia deaths, always a measure of obstetric performance, fell from 0.61 to 0.03 per thousand births.<sup>17</sup>

With the establishment of National Women’s Hospital, the bulk of postgraduate teaching moved from the Society to the Postgraduate School of Obstetrics and Gynaecology. The Society devolved with a national executive rotating through local branches around New Zealand. The city hosting

the national executive would typically have large 2–3 day meetings, often with international speakers and much evening revelry.

In 1932, the Royal College of Obstetricians and Gynaecologists established a New Zealand Reference Committee and, after the war, a New Zealand Regional Committee. When Australia formed its own College, New Zealand felt obliged to follow suit, forming its own College in 1982, eventually amalgamating with the Royal Australian College in 1998. A combination of legislative changes, social and economic factors, and a now autonomous midwifery service brought general practitioner obstetrics—and the Obstetric and Gynaecological Society—to an end by the mid-1990s.

The Doris Gordon Trust, which was established following her death, was re-established to allow and that funds are now used for public lectures on aspects of women's health. While the scientific advances promoted by the Society were abreast of the times, social attitudes of the largely male

membership sometimes remained Victorian. For example, when in 1935 a member promoted the addition of "Gynaecological" to the Society title, and "the necessity for an obstetrician to be 'gynaecologically minded'... as otherwise, not only might a woman's happiness be wrecked by disturbances such as septic cervix, relaxed uterine supports, parametritis, etc., but a husband's success in life might be retarded and children cheated of their rights to a happy childhood, as no patient with the above gynaecological disorders could give of her best to her husband."<sup>18</sup>

What did the Society achieve? First and foremost, both academic Chairs in Obstetrics and Gynaecology in New Zealand, together with two travelling scholarships. Second, it established a national organisation to pursue continuing education and a forum on medico-political maternity-related issues. As noted above, the Society can also take some credit for the dramatic improvements in maternity statistics, one of the Society's aims.

**COMPETING INTERESTS**

Nil

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# The responsibilities of medical students in providing advice on the COVID-19 vaccination programme

Lynley Anderson, Simon Walker, Tony Zaharic, Kristin Kenrick, Rathan M Subramaniam

## ABSTRACT

The COVID-19 global pandemic has highlighted the potential roles and responsibilities of medical students in healthcare systems. Senior clinical students may be able to contribute practically, but all medical students, regardless of their level of training have the opportunity to assist public health measures, eg supporting vaccination uptake. Medical students may tread a difficult line in such situations. On one hand, students are advised not to act beyond their level of expertise, yet they can feel an expectation to be authoritative by the community. Navigating these spaces can be challenging for medical students and an important part of their professional development.

Having active COVID-19 within the community raises complex questions about the roles and responsibilities of medical students in a time of the global pandemic. COVID-19 has had many adverse effects on medical student learning by disrupting teaching opportunities and limiting clinical contact, particularly during the most stringent lockdowns. New Zealand's medical schools have worked hard to mitigate these problems by using online classes, assessments and innovative teaching methods. However, among these challenges, new opportunities for student engagement have emerged. There have been documented examples from around the world of senior clinical students contributing in various ways to the medical response to COVID-19.<sup>1,2,3</sup> The same has occurred in New Zealand. For example, senior students from the University of Otago Medical School (OMS) have volunteered in COVID-19 testing, screening and vaccination clinics. At Auckland Medical School (AMS), year two and three students have worked as contact tracers, while clinical students were offered an opportunity to become vaccinators. As such opportunities have emerged, both schools have needed to consider the safety of students engaged in these activities and the impact on their learning, including their professional development.

The arrival of the COVID-19 Delta variant into New Zealand meant the lockdown approach that worked so well in 2020 was less effective in containing community transmission. Achieving high levels of community vaccination rates now appears

to be our best means of responding to the pandemic. Students at all levels of learning can assist by supporting public health measures and encouraging vaccination uptake. Students will often find themselves fielding questions from friends, whānau, or members of the public on health issues pertaining to COVID-19 and the vaccination response, in particular. In these situations, students have the opportunity to make a valuable contribution to the nation's response by addressing common concerns and affirming the substantial benefits of vaccination. Through these simple actions, they participate in improving the health of all members of our community, either directly or through a halo effect for more vulnerable individuals who cannot or are less likely to be vaccinated.

The Medical Council of New Zealand (MCNZ) holds a clear position on vaccination. This position has been reiterated recently in response to a small number of registered doctors who have made statements inconsistent with the weight of evidence regarding the safety and efficacy of COVID-19 vaccinations. In August 2021, Dr Curtis Walker, the Chair of the MCNZ, released the following in a media statement:

*[It is the] Council's view that there is no place for anti-vaccination messages in professional practice, nor any promotion of anti-vaccination claims including on social media and advertising by health practitioners. Council expects doctors to be aware of, and comply with, its published standards of clinical and ethical practice.<sup>4</sup>*

The Council's full statement on the COVID-19 vaccine and professional responsibility, published in conjunction with the Dental Council of New Zealand, states:

*You have an ethical and professional obligation to protect and promote the health of patients and the public, and to participate in broader based community health efforts. Vaccination will play a critical role in protecting the health of the New Zealand public by reducing the community risk of acquiring and further transmitting COVID-19.<sup>5</sup>*

These statements pertain to qualified doctors, but medical students have similar responsibilities. In addition, the community often views medical students as having access to information that is not readily available to others. Because of this, the views of a medical student are often held in high regard, irrespective of that student's level of training.

The *Code of Professional Conduct for Medical Students at the Universities of Auckland and Otago* is a document that all medical students in Aotearoa New Zealand sign at the commencement of their studies. This document states:

*Patients and whānau place significant trust in the medical profession and also in those learning to be a doctor. Whenever you meet people, you represent the Medical School, the University, and the medical profession. Your behaviour both within and outside of the clinical environment should uphold the reputation of the medical profession that you are joining.<sup>6</sup>*

This document also states that students have an obligation to be careful about advice or information

they give out. Under the heading 'Appreciating the limits of my role' students are required to declare that they will:

*Not give advice or provide information to patients, whānau or the general public, that is beyond my level of knowledge and expertise. When asked for such comment, I will direct that person to an appropriate professional.<sup>6</sup>*

Navigating these requirements can be challenging for medical students. While most are aware of their own limitations, they may feel an expectation to be authoritative, and this may prompt them to express their thoughts with greater certainty than their level of expertise warrants.<sup>7</sup> Alternatively, medical students who are aware of the professional requirement to play a positive role in public health measures (such as those stated by the MCNZ), may feel hesitant about doing so because they are also aware they should not give advice "beyond their level of knowledge and expertise". Additional tensions arise as they learn to negotiate their identities as private citizens able and entitled to comment on issues of public interest (which on medical issues is more likely to be a well-informed position consistent with the prevailing medical consensus), and as a medical student constrained by their level of training.<sup>7</sup>

These tensions will be familiar to practitioners from many health professions. For many, it requires ongoing vigilance to find the appropriate balance between the personal and the professional—a skill that all health professionals need to acquire. This crucial element of professional development is another area of immediate learning that has emerged for medical students with this pandemic.

**COMPETING INTERESTS**

Nil.

**ACKNOWLEDGEMENTS**

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# In defence of mātauranga Māori: a response to the ‘seven academics’

Waikaremoana Waitoki

**O**n 28 July 2021, a group of academics from the University of Auckland published a letter in the Listener, a well-known, non-academic magazine. The letter writers expressed their moral outrage that the Government's NCEA curriculum working group proposed that science would be taught to Māori students along with its colonising history. The writers were also concerned that mātauranga Māori would be taught to ensure parity with other bodies of knowledge. A central premise of the letter was a complete dismissal of the value of mātauranga Māori as a valid science, and a disregard for the importance of teaching students to think critically about their studies. The letter prompted a very public backlash, and interviews were held in print media and on television. The viewpoint letter was sent to members of the New Zealand Psychological Society (NZPsS) and is repeated below. This viewpoint letter offers a rebuttal to the letter for its lack of research or critical analysis. Using a discourse analysis to examine the arguments made, it is evident that rhetorical devices, racist tropes and invitations to moral panic were used to justify the writers' conclusion that mātauranga Māori lacked scientific basis. Moving forward, the NZPsS has an obligation to consider its responsibility to uphold Te Tiriti o Waitangi and offer a mana-enhancing solution to resolve situations of this nature.

As the President of the New Zealand Psychological Society, I believe it is important that we express our disappointment at the 28 July 2021 letter to the Listener<sup>1</sup> written by professors of psychology, biological sciences and critical studies. As a Society, we also wish to express our support and aroha for those who were, and continue to be, negatively affected by the letters content. We note that the letter reflected an unchecked assumption about the current NCEA curriculum and its future intentions, and a disregard for the effects of dismissing the knowledge system of an entire culture. In reviewing the letter, it was readily apparent that racist tropes were used, alongside comments typical

of moral panic, to justify the exclusion of Māori knowledge as a legitimate science. Responses to selected portions of the letter are outlined below:

1. The writers are dismayed at the proposed changes to the NCEA curriculum which ensures mātauranga Māori has parity with other bodies of knowledge. They are also concerned at the proposal for a new course that aims to teach how science has been used to support the dominance of a Eurocentric view (along with its rationale for the colonisation of Māori and the suppression of Māori knowledge). The writers demonstrate a lack of understanding that the push for NCEA to reflect the worldviews of Māori, within the context of colonisation and epistemic racism, represents a move towards levelling the playing field. The originators of this change are young Māori students<sup>2</sup> from Otorohanga High School,<sup>3</sup> Leah Bell, Waimarama Anderson and Tai Jones, who petitioned the Government to be told the truth about New Zealand history. That same desire exists with students across all disciplines who consistently ask to have their cultural worldviews made visible, respected, taught and valued.
2. The letter writers express their concern that science is being misunderstood at all levels of education and science funding. They further add that science itself does not colonise—while acknowledging that “it has been used to aid colonisation, as have literature and art”. This is similar to saying “Guns don’t kill people. People kill people”. Esteemed scholar, Professor Linda Tuhiwai Smith<sup>4</sup> (and others), established that science has indeed been used, under the pretence of its own legitimacy, to colonise and commit genocide towards Māori and other Indigenous peoples. Science, in the hands of colonisers, is the figurative gun. The writers fail to note the overwhelming evidence, that the users of the science they favour are also the ones who set the rules about what counts as

- science, where it can be taught, learned, published or funded. This issue is extremely relevant to the need to decolonise the power base held in our learning institutions.
3. The trope of colonial imagination: “Science is universal, and not especially Western”— here the writers state that “western science derives from ancient Egypt, Greece, Mesopotamia, and India before developing later in the US and with a strong presence across Asia”. They also added: “with contributions from mediaeval Islam”. This trope imagines that science developed naturally through the healthy exchange of knowledge between cultures, rather than through the inextricable ties to imperialist expansion via the colonisation of peoples and the plunder of their natural, cultural and intellectual resources. As I read their narrow understanding of history, I noted the absence of the Pacific, Africa, the Americas, Greenland, and the Arctic circle, all of whom exist in relationship with their own mātauranga science. To add to the point above, if the New Zealand curriculum intends for their future citizens to understand the world, they also need to know about hegemonies, sexism, racism, Islamophobia, and the forces that use science to oppress some peoples and privilege others.
  4. Inciting moral panic trope: “science is helping us battle worldwide crises... COVID-19, global warming”. The assumption here is that the science they refer to is the key to our survival, and that we can’t afford to mistrust science (see point 1). While science is in a global debate about truth, this should not be an invitation to panic about mātauranga Māori potentially destabilising their safety zones. Māori do have solutions to global warming, as do many other Indigenous epistemologies. These solutions centre on protecting the planet as an ancestor by using Indigenous science and addressing exploitative capitalism. It is unfair to claim that we should be concerned (and therefore panic) that science won’t be trusted if we teach the truth about the colonisation of peoples, or about racism that occurs in New Zealand society. We should instead be concerned that viable and sustainable solutions, derived from Indigenous worldviews, are systematically ignored and marginalised, or suppressed and criminalised by those who do not understand their role in epistemic injustice.
  5. The White Saviour trope: this is where Māori are told which elements of our Indigenous knowledge are important and to whom. The writers, speaking for Māori, offer the opinion: “Indigenous knowledge is critical to the perpetuation and preservation of culture and local practices and plays key roles in management and policy”. The writers (as is their inherent privilege) relegate Māori knowledge to archival value, ceremony, management and policy (although it is not clear what is meant here). Speaking for Māori ignores obligations to honour Te Tiriti o Waitangi, and ignores the overwhelming evidence that racism is a primary reason that mātauranga Māori science is undervalued. Māori knowledge is indeed critical to the preservation of our culture and practices because we are resisting epistemic and cultural genocide, while also striving to flourish and develop. Speaking for Māori again, they add that “in the discovery of empirical, universal truths, it falls far short of what we can define as science itself”. Māori aren’t asking them to define science. We have done that ourselves despite having obstacles thrown up at all stages.
  6. The writers also use the trope of condescending compassion, and, dangerously, the myth of the “White man’s burden”<sup>5</sup> where Māori need to be saved from ourselves. They comment: “to accept it as the equivalent [of Western science] is to patronise and fail indigenous populations. Indigenous knowledge may help advance scientific knowledge, in some ways, but it is not real science”. This statement of condescending compassion is also a form of gaslighting (manipulation and psychological control)<sup>6</sup> where Māori are told that believing in ourselves, and our potential, will fail us. Trusting our own cultural epistemologies is viewed as dangerous, and like children, we must be protected, not by our own, but by Western science. Or as the writers note, [Māori are] “better off participating in the world’s scientific enterprises”.

Psychology has a long history of marginalising Māori knowledge, and it is concerning that two of the writers are professors of psychology. We note that the letter reinforces known racist assumptions about the validity of mātauranga Māori science that occur across psychology and academia. We are particularly concerned about the wellbe-

ing of Māori staff and students in academia who must now navigate the fallout of this letter. We are often expected to justify our existence, to explain or defend Indigenous knowledge of psychology, mātauranga Māori, and kaupapa Māori theory. This is an example of Māori doing double-duty<sup>7</sup> to educate others within a largely hostile system (see McAllister et al,<sup>8</sup> and institutional racism allegations at the University of Waikato<sup>9</sup>).

Research conducted over 40 plus years in psychology shows the impact of racism on Māori health outcomes, curriculum development, student numbers, research outputs, and staff recruitment, advancement and retention. More needs to be done, and the NCEA curriculum changes will go some way to achieving mātauranga parity. We welcome the changes on the horizon and embrace the potential for enhanced understandings of science, whatever their origins.

Across the country (and internationally) colleagues spoke up and rejected the letter. Tina Ngata's blog is particularly good,<sup>10</sup> as is the Royal Society of New Zealand,<sup>11</sup> the University of Auckland, the New Zealand Association of Scientists<sup>12</sup> and the students' reply to university academics.<sup>13</sup> However, systemic change is needed to dismantle the foundations of institutional and scientifracism<sup>14</sup> that employs, enables, promotes, and protects the science that is reified in the letter, and the deliberate exclusion of mātauranga Māori.

The NZPsS is in the process of reviewing their membership and awards process to consider their ethical responsibilities when members, or holders of distinguished awards, bring the profession into disrepute. In taking this approach, the NZPsS is cognisant of its values to protect the dignity and mana of members and the organisation. Other organisations are keenly interested in the outcomes of this process as similar issues (including sexual harassment and bullying) occur across differing professions.

Since the letter was published, the Royal Society of New Zealand has received complaints about the letter writers who are members of the Society. According to the Royal Society's complaints process they are obliged to consider whether to proceed to a full investigation. On 11 March 2022, the Royal Society published their decision not to investigate complaints against their members, stating: "The Panel referred to clause 6.4(i) of the Complaints Procedures: "the complaint is not amenable to resolution by a Complaint Determination Committee, including by reason of its demanding the open-ended evaluation of contentious expert opinion or of contested scientific evidence amongst researchers and scholars."<sup>15</sup> The decision not to proceed appears to be based on concerns that an investigation will be open-ended, and amount to who is right and who is wrong. Rather than become enmeshed in an ontological enquiry, the investigation could consider whether there is evidence that the Society's fellows were dishonourable in their processes. Our questions are simple. Did the letter writers act as good scientists? Did they consider the impact of their viewpoints in a magazine whose readership is unlikely to feature Māori perspectives? Did the writers consider that their letter will have revisited the impact of epistemic racism on Māori academics and researchers? In the very least, did they consult with their colleagues in their own institutions?

Finally, Mihingarangi Forbes on the Hui (2 August 2021)<sup>16</sup> asked one of the writers, the late Professor Corballis, if he knew what mātauranga Māori is. He stated: "We've tried to find out about it... we don't know any Maori who knows what matauranga [sic] is". Following the interview, Dr Jade Le Grice tweeted her response to not knowing any Māori: "and yet western Science cannot assist him to navigate his way to my office, next door".<sup>17</sup> I agree, we've been here all along, right next door, practicing our mātauranga-informed science.

**COMPETING INTERESTS**

Nil.

**ACKNOWLEDGEMENTS**

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# Comprehensive healthcare system needed

Gil Barbezat

The editorial by Saxon Connor published in your *Journal*<sup>1</sup> raises many debatable points.

His suggested answers to the challenges posed by increasing demands of healthcare will be of great concern to many. Particularly disturbing is that his solutions lie in some form of further restriction and rationing, rather than any possibility of expanding the provision of resources for services. He reflects the view of the privileged who can afford an alternative source of healthcare, something elusive to the majority of our population.

Abiding by the principles of the Treaty of Waitangi could be life-saving. Care of the community is far more important than the rights of individuals. Thoughts of any further restrictions amongst those who already have the poorest provision of services and outcomes are abhorrent. The rise in average lifespan has come at a price; some of us are more privileged than others, and bear a societal obligation to contribute towards benefiting our community's health and paying for it.

Connor glibly uses phrases such as: match "available resources", "healthcare is a right", "reasonably achieved within funding provided", "DHBs to provide a good and safe working environment for staff". He also notes that secondary care is "in crisis", with its big deficits, shortfall in staff training and availability, emergencies displacing elective requirements, "wide variety of acceptance" of rationing. All these factors are important but have an immense range of interpretations which need to be debated; it cannot be assumed, as he seems to do, that his interpretations encapsulate all the answers. His stock answer, illustrated in every section of the table, is to reduce demand, equating health values and life itself with commodities, such as dairy products and wool. That is not the type of health system most of us could tolerate. While perfection is not practically possible, we can surely do far better than his range of limitations.

Secondary care funding problems are particularly prone to occur when not based on sound public health and primary care foundations. Usurping those functions introduces practices which are often misguided, misinterpreted and result in costly and unnecessary interventions. This

applies particularly to end of life care.

In a democratic society, we elect our politicians to develop and enact policies compatible with our prioritisation of values. Surely health, housing and education must be priorities if we are to maintain a civilised collaborative community who value their future. When the population is presented with the alternative of spending discretionary income on unnecessary luxuries or basic community necessities required of a satisfactorily functioning public health system, we do not have to look far to see what vast differences such choices produce on populations.

The result of favouring the individual above the community results in a situation currently bedevilling the USA. Despite the highest per capita expenditure on health (19.7% of GDP), close to 30 million have no access to funded healthcare; preventive medicine is only available to those who can afford it, life expectancy is decreasing, and the commonest cause of bankruptcy is healthcare debt.<sup>2</sup> In contrast, a medium income country, Costa Rica, has revolutionised its healthcare provision over the last 50 years with a more community-based public health approach; it has reversed its declining life expectancy, and now has a better record and longevity rate than the USA at less than half the cost (7% of GDP).<sup>3,4</sup>

There is a ray of hope in that Connor calls for legitimate institutions to make transparent decisions from information-led data with public engagement. We can only wish that were possible, but that would require firm support from the community and the political will of those in power. There is certainly much room for improvement in current DHB health provision. We wait with bated breath for the small print of the "new health system" soon to be enacted. Greater efficiency is required to meet resource issues. Changes should be focussed around the needs of patients as members of a community, with medical education, staff and facilities tailored to meet those requirements. The shoe needs to be designed to fit the foot, not the foot squeezed into whatever footwear is cobbled together by ad hoc assembly of readily available historic components.

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**COMPETING INTERESTS**

Nil.

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# The answer is more investment in health and welfare—not more rationing of healthcare!

Philip Bagshaw, Sue Bagshaw, Pauline Barnett, Gary Nicholls,  
Stuart Gowland, Carl Shaw

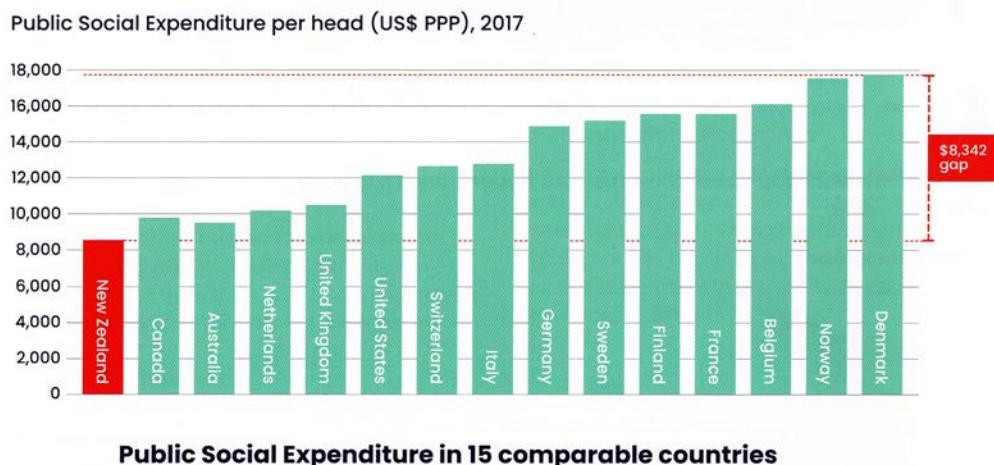
We wish to respond to the editorial by Dr Connor published in the *NZMJ* on 25 February last. His arguments are based on one premise: "The attempt to meet all the healthcare needs would overwhelm any country's resources, including the need for other social goods, etc...". This is a central mantra of neoliberal philosophy, with its policies for free market economies and the private provision of public service,<sup>1</sup> with which we strongly disagree.

High levels of unmet need and a creaking healthcare system should suggest a need to examine the underlying reasons for both and should not rely on a managerialist technical solution.

It is obvious that a major contribution to the high level of unmet need lies in predeterminants of health such as: poverty, access to primary healthcare, inadequate housing, and poor diet. The other main reason for the creaking health and welfare services is the thirty years of underinvestment. Objective data from many democratic countries shows that neither

healthcare needs nor the required level of adequate funding are overwhelming, as follows:

1. Multi-national European studies have shown that investment policies in healthcare and other welfare services pay large positive fiscal dividends and promote economic growth (i.e., for every dollar put into health services governments get more dollars back, often referred to as fiscal multipliers).<sup>2</sup> Even the International Monetary Fund, a bastion of neoliberalism, which initially disagreed with the results of these studies, has since conceded that such positive fiscal multipliers do result from investments in health and welfare.<sup>1</sup>
2. Finland is an exemplar of a country that has shown what can be achieved by a policy of welfare investment.<sup>3</sup> By comparison (See Figure 1)<sup>4</sup> our own level of social expenditure per capita is much lower, and we can afford to do much better.<sup>5</sup>



Source: OECD Social Spending Indicator 2021

The assault on the healthcare system of Aotearoa New Zealand started in earnest with Rogernomics in the early 1990s, and continued through the Core Services Committee and the National Waiting Time Project.<sup>6</sup> These steps were needed to prepare the public for the progressive rationing of secondary elective healthcare. There was some isolated and sporadic opposition to these moves from the medical profession.<sup>7</sup> However, we neither mounted a coordinated opposition to them through our representative bodies, nor did we effectively highlight the fundamental underlying problems by addressing either the predeterminant of health or the chronic underfunding of primary and secondary healthcare.

Undoubtedly, the situation has continued to deteriorate because not only has residual neoliberalism continued to eat away at healthcare funding, but it has also fuelled a widening of the gap between the “haves” and the “have nots”.<sup>8,9</sup> As a consequence, people in the lowest decile groups have suffered the double jeopardy of the worst predeterminants of health and the poorest access to healthcare services.

So, coming to Dr Connor’s proposal that, as the secondary healthcare system is under massive stress and about to collapse, a potential solution is to extend rationing into acute secondary healthcare.

Why again should this be contemplated, rather than a move to an investment model for health and welfare spending that has been shown to be successful overseas? Is it likely that yet again we, the medical profession, will not advocate *en masse* on behalf of the public?

If serious rationing of acute secondary services takes off rapidly here, as happened before with elective healthcare, we are likely to end up with a USA-type healthcare system, that is heavily privatised and inefficient, and where: the wealthiest 20% have some of the best healthcare in the world; middle-class Americans live in dread of having a major acute or chronic illness and thereby needing to declare bankruptcy; and a poor, uninsured 27.5 million people have almost no access to healthcare.<sup>10</sup> It is easy to see how such a dystopian scenario is unlikely to motivate doctors like ourselves, who can afford to pay for private healthcare, but would be a persistent nightmare for many other people.

The real question is not “whether it is time to ration acute secondary care?” It is instead: “when will the medical profession wake from its slumbers and begin advocating for the changes in policies for adequate health and welfare funding to achieve the goal of equity of health outcomes for all the people we serve?”.

**COMPETING INTERESTS**

Nil.

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# Response to the health crisis is responsible investment, not more rationing

Sarah Dalton, Lyndon Keene

**D**r Saxon Connor describes well the mounting pressures on our health system that are creating impossible conditions for services to operate effectively. But the answer to this is not in more rationing which, aside from causing additional suffering, would simply shift the cost of ill health elsewhere. The response to his question: "Is 'cradle to the grave' philosophy still appropriate, sustainable or affordable?", is yes, yes, and yes, though requiring more forward-thinking fiscal policies.

In reverse order, here's why:

## Affordability

Of 15 comparable countries in 2019,<sup>1</sup> New Zealand ranked second-to-bottom, both on per capita health spending and total health spending per gross domestic product (GDP). In terms of spending per GDP, New Zealand (9.1%) would have needed an additional \$4.5 billion to match the spending of the median country level (Norway, 10.5%).<sup>1,2</sup> It would be much higher today. Those countries—the USA aside—have overall better health statistics than New Zealand. And there's no evidence to support the commonly argued idea that health spending is an economic drain. Most have stronger economies than New Zealand.

New Zealand's relatively low spending on health is a consequence of having a relatively small government and overly conservative fiscal policies. While our GDP per capita is around average for OECD countries (measured in US dollars), our general government spending per GDP is among the lowest in the OECD, and our government debt is one of the lowest in the world.<sup>3,4,5</sup>

The affordability of our public health system, then, is more to do with politics than economic capacity, as is its sustainability. As well as having a low-tax economy,<sup>6</sup> few other OECD countries

appear to have been so obsessed with making budget surpluses as New Zealand. The usual rationale for making a surplus is to reduce the fiscal burden for future generations, but the economic reality of this has been challenged.<sup>7</sup> Among other things, a government's failure to invest in infrastructure, for example, can create significant costs for future generations. A simple example is today's \$14 billion bill (announced by the Minister of Health in 2020) to restore our dilapidated hospital buildings due to the penny-pinching of previous governments. The social and economic costs loaded on future generations due to today's under-investment in healthcare and the determinants of health will be much greater.

## Sustainability

The seminal report of the WHO's Commission on Macroeconomics and Health in 2001 found that poor health dragged down economic growth in developing countries. Later work showed how the same was true in high- and middle-income countries. People in poor health are less likely to work and, when in work, are less productive. They are less likely to invest in their own education or to save for retirement, and so to support the wider economy. Researchers have found a healthy population including healthy older people can contribute very substantially to the economy, and that "the economic position of countries today owes much to the extent to which they were able to achieve better health historically".<sup>8</sup>

As the United Nations' High-Level Commission on Health Employment and Economic Growth (the UN Commission) points out, investing in health is not only good for population health and wellbeing, but the health sector is also a key economic sector, a job generator and a driver of inclusive economic growth.<sup>9</sup>

Some analysts argue that investing in appropriate health system interventions may actually reduce the growth of healthcare expenditure in the future. The two Wanless Reports, in their exam-

<sup>1</sup> USA, Germany, Switzerland, France, Sweden, Canada, Belgium, Norway, Netherlands, UK, Denmark, Australia, Finland, New Zealand, Italy

ination of the financial sustainability of UK health services, recommended further investment to strengthen the National Health Service, and in particular its contribution to public health, as a means of achieving long-term sustainability.<sup>10,11</sup>

These are not arguments for a blank cheque. Investments in health system interventions must be underpinned by evidence on performance, including impacts on overall population health gain and value for money.

### **'Cradle to the grave' healthcare?**

It is never going to be perfect, but if the health system is, in principle, affordable and sustainable, then the universal approach to healthcare must surely be appropriate.

### **Responsible funding vs rationing**

In 2016, the UN Commission sought to change the mindset of political leaders, policy makers

and economists who view health employment as a burden on the economy. It wanted to shift the focus of health employment (about two-thirds of health expenditure) as 'consumption' to health employment as an 'investment'. That same year an *NZMJ* editorial called for "an honest appraisal and public debate... to determine more appropriate levels of healthcare spending".<sup>12</sup> That debate is needed now more than ever. Health professionals, who see the effects of under-investment every day, are in a strong position, with support from their representative organisations, to lead the way. While more rationing is not the answer to the health system's current crisis, Dr Connor's editorial is a timely reminder that rationing is the slippery slope alternative to adopting more responsible funding policies.

Which way we go must be determined by the public; getting that debate started may be largely up to us.

**COMPETING INTERESTS**

Nil.

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# Reply to letters to editor re: “Is it time to ration access to acute secondary care health services to save the Aotearoa health system?”

Saxon Connor

Some of Aotearoa New Zealand’s most prominent advocates for the Aotearoa public health system have responded to my editorial regarding the current state of the Aotearoa secondary care health system. There is no doubt that this is a complex problem with many drivers and no easy solution. It will not be solved by sound bites but will require significant thought, deliberation and consultation if those in Aotearoa society are to save the Aotearoa secondary health care system. Blaming various factions is unlikely to achieve a solution. Although many of the points are well made, none of the responding authors offer practical solutions to the issues those working at the coalface in secondary care are currently facing every day. Nor is it acknowledged that, like it or not, implicit rationing is a daily occurrence in the Aotearoa secondary health care system. This leads to siloed decision-making that is unfair and unjust, and is at heart of the inequity that exists within the public health system. Part of my initial argument is that if rationing is occurring, then it should be done explicitly, fairly, transparently and follow an ethical process designed by all stakeholders in the community it serves. In their letters, the authors concerned to do not consider that such explicit rationing, when well-designed, may improve the fairness of current system and prioritise those most in need. It does not need to favour the privileged.

Even if the “financial tap”, was fully-opened tomorrow, the issues relating to underlying infrastructure and workforce capacity would persist.

Solutions to these will require a decade or more to resolve. Importation and exploitation of overseas medical workforces at a time of a global shortage of healthcare workers hardly seems an ethical solution. Aotearoa needs to be self-sufficient in maintaining a sustainable healthcare system.

I am curious as to why the authors think Aotearoa society has chosen not to invest more in health? Several of the authors have spent their whole career advocating for more healthcare expenditure. Aotearoa has had political parties from both sides of the house in government, both coalition and majority. There have been health professionals within the ministerial health portfolio. So why has the call for more health expenditure fallen on deaf ears? Could it be that the people of Aotearoa do not want to invest more? Do we know? Imagine a young adult in Aotearoa today saddled with student debt, locked out of the housing market, facing rapidly escalating costs of living, saving for their retirement. Now they are being asked to commit more to the healthcare, much of which will be spent on those reaching the end of what’s physiologically possible for a human life. Will they vote “yes” to spending more on healthcare? To stand by and do nothing, and allow implicit rationing to flourish, is equivalent to watching the tragedy of the commons unfold. New processes are required, that will engage the population and health workforce in a meaningful way to facilitate complex decision-making, to ensure a fair and sustainable healthcare system.

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**COMPETING INTERESTS**

Nil.

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# Medical Education in New Zealand

*NZMJ, April 1922*

**URL:** [www.nzma.org.nz/journal-articles/medical-education-in-new-zealand](http://www.nzma.org.nz/journal-articles/medical-education-in-new-zealand)

The medical faculty in the School of Medicine at Otago University deserves great praise for the steady progress that has been made year by year in the medical school. The public purse and munificence of public-spirited citizens have provided new buildings, new class-rooms and laboratories, and there is now a large staff of professors, lecturers and assistants, in contrast to the days when one professor was expected to teach both anatomy and physiology. We believe that one medical school will suffice for the needs of New Zealand for a long time to come, and that the medical school should remain in Dunedin, but the recent political blunder of sub-dividing the Otago hospital district has caused serious but not vital damage to the Dunedin medical school. The amount of clinical material available may be sufficient, or barely sufficient, for present teaching requirements in Dunedin, but it is insufficient for further progress. The systematic lectures and laboratory teaching present no difficulties, but if students are not to have an abundance of bedside teaching they will become very indifferent practitioners. Fortunately there is available at Christchurch, Wellington and Auckland, clinical material for teaching purposes sufficient to supplement what may be lacking at Dunedin. If the medical course is to be extended to six years a number of sixth year students should be sent to other hospitals from Dunedin for further clinical training. As a preliminary to this it will be necessary to organise the honorary staffs of the large hospitals with a view to efficient teaching. Probably the members of honorary staffs who give time and thought to clinical teaching will need to be paid for their services. In any event it is time that the honorary staffs of hospitals met regularly together to discuss methods for the improvement of their work and for the continued raising of the standard of hospital practice. The surgeons, physicians and specialists respectively should meet to further the progress of their own branch of practice. It may be advisable to have honorary assistants appointed at the large hospitals in England and in America.

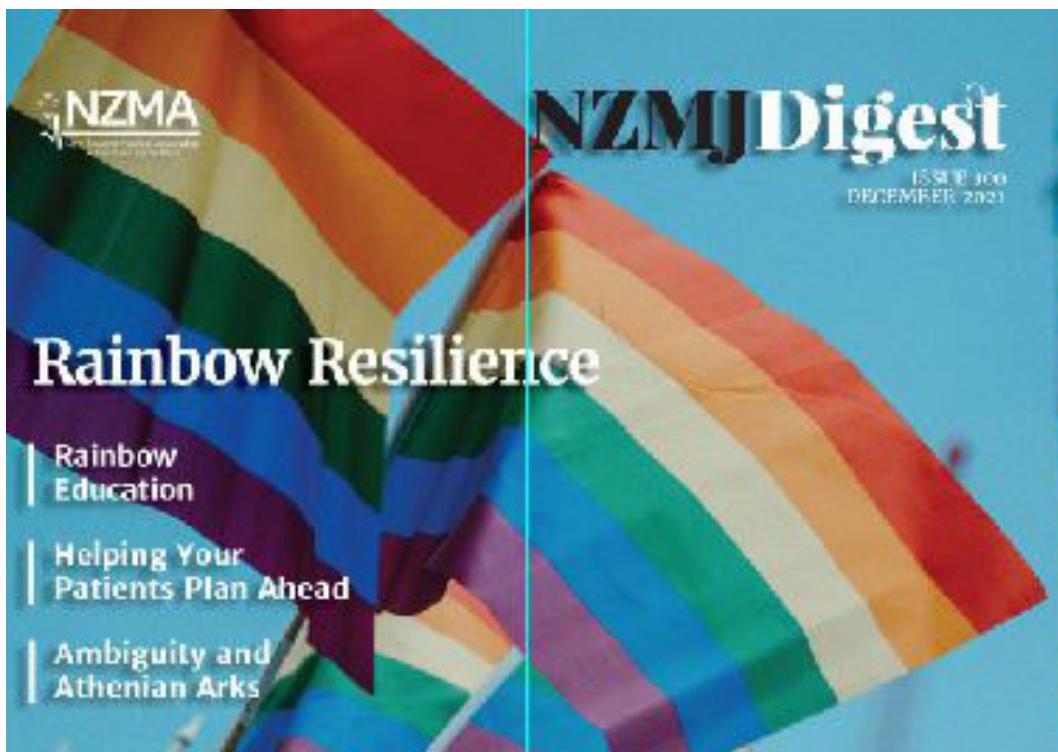
An urgent need is to give powers to the Medical Board of New Zealand to exercise some control over medical education in accordance with the practice in England. If the New Zealand Medical Board had power to appoint visitors and to make suitable recommendations it would strengthen the hands of the medical faculty in the medical school. If something upon the lines suggested is not accomplished there is a prospect of the New Zealand Medical School becoming over-crowded, so that an increasing, and not a diminishing number of young New Zealanders will proceed to the Home Universities.

There can be no objection to examinations within certain limits, but at present, unfortunately, medical education is overlaid with examinations and concomitant cramming. Answering within a specified time a series of written or spoken questions may be a test of memory depending partly on the recent reading of the candidate, and the whim of the examiner, but it is a very incomplete test of intellect, and of acquired knowledge and efficiency. During the final year devoted to clinical teaching in the larger hospitals, the students should pass or fail not on the usual examination test, but on the quality of their work for the year which depends on applied knowledge, common-sense, industry not unmixed with the spirit of enquiry and criticism.

The post-graduate standard of medical knowledge and training, for a medical practitioner must be a student all his days, will be greatly improved by the adoption of Professor Barnett's scheme for the foundation of an Association of Surgeons in New Zealand. In the same way an association of physicians can be formed. Such an association, managed as it should be, can do no wrong to anyone, and will provide for New Zealand medical graduates a system of training tested by clinical skill and experience. Where this scheme is now in practice it has done much to raise the standard of both hospital and private practice, and it cannot operate less beneficently in New Zealand than elsewhere.

# NZMJDigest

published by the New Zealand Medical Association



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NZMJDigest

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