COVID-19 pandemic studies of relevance to Aotearoa New Zealand
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Deficient hand washing amenities in public toilets in the time of the COVID-19 pandemic: a multi-regional survey
Nick Wilson, George Thomson
This study found major gaps in the way New Zealand public toilets are designed and serviced that could contribute to the risk of infectious disease transmission. This issue is relevant to helping with control of any COVID-19 outbreaks but also other diseases such as the more common norovirus infection. Nevertheless, hand hygiene may only be of relatively minor importance for COVID-19 control when compared to reducing aerosol transmission via improved ventilation, mask use and physical distancing.

Māori and Pacific people in New Zealand have higher risk of hospitalisation for COVID-19
Nicholas Steyn, Rachelle N Binny, Kate Hannah, Shaun C Hendy, Alex James, Audrey Lustig, Kannan Ridings, Michael J Plank, Andrew Sporle
We use data on cases of COVID-19 in Aotearoa New Zealand up to September 2020 to estimate the risk of hospitalisation for different age and ethnicity groups. After controlling for age and pre-existing conditions, we find that Māori and Pacific people face significantly higher risk of hospitalisation with COVID-19. Our work focuses on the likelihood of hospitalisation given infection, but other risk factors may mean that Māori and Pacific communities also face greater risk of infection.

Higher perceived stress and exacerbated motor symptoms in Parkinson's disease during the COVID-19 lockdown in New Zealand
Rebekah L Blakemore, Maddie J Pascoe, Kyla-Louise Horne, Leslie Livingston, Bob N Young, Beth Elias, Marie Goulden, Sophie Grenfell, Daniel J Myall, Toni L Pitcher, John C Dalrymple-Alford, Campbell J Le Heron, Tim J Anderson, Michael R MacAskill
This manuscript describes findings from a study conducted during New Zealand’s strict and relatively successful lockdown period to contain the SARS-CoV-2 virus. We surveyed our Parkinson’s disease (PD) and healthy control cohorts who are part of our established PD longitudinal study at the New Zealand Brain Research Institute. Here we report strong evidence of an association between higher levels of perceived stress and worsening of PD motor symptoms and higher perceived stress in PD than controls since the lockdown began. This report highlights the close interaction between stress and altered movement function in PD, indicating that monitoring and minimising stress levels during the pandemic may be an important adjunct strategy to improve motor function in PD.
Life during lockdown: a qualitative study of low-income New Zealanders’ experience during the COVID-19 pandemic

Kimberley Choi, Namratha Giridharan, Abigail Cartmell, Dominique Lum, Louise Signal, Viliami Puloka, Rose Crossin, Lesley Gray, Cheryl Davies, Michael Baker, Amanda Kvalsvig

This research explores the experience of 27 low-income New Zealanders during the COVID-19 pandemic lockdown. Life during lockdown was challenging for study participants who were fearful of the virus and experienced mental distress and isolation. Participants were also resourceful and resilient including using technology, self-help techniques and support from others. New Zealand’s welfare state ensured participants had access to health services and welfare payments, but there were challenges. Despite welcome increases in welfare payments these did not fully meet participants’ needs, and support from charitable organisations was critical. Participants were overwhelmingly positive about the Government’s response and advised the Government to take the same approach in the future. An early and hard lockdown, the welfare state, compassion and clearly communicated leadership were keys to a successful pandemic response for the low-income people in this study.

Making sure the New Zealand border is not our Achilles heel: repeated cross-sectional COVID-19 surveys in primary care

Kyle Eggleton, Nam Bui, Felicity Goodyear-Smith

This is paper presents a primary care perspective on border openings in the context of the COVID-19 pandemic. The study itself is part of an international collaboration designed to analyse and disseminate concerns of primary care in relation to the pandemic. Results from this study show that primary care has expressed repeated concerns about opening the border and see the border as being an ‘Achilles heel’ in our defence against COVID. And the fragile nature of the border means that primary care believes that effective strategies to reduce local transmission must be maintained.

An NP-led pilot telehealth programme to facilitate guideline-directed medical therapy for heart failure with reduced ejection fraction during the COVID pandemic

Andy McLachlan, Chris Aldridge, Mary Morgan, Mayanna Lund, Ruvin Gabriel, Valerio Malez

For most patients, the home monitoring/telephone process resulted in rapid titration and less need for clinic review. Patients found the process acceptable and 60% of clinic visits were able to be held remotely, saving patients both time and money. Titration rates and markers of improved outcomes improved across cardiac imaging, biochemical and clinical findings and were comparable to most real-world clinical reports. Although this is not a novel or innovative process, it is not usual care in New Zealand. However, this simple and straightforward process could be replicated across DHBs.
Empty waiting rooms: the New Zealand general practice experience with telehealth during the COVID-19 pandemic
Geraldine Wilson, Olivia Currie, Susan Bidwell, Baraah Saeed, Anthony Dowell, Andrew Adiguna Halim, Les Toop, Ann Richardson, Ruth Savage, Ben Hudson

In response to the COVID-19 pandemic, in early 2020 New Zealand general practices rapidly changed in the way they delivered healthcare, including using telehealth (eg, by phone or video) instead of seeing patients in person. For most patients and primary care practices this was convenient and allowed for patients to be safely given the care they required. There were problems where practices and patients did not have access to suitable technology to use telehealth, and some patient groups were found to be more disadvantaged. To make sure future telehealth consultations can be used by all in an equitable way, we propose that practices are given adequate funding and training; patients need to be given clear communication about how telehealth works and skills and access to technology to use it. Telehealth worked best where there were existing relationships between the practice and patients, and we recommend that healthcare provided by telehealth is integrated with existing primary healthcare services.

Emergency COVID-19 funding to general practices in early 2020: lessons for future allocation to support equity
Vanessa Selak, Sue Crengle, Matire Harwood, Samantha Murton, Peter Crampton

There were serious concerns about the financial sustainability of general practices during the COVID-19 national lockdown in early 2020, which led to the Ministry of Health to provide emergency funding to support general practices in March and April 2020. We sought to describe the distribution of this emergency funding according to the proportion of high needs patients (Māori, Pacific and those living in areas with the highest level of socioeconomic deprivation) in each practice. We found that although the March payment was higher for practices with higher proportions of patients with high needs relative to those with lower proportions of such patients, the April payment was similar irrespective of patient need. In order to meet its aspirations to support equitable health outcomes, the Ministry of Health should apply pro-equity resource allocation in all emergency circumstances.

COVID-19 and the impact on urology service provision at Capital & Coast District Health Board
Simon Lambracos, Lance Yuan, Andrew Kennedy-Smith

Our study demonstrated how restrictions as a result of the COVID-19 pandemic restrictions affected urology service provision in the Capital & Coast District Health Board region. The adjustments that were implemented to our service showed how we could function more efficiently, economically and environmentally. It also set a potential precedent for optimising healthcare service provision in other district health boards across the country on a routine basis as well in response to a crisis.

Impact of the COVID-19 pandemic lockdown on public sector ophthalmic work by New Zealand’s ophthalmologists
Daniel A R Scott, Peter W Hadden, Graham A Wilson

Publicly employed ophthalmologists experienced dramatic reductions to elective clinic and operating volumes during the COVID-19 lockdown. National-level information confirmed clinic and elective operating volumes reduced to 38.2% and 11.5% of usual service volumes during April 2020. The return of service delivery volumes back to normal within two months supports the value of a COVID-19 elimination strategy in New Zealand. A 17.9-fold increase in the volume of non-contact/virtual visits allowed ongoing management without risking virus transmission for selected patients. At a personal level, the lockdown resulted in reported physical health benefits for ophthalmologists.
Addressing structural discrimination: prioritising people with mental health and addiction issues during the COVID-19 pandemic

Helen Lockett, Ashley Koning, Cameron Lacey, Susanna Every-Palmer, Kate M Scott, Ruth Cunningham, Tony Dowell, Linda Smith, Alison Masters, Arran Culver, Stephen Chambers

This paper resulted in people with mental health and addiction issues being recognised as a priority group for COVID-19 vaccinations. People with mental health and addiction issues have a significantly reduced life expectancy, much of which can be attributed to physical illnesses that, if recognised earlier and treated fairly, could have been mitigated. Structural discrimination worsens these physical health inequities. Structural discrimination is where the policies and practices of health care organisations impact unfairly on access to and quality of care. An expert advisory group, convened as part of the Aotearoa Equally Well collaborative, considered findings of a literature review on the vulnerability of people with mental health and addiction issues of contracting and dying from COVID-19. The group concluded mental health and addiction issues should be recognised as underlying health conditions that increase COVID-19 vulnerability, and that people with these issues should be prioritised for vaccination. The COVID-19 vaccination sequencing framework adopted the recommendations, placing people with mental health and addiction issues in vaccination group 2 or 3.

How were medical students from Christchurch, New Zealand, involved in their COVID-19 response?

Matthew J Cowie, Cicely V M Barron, Anna G Bergin, Noella N Farrell, India G Hansen

Medical students from the University of Otago, Christchurch School of Medicine were involved in their local COVID-19 response. A group of ten students helped with the assessment of individuals at community-based assessment centres or mobile testing units. They primarily helped assess and test individuals alongside experienced healthcare workers. The students gained valuable clinical and public health experience. Key learning points were the risks with pandemic involvement, identifying local barriers to healthcare and developing an appreciation for an evolving health response. Overall, students felt that preparation for future involvement could benefit further pandemic responses.

COVID-19 serology: use and interpretation in New Zealand

Gary N McAuliffe, Timothy K Blackmore

We describe how serology is used to test for COVID-19 infections in New Zealand and how the different available tests fit in with the body’s response to infection. We provide some guidance to interpretation of the different tests for New Zealand doctors.

Dangers of a single pellet

Jeong Ha, Olga Korduke, Megan Rodney, Peter Stiven

In this case study a patient presented to a rural New Zealand hospital with a shotgun wound to the thigh. Although selective non-operative management is described throughout the literature, this presents issues within the context of a rural hospital. It is uncommon for clinicians to encounter gunshot wounds in New Zealand. The decision to commence explorative surgery was made and perforation of the bowel from a stray pellet was found.
Bumper issue of COVID-19 pandemic studies of relevance to Aotearoa New Zealand

Nick Wilson, Jennifer A Summers, Leah Grout, Michael G Baker

ABSTRACT

In response to the COVID-19 pandemic, Aotearoa New Zealand adopted a clear ‘elimination strategy’, which has (up to June 2021) been very successful in both health and economic terms compared to other OECD countries. Nevertheless, the pandemic response has still been a very major shock to the New Zealand health system. This issue of the New Zealand Medical Journal has 14 new pandemic-related articles. Some of this work can help inform vaccination prioritisation decisions and inform preparations of primary and secondary care services and social services for any future raising of levels in the pandemic Alert Level system. Particularly strong themes are around the value (and challenges) of telehealth services, and also the need for responses throughout the health system to ensure health equity and support for the most vulnerable citizens.

As with a number of other jurisdictions in the Asia–Pacific region, New Zealand adopted tight border controls and other stringent public health and social measures (PHSMs) to control the COVID-19 pandemic. The country's clearly articulated COVID-19 ‘elimination strategy’ has been remarkably successful. Despite occasional border system failures that have caused outbreaks, the country has regained its elimination status after each instance (at least up to late June 2021).

Indeed, New Zealand has the lowest COVID-19 cumulative death rate in the OECD (data from the Worldometers website on 26 June 2021). It has also had the lowest level of ‘excess deaths’ among OECD countries and within a grouping of 29 high-income countries. Similarly, New Zealand was one of only a few high-income countries where life expectancy actually increased between 2018 and 2020, with pandemic-related reductions in the others.

New Zealand has also done better than the OECD average in terms of average changes in quarterly GDP (from Q1 2020 to Q1 2021 and with higher growth in the first quarter of 2021). It also had relatively lower increases in unemployment than the OECD average. Also, relative to other OECD countries, New Zealand topped a ‘normalcy index’ that assessed return to ‘pre-pandemic life’. However, a full and proper analysis of New Zealand's elimination strategy response to the COVID-19 pandemic will need to take account of a multi-year perspective. In particular, it will need to be done after COVID-19 vaccination coverage has stabilised in New Zealand and comparable OECD countries. Indeed, the country is still at risk of large outbreaks until it achieves high vaccination coverage (it was near the bottom of the OECD on 24 June 2021 for people fully vaccinated and equity goals were not being met).

The Government also needs to upgrade the outdated Alert Level system, integrate mass masking in a systematic manner and enhance border protections, along with other potential upgrades. There are of course numerous lessons for the future in terms of enhancing New Zealand’s pandemic response capabilities.

What are some of the health impacts of the pandemic response in New Zealand?

Much research relating to COVID-19 and New Zealand has already been reported, including the psychological distress associated with raised Alert Levels.
was also an increase in alcohol-related emergencies involving ambulance staff attendances in 2020, and increased smoking levels in some groups. Potential adverse impacts of increased COVID-19-related unemployment onto cardiovascular disease have been modelled. Publications have also considered equity issues around health service impacts, and the perspectives of Māori and Pasifika. Although it appears that cancer care services were disrupted by the pandemic response, this was relatively minor overall (e.g., “an 8% year-to-date decrease in radiation therapy attendances”). There was also “little evidence of differential impact of COVID-19 on access to cancer diagnosis and care between ethnic groups,” but for lung cancer there was a decrease in new diagnoses among Māori.

Identified benefits of the response included that the experience of the raised Alert Levels had positive psycho-social aspects for some people. There was also a reduction in 2020 in infectious respiratory diseases. These reductions in infectious diseases may have long-term implications for disease control (e.g., the value of staying at home when unwell and mask wearing on public transport in winter months).

What do the new studies in this Journal show?

The 14 new articles relating to COVID-19 in this issue of the New Zealand Medical Journal span epidemiology and public health (n=4), secondary care services (n=3), telehealth services (n=3) and various other COVID-19 issues (n=4) (see Table 1 for brief summary details). Particularly notable is the evidence for increased risk of hospitalisation from COVID-19 for Māori and Pasifika by Steyn et al. This work has immediate relevance with the current COVID-19 vaccine rollout, as does the article presenting the case for prioritising those with mental health and addiction issues by Lockett et al. Also of substantial current relevance is thinking around the importance of border controls by Eggleton et al. and the health and social support needed for low-income people if raised Alert Levels are required again (the work by Choi et al). The articles relating to secondary care provision can all provide lessons if New Zealand needs to go up levels in the COVID-19 response Alert Level system in response to outbreaks or the threat of outbreaks (Table 1). A particularly strong theme is around the expanded use of telehealth services, with this being the major theme for three articles and also considered in three others. The overall impression given is that telehealth services were very useful when Alert Levels were raised, albeit with various limitations and issues of concern raised (e.g., risk of increasing inequities). Some authors consider that increased routine use of telehealth in some areas of healthcare delivery may have long-term efficiency benefits. One study also includes qualitative data on the use of telehealth for contacting Māori patients through a marae clinic.

A notable feature of this body of new articles is that many consider aspects of equity in terms of ethnic or income inequities, those with chronic/underlying conditions, how government funding support for general practices was not consistently pro-equity during the response and whether telehealth in primary care exacerbates inequities. With regard to the latter, it might be that, for well-designed telehealth services (as argued for in one article), there could be long-term equity benefits if these new services can be used to reduce waiting times and improve service delivery to underserved communities. But to facilitate this, further improvements could be made to internet broadband and mobile phone access across the country (as per some of the difficulties identified in one study).

Conclusions

In response to the COVID-19 pandemic, Aotearoa New Zealand adopted a clear elimination strategy, which has (up to June 2021) been very successful in both health and economic terms compared to other OECD countries. Nevertheless, the pandemic response has still been a very major shock to the New Zealand health system. This issue of the Journal includes work that can help inform vaccination prioritisation decisions and preparations of primary and secondary care and social services for any future raising of levels in the Alert Level system. Particularly strong themes are around the value (and challenges) of telehealth services, and also the need for responses throughout the health system to ensure health equity and support for the most vulnerable citizens.
Table 1: New studies in this issue of this Journal on COVID-19 pandemic-related issues in Aotearoa New Zealand.

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<thead>
<tr>
<th>Topic and authors</th>
<th>Key findings</th>
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<tbody>
<tr>
<td><strong>Epidemiology and public health</strong></td>
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<tr>
<td>Risk of hospitalisation with COVID-19 in New Zealand (Steyn et al\textsuperscript{32})</td>
<td>This analysis of 1,829 COVID-19 cases in New Zealand reported that Māori had 2.5 times greater odds of hospitalisation and Pacific people 3 times greater odds than non-Māori, non-Pacific people (after controlling for age and pre-existing conditions). The authors concluded that “structural inequities and systemic racism in the healthcare system mean that Māori and Pacific communities face a much greater health burden from COVID-19. Older people and those with pre-existing health conditions are also at greater risk.” The authors state that these findings should inform future decisions around prioritisation for vaccination.</td>
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<tr>
<td>Prioritising people with mental health and addiction issues for vaccination (Lockett et al\textsuperscript{33})</td>
<td>This article reports on the work of an expert advisory group convened as part of the Aotearoa Equally Well collaborative. It found that “evidence indicates an association between mental health and addiction issues and infection risk and worse outcomes.” “The group concluded mental health and addiction issues should be recognised as underlying health conditions that increase COVID-19 vulnerability, and that people with these issues should be prioritised for vaccination.” The authors argue that “addressing these inequities must be integral in modern health policy—including our COVID-19 pandemic response.”</td>
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<tr>
<td>Views on border control and other control strategies (Eggleton et al\textsuperscript{34})</td>
<td>From three surveys of primary care practices, this study reported increasing support for “opening a trans-Tasman border but not internationally.” Two broad themes were for making sure that the border is not an Achilles heel and effective strategies to reduce local transmission. Sub-themes included community control, tracing and testing individuals and vaccinating population. An issue raised concerned the need to prevent pandemic spread from New Zealand: “Would be scared of NZ taking it into Pacific Islands after measles problems.”</td>
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<tr>
<td>Handwashing amenities in public toilets (Wilson and Thomson\textsuperscript{40})</td>
<td>This study concluded that “although handwashing is probably a much less critical COVID-19 control intervention than reducing aerosol transmission, it should still be strongly supported. Yet this survey found multiple deficiencies with handwashing amenities at public toilets and only modest improvements since a previous survey.”</td>
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### Table 1: New studies in this issue of this *Journal* on COVID-19 pandemic-related issues in Aotearoa New Zealand (continued).

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<td><strong>Secondary care</strong></td>
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<td>Impact of the raised Alert Levels on patients with Parkinson’s disease (PD) (Blake-more et al⁴¹)</td>
<td>This study surveyed 134 people with PD and 49 healthy controls, and reported that perceived stress was higher in PD patients than controls and “in those reporting a worsening of tremor, balance/gait, dyskinesia and bradykinesia compared to those indicating no change during the COVID-19 lockdown.” The authors conclude that “Reducing stressors may be an important adjunct treatment strategy to improve motor function in PD.”</td>
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<tr>
<td>Delivery of ophthalmology services and the raised Alert Levels (Scott et al⁴²)</td>
<td>This study surveyed ophthalmologists nationwide and found that a large majority of respondents (82% and 98% respectively) reduced elective clinic and surgical volumes by at least 75%. National-level information confirmed major reductions in clinics (down to 38.2% of normal) and elective operating volumes (down to 11.5%), with virtual visits increasing 18-fold. However, recovery was rapid with: “Elective clinic and elective operating volumes promptly recovered to usual volumes on the second month post lockdown.” In terms of telehealth, the authors note that “this form of service delivery may have a greater role in our overburdened public health system for the future.”</td>
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<td>Impact on a urology service from the raised Alert Levels (Lambracos et al⁴³)</td>
<td>This study detailed how the raised Alert Levels resulted in “an overall reduction in service delivery and a reorientation to non-contact outpatient consultations.” But this was “mitigated by proactive outsourcing of elective surgery to a private hospital and a dramatic shift to virtual consultations.” The authors report that this experience can inform crisis response management for the future but also the potential benefits of telehealth going forward: “Furthermore, with regard to the virtual consultation platform, the data also suggest ways in which our practice can be adapted on a routine basis in the future, in order to increase efficiency and to provide a service that is both economic to the patient and environmentally prudent.” A notable feature of this study was how the telehealth aspect was estimated to have saved “an average 22.7km of travel per patient,” with benefits for the environment, and out-of-pocket travel costs for patients.</td>
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<tr>
<td>Topic and authors</td>
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<td><strong>Experiences with telehealth (see also the articles on urology services and ophthalmology services in the two rows directly above, and the study by Choi et al in the next subsection below)</strong></td>
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<tr>
<td>Experiences with telehealth in primary care (Wilson et al(^36))</td>
<td>This study reported on nationwide surveys of New Zealand general practice teams. It reported that telehealth consultations were “most successful where there was a pre-existing relationship between healthcare provider and patient.” But various barriers identified included “technological challenges, communication difficulties for those with hearing impairments, concern regarding the cost and difficulty in making online payments.” The authors noted that the experiences described were “consistent with other international work showing that telehealth risks increasing inequity” (eg, “it can create extra barriers for those who are already disadvantaged, such as those in rural areas, those with hearing impairment or cognitive decline and refugee and migrant populations who may have language barriers”). Of note was that after the Alert Level restrictions there was a “rapid move back to in-person care and ‘business as usual’ was felt by the GP teams to be driven by patient choice. So while telehealth may play an increasing role in the future, it is unlikely to fully replace in-person care.” The authors provide a number of recommendations for improving the use of telehealth in primary care settings.</td>
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<td>A nurse practitioner-led telehealth programme for heart failure management (McLachlan et al(^37))</td>
<td>This study found that “for most patients, the home monitoring/telephone process resulted in rapid titration and less need for clinic review. Patients found the process acceptable and 60% of clinic visits were able to be held remotely, saving patients both time and money.” Titration rates and markers of improved outcomes improved across cardiac imaging, biochemical and clinical findings and were comparable to most real-world clinical reports.” The authors suggest that this simple and straightforward process could be replicated across District Health Boards.</td>
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<tr>
<td>Telehealth and ophthalmology (March de Ribot et al(^39))</td>
<td>This article considers some of the international literature around ‘teleophthalmology’ and the New Zealand situation with respect to service demand and the impact of the raised Alert Levels. The authors argue the case that teleophthalmology could improve the referral process, and if teleophthalmology is properly implemented, they anticipate “a 40% decrease in the number of referrals to public ophthalmology services in New Zealand, which would improve the workflow in ophthalmology departments of public hospitals by about 20%.” Limitations such as cost are discussed but overall the authors argue that “now is the moment to implement innovations so as not to leave anyone behind.”</td>
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Table 1: New studies in this issue of this Journal on COVID-19 pandemic-related issues in Aotearoa New Zealand (continued).

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<td><strong>Other</strong></td>
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<tr>
<td>A qualitative study of low-income New Zealanders’ experiences with raised Alert Levels (Choi et al35)</td>
<td>This qualitative study used 27 interviews with low-income people in June–July 2020 (immediately after ‘lockdown’ was lifted). It reported that life during lockdown was challenging for study participants. “They were fearful of the virus and experienced mental distress and isolation. Most participants felt safe at home and reported coping financially while still experiencing financial stress. Participants were resourceful and resilient. They coped with lockdown by using technology, self-help techniques and support from others.” The study found that, although participants had access to health services and welfare payments, “welfare payments did not fully meet participants’ needs, and support from charitable organisations was critical.” Nevertheless, participants were “overwhelmingly positive about the Government’s response and advised the Government to take the same approach in the future.” The study authors concluded that “An early and hard lockdown, the welfare state, compassion and clearly communicated leadership were keys to a successful lockdown for the low-income people in this study.” They also note that capturing the experience of low-income people during pandemics “is critical to ensuring inequities in pandemic impact are mitigated.”</td>
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<td>Ministry of Health (MOH) funding of general practices (Selak et al38)</td>
<td>This study reported that initial emergency financial support in March 2020 for general practices was higher for those with more high-needs patients. But this was not the case for the funding in April 2020. The authors argue that “in the future, the MOH should apply pro-equity resource allocation in all emergencies, as with other circumstances.” The article provides valuable context in terms of the inequitable burden of COVID-19 according to ethnicity and also evidence for the wider problem of inadequate New Zealand Government funding of health services according to need.</td>
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<td>Review of COVID-19 serology in the New Zealand context (McAuliffe and Blackmore44)</td>
<td>This article provides a review of the use of COVID-19 serology in the New Zealand context. “Testing may provide useful information in public health investigations or select cases of post-infectious complications and is necessary for overseas travel to some destinations.” But the authors note that “test reliability varies substantially according to the testing scenario.” Importantly they note that “the role of post-vaccination serology testing as a correlate of immunity has not yet been determined,” and make an argument for clinical microbiologist advice for interpretation in “high-consequence cases.”</td>
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<td>Medical student contribution to the COVID-19 response (Cowie et al45)</td>
<td>This article describes how a group of New Zealand medical students were involved in a local COVID-19 response. It identified both the helpful contribution the students made to the response, alongside the “valuable clinical and public health experience” gained. They reported that “we found our involvement rewarding, whether it was on the frontline or not, and the level of risk balanced well with learning opportunities.” Home visits for COVID-19 testing were also considered valuable from a learning perspective: “These visits let us view living situations from the centre of a patient’s home. This left a lasting impact on many of us and cemented a strong reminder of how risk factors and living conditions can impact upon health.”</td>
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Competing interests:
One of these 14 COVID-19 related articles described here involved the first author of this Editorial (ie, the survey by Wilson and Thomson). He is also the sibling of the third author in the survey by Scott et al. The last author of this editorial was also a contributor to the article by Choi et al.

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REFERENCES


Deficient handwashing amenities in public toilets in the time of the COVID-19 pandemic: a multi-regional survey

Nick Wilson, George Thomson

ABSTRACT

AIMS: To identify the extent of the provision of handwashing amenities in public toilets at the time of the COVID-19 pandemic, and also to make comparisons with a related pre-pandemic survey.

METHODS: We collected data from 400 toilet facilities that were open to the public: all those in three contiguous city council territories (228) and a further convenience sample of 172 around other parts of New Zealand. Comparisons were made with the data on the same facilities included in a 2012/2013 survey.

RESULTS: Of the toilets in this survey, 2.5% had no water for handwashing and 14.8% had no soap. There was COVID-19-related health messaging signage in 19.5% of toilets, with posters of the COVID-19 QR code used for contact tracing in 12.3%, and generic handwashing signage in 1.8%. The handwashing water had ‘no-touch’ activation at 28.0% of toilets, and 18.5% of toilets had no-touch bowl flushing. Toilet bowl lids were not present at 32.8%, and 2.3% of toilets had damage that would impair their functionality (eg, broken toilet seats). This new survey found significantly increased provision of soap (risk ratio = 1.47; 95%CI: 1.25 to 1.72), but no increased provision of water, at the 128 sites that had also been examined in the previous survey.

CONCLUSIONS: Although handwashing is probably a much less critical COVID-19 control intervention than reducing aerosol transmission, it should still be strongly supported. Yet this survey found multiple deficiencies with handwashing amenities at public toilets and only modest improvements since a previous survey.

The COVID-19 pandemic has focused international attention on non-pharmaceutical interventions to reduce pandemic spread prior to vaccination roll-out. These interventions include hygiene practices such as appropriate handwashing, which is an evidence-based measure for preventing respiratory virus transmission. More specifically, the World Health Organization (WHO) has issued guidance on COVID-19 and hygiene/sanitation, which covers the need for handwashing amenities with water and soap.

The COVID-19 pandemic virus (SARS-CoV-2) appears to survive much longer on human skin than influenza A virus. Expert commentary has recommended handwashing for COVID-19 control, even though the current evidence indicates that the role of contaminated surfaces in transmission is likely to be small when compared to the inhalation route of transmission. In public toilets, which are often unheated and where the surfaces are generally impermeable, cooler temperatures and surfaces more retentive to coronavirus may increase the role of contaminated surfaces in transmission compared to other living and working situations.

Improved hygiene is also beneficial for reducing the spread of other respiratory viruses such as seasonal influenza and norovirus infection. For example, one review identified six studies that implicated...
bathroom surfaces as primary sources of human norovirus infection.\(^7\)

WHO also recommends having separate toilets “for people with suspected or confirmed SARS-CoV-2 infection” and that “the toilet should be flushed with the lid down to prevent droplet splatter and aerosol clouds.”\(^8\) The latter recommendation is supported by data from a COVID-19 quarantine room study, which found that “the inner walls of toilet bowl and sewer inlet were the most contaminated sites with the highest viral loads.”\(^8\) Another such study reported that “there was extensive environmental contamination by 1 SARS-CoV-2 patient,” with toilet bowl and sink samples being positive for viral RNA.\(^9\) A study using genomic sequencing also implicated exposure to sewage as a risk factor for SARS-CoV-2 infection.\(^10\) There has also been one study indicating circumstantial evidence of faecal aerosol transmission of COVID-19 via an apartment drainage system,\(^11\) similar to an outbreak from faecal aerosols of SARS-CoV-1 in 2003.\(^12\)

In New Zealand, there was community spread of the pandemic virus (SARS-CoV-2) on a number of occasions during the 2020 year, but elimination was successfully achieved and re-achieved after a series of border control failures.\(^13\),\(^14\) These successes arose largely from a combination of tight border controls (quarantine and isolation), a strict lockdown and widespread testing/contact tracing. Actions related to hygiene included:

- mass media messages relating to handwashing, cough etiquette, staying home when sick and mask use.
- actions by organisations to install hand sanitisers and posters with hygiene messaging in workplaces and various public places
- public toilets were all closed at the highest lockdown level
- actions by some local government agencies to increase soap availability in the public toilets they maintain (eg, Napier City Council\(^15\)) and to include posters with hygiene messaging in these facilities.

Given the latter point on public toilets, the aim of this study was to identify the provision of water and soap for handwashing (along with related health messaging) in New Zealand public toilets at the time of the COVID-19 pandemic. We also aimed to report on other toilet features relevant to hygiene and COVID-19 transmission, and to make comparisons with a pre-pandemic survey\(^16\) that included a sample of the same facilities.

By way of context, New Zealand has previously reported shortages of public toilets, especially in areas with high numbers of international tourists.\(^17\),\(^18\) Previous research has also shown deficiencies with public toilets in the country, in terms of lacking handwashing water (4%) and soap (39%).\(^16\),\(^19\) Another study of toilets in one New Zealand city (mainly at cafés and public facilities) found that some had no handwashing facilities (2%) and no soap (13%).\(^20\) Within this sample, the lack of soap was highest in the public toilets, at 38%. Another study of primary school toilets also reported that only 28% had facilities meeting the relevant code of practice (eg, there was a lack of hot water, lack of drying facilities and lack of soap).\(^21\) Inadequate hand hygiene has also been recorded, with public toilet users in New Zealand sometimes not washing hands (13%) or using soap (28%).\(^22\)

In New Zealand there are a range of public toilet types. These include both unisex and/or single-sex facilities (male and/or female). Unisex facilities contain a toilet bowl and usually handwashing amenities, and less frequently a urinal. Single-sex toilet facilities can contain separate cubicles (with toilet bowls, and sometimes with their own handwashing amenities) and, typically, common handwashing amenities. Male toilet facilities usually include urinals.

### Methods

#### Definitions

A ‘toilet facility’ was the sampling unit in this study. We defined this as where there was an opening door from the outside world to a discrete toilet area (ie, a ‘male toilet’, a ‘female toilet’, a ‘unisex toilet’ or a ‘urinal-only toilet’). In some situations there could be multiple toilet facilities that make up a ‘toilet complex’. A ‘toilet complex’ was defined as where there was at least one toilet facility or multiple facilities, either in the same connected structure or within five metres of each other (eg, a male toilet and a female toilet, or two or more unisex toilets).
A ‘toilet cubicle’ was defined as the enclosed area with a toilet bowl and a lockable door.

Survey sampling
We attempted to include all the public toilet facilities in three contiguous cities (the ‘three council area survey’) with a combined population of 389,000 (Wellington City, Hutt City and Porirua City). We conducted additional convenience sampling in cities and rural areas, based on author travel plans for other reasons around New Zealand from 18 July 2020 to 2 January 2021. This sampling was for only toilets that could be accessed within those plans and was not of all toilets in any convenience sample local authority area. We expanded the sample to a total of 400 toilets, which we estimated would be at least 10% of the facilities nationwide. But we also aimed to replicate a previous survey of amenities in public toilets in the lower North Island in 2012/2013. The public toilets were located by:

- using online city council maps of public toilets, for the three council area survey
- using Google Maps to locate a city/town/district, and then searching for ‘public toilets’ in the map
- using the smartphone app version of CamperMate
- watching for roadside public toilet signs when travelling by car.

The sample excluded temporary toilets, portable toilets and public toilets that were not directly open to the outside (ie, which were inside of other buildings, such as shopping complexes, council-owned buildings (eg, libraries) and railway or ferry buildings, some of which were signed as for ‘patrons only’). Where toilet facilities were closed or were being cleaned, we attempted repeat visits where this was convenient.

Data collection
At each toilet complex, we surveyed all the male and unisex toilet facilities. Data were collected on the availability of water and soap for handwashing either in the toilet cubicles or toilet facility. ‘Soap’ included liquid, foam and cake forms, and we aimed to separately identify alternatives (eg, alcohol gel). Toilets with only empty soap containers were counted as without soap. We also photographed all health-related signage (eg, relating to COVID-19 and handwashing).

Requirements for touching (or not touching) taps/buttons/levers that activated tap water and flushed the toilet were noted. The presence of lids for toilet bowls was documented, given concerns around potential virus dispersion when flushing when the lid is not down (see the introduction).

Analysis
We compared the results of the three council area survey with the supplementary convenience sample. Comparisons were also made with the exact same facilities involved in the previous survey conducted in 2012/2013 (albeit excluding the 14.7% (22/150) that were not readily accessible or that had subsequently been closed down). Statistical analysis used OpenEpi (v 3.01) and Mid-P exact values were calculated (2-tailed).

National denominator estimation
To provide context for our survey, we estimated the total number of public toilet complexes in New Zealand using the following steps:

- For city-based local authorities, we used as a basis the facilities we surveyed in the three council area survey (n=131 or 3.4 per 10,000 population).
- For the other local authorities (LAs), we used data from Google Maps in three LAs in the Wairarapa region (n=13 facilities) and scaled from our estimate of the sensitivity of such data on Google Maps from the three council area survey (at 61.8% or 81/131, giving a scaling factor of 1.62). This gave 21 complexes, or 4.3 per 10,000 population.
- We then extrapolated the three council area survey results to the 12 other city LAs in New Zealand, and we extrapolated the Wairarapa results to the other 51 LAs that were council districts.

Results
Survey results for 2020/21
Data could not be collected at seven toilet complexes in the three council area survey that we intended to be complete, due to closure for repairs and/or being padlocked shut—the latter finding suggestive that these locked toilet complexes were only opened for specific sporting events.
Our total survey comprised 400 toilet facilities at 242 toilet complexes. The distribution of these 400 facilities spanned major urban areas (49% of the sample), other urban areas (40%) and small town and rural areas (11%) (Table 1). Most of the city councils in the country were included in the sampling (62%), but only 26% of the district councils were included. We estimated that the total number of such toilet complexes nationwide was around 1,104 in city councils and 760 in district councils (ie, around 1,864 in the whole country, or 3.7 per 10,000 population). So, our sample was estimated at 13.0% of the estimated total (242/1,864), which was greater than our target of a 10% sample.

Our estimate of the total number is slightly higher than an OpenStreetMap estimate of 1,740 in 2016.

Most of the sample of 400 toilet facilities were from the survey of three contiguous city councils (n=228), relative to the additional convenience sample (n=172). The former group consisted of toilet facilities that were all in the lower North Island, more likely to be in major urban areas and more likely to be unisex (vs male toilets) (Table 1).

The proportion of all the 400 toilet facilities without water for handwashing was 2.5%, with this being higher in the convenience sample than the three council area survey sample (5.2% vs 0.4%; risk ratio (RR)=11.9; 95%CI=1.53 to 93.3; p=0.0030). None of the toilets without running water had any other methods of hand sanitation (eg, alcohol gel) that could replace use of soap with water. Absence of soap was 14.8% overall, and this absence was also higher in the convenience sample vs the three council area survey sample (21.5% vs 9.6%; RR=2.23; 95%CI=1.37 to 3.64; p=0.0011). Most soap was dispensed as a liquid or foam (Supplementary File 1, Figure S1-3), but at 6.0% of toilets it was available in a cake/bar form. A number of toilets had containers for liquid soap that were empty (Table 1).

‘No-touch’ activation was available for handwashing water at 28.0% of facilities, for toilet bowl flushing at 18.5% and for urinal flushing at 80.5%. Toilet bowl lids were not present for 32.8% (many were designed or built this way) (Supplementary File 3, Figure S3-1), and 2.3% of toilets had damage that would impair their functionality (eg, Supplementary File 3: broken toilet seats, Figure S3-1; broken toilet rolls, Figure S3-2; destroyed liquid soap dispensers, Figure S3-3).

The majority of toilets had no health-related signage (72.8%). Out of those with signage, some form of COVID-19-related health messaging was the most common type (19.5%), followed by the NZ COVID Tracer App QR code used to facilitate contact tracing (12.3%), generic handwashing signage (1.8%) and then non-smoking signage (1.3%) (see Supplementary File 2 for examples of these posters). Signs with COVID-19 health messaging were more common in the convenience sample than in the three council area survey sample (RR=1.81; 95%CI=1.21 to 2.71; p=0.0040). There was no signage that promoted toilet lid lowering prior to flushing.

From a qualitative perspective, we noted that several COVID-19 signs in tourist areas were in Chinese language (Supplementary File 2, Figure S2-1), and a few handwashing signs included te reo Māori (Supplementary File 2, Figure S2-3). We also noted that some automatic water and soap dispensers took some time to activate and then dispensed too little soap or too little water for a satisfactory handwash (ie, repeat activation was required).

**Comparing survey results for 2020/21 with 2012/13**

The comparison of the exact same toilet facilities involved in the previous survey in 2012/13 is shown in Table 2. There was no improvement in the availability of water for handwashing, but soap availability improved significantly from 59% to 86% (RR=1.47; 95%CI: 1.25 to 1.72; p<0.000001).

**Discussion**

**Main findings**

This survey found a deficient provision of both soap (14.8% of toilet facilities with none) and, to a lesser extent, water (2.5% with none). These findings suggest that although there has been a statistically significant improvement in soap provision (but not water provision) in the eight-year period since the previous survey, the attempts by some local government agencies to increase soap provision at the time of the COVID-19 pandemic need to be further augmented.
### Table 1: Full results for the 2020/2021 survey of public toilet facilities in New Zealand (n=400 surveyed), showing column percentages.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Attempted complete sample of three city LAs (n=228 unless indicated otherwise)</th>
<th>Additional convenience sample (n=172 unless indicated otherwise)</th>
<th>Total (n=400)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Type, location</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toilet complexes (ie, some with multiple toilet facilities)</td>
<td>131</td>
<td>–</td>
<td>111</td>
<td>–</td>
</tr>
<tr>
<td>Male toilet facility</td>
<td>44</td>
<td>19.3%</td>
<td>65</td>
<td>37.8%</td>
</tr>
<tr>
<td>Unisex toilet facility</td>
<td>184</td>
<td>80.7%</td>
<td>107</td>
<td>62.2%</td>
</tr>
<tr>
<td>Toilet facilities in the North Island</td>
<td>228</td>
<td>100.0%</td>
<td>126</td>
<td>73.3%</td>
</tr>
<tr>
<td>In the South Island</td>
<td>0</td>
<td>0.0%</td>
<td>46</td>
<td>26.7%</td>
</tr>
<tr>
<td>In a city council territory</td>
<td>228</td>
<td>100.0%</td>
<td>40</td>
<td>23.3%</td>
</tr>
<tr>
<td>In a district council territory</td>
<td>0</td>
<td>0.0%</td>
<td>132</td>
<td>76.7%</td>
</tr>
<tr>
<td>In a major urban areas (100,000+ population) *</td>
<td>185</td>
<td>81.1%</td>
<td>9</td>
<td>5.2%</td>
</tr>
<tr>
<td>In a small, medium or large urban areas (1,000 to 99,999 population) *</td>
<td>38</td>
<td>16.7%</td>
<td>123</td>
<td>71.5%</td>
</tr>
<tr>
<td>In a small town or rural area (&lt;1,000 population) *</td>
<td>5</td>
<td>2.2%</td>
<td>40</td>
<td>23.3%</td>
</tr>
<tr>
<td>Water for handwashing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water not available</td>
<td>1</td>
<td>0.4%</td>
<td>9</td>
<td>5.2%</td>
</tr>
<tr>
<td>Automatic, no-touch water delivery</td>
<td>104</td>
<td>45.6%</td>
<td>8</td>
<td>4.7%</td>
</tr>
<tr>
<td>Lever mechanism for tap</td>
<td>5</td>
<td>2.2%</td>
<td>11</td>
<td>6.4%</td>
</tr>
</tbody>
</table>
Table 1: Full results for the 2020/2021 survey of public toilet facilities in New Zealand (n=400 surveyed), showing column percentages (continued).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Attempted complete sample of three city LAs (n=228 unless indicated otherwise)</th>
<th>Additional convenience sample (n=172 unless indicated otherwise)</th>
<th>Total (n=400)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Soap</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not available</td>
<td>22</td>
<td>9.6%</td>
<td>37</td>
<td>21.5%</td>
</tr>
<tr>
<td>Dispenser not working / empty</td>
<td>12</td>
<td>5.3%</td>
<td>3</td>
<td>1.7%</td>
</tr>
<tr>
<td>Bar/cake soap only</td>
<td>0</td>
<td>0.0%</td>
<td>24</td>
<td>14.0%</td>
</tr>
<tr>
<td>Toilet bowls</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automatic flushing (no need to use a button or lever)</td>
<td>58/226</td>
<td>25.7%</td>
<td>14/163</td>
<td>8.6%</td>
</tr>
<tr>
<td>Lid missing</td>
<td>78/240</td>
<td>32.5%</td>
<td>68/205</td>
<td>33.2%</td>
</tr>
<tr>
<td>Urinal flushing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automatic flushing</td>
<td>52/55</td>
<td>94.5%</td>
<td>43/63</td>
<td>68.3%</td>
</tr>
<tr>
<td>Notable facility damage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Damage</td>
<td>6</td>
<td>2.6%</td>
<td>3</td>
<td>1.7%</td>
</tr>
<tr>
<td>Health-related signage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any COVID-19-related behavioural messaging</td>
<td>33</td>
<td>14.5%</td>
<td>45</td>
<td>26.2%</td>
</tr>
<tr>
<td>Any COVID-19 QR code signage</td>
<td>27</td>
<td>11.8%</td>
<td>22</td>
<td>12.8%</td>
</tr>
<tr>
<td>Any handwashing signage</td>
<td>7</td>
<td>3.1%</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Any non-smoking signage</td>
<td>2</td>
<td>0.9%</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>No health-related signage</td>
<td>175</td>
<td>76.8%</td>
<td>116</td>
<td>67.4%</td>
</tr>
</tbody>
</table>

* Using the New Zealand Statistical Standard for Geographic Areas 2018.

** Damage included broken seats, a toilet bowl lid with a hole, soap dispenser container remnants, the light not working and a toilet roll holder on the ground.
The higher absence of water (5.2% vs 0.4%) and soap provision (21.5% vs 9.6%) in the convenience sample versus the three council area survey sample is likely to reflect the more modern amenities in the latter and/or a higher-quality maintenance schedule. As New Zealand is highly urbanised, we suspect that the true nationwide results would be closer to those of the three council area survey than the convenience sample ones. However, as provincial and rural areas have a proportionately greater number of domestic and international tourists in comparison to the resident population, which has a greater impact on public toilets, there appears to be a further and continued long-term need for central government investment in, and regulation of, rural and small-town toilets. The consistent need for a high or very high prioritisation of toilet infrastructure for tourists across rural regions and roads indicates a large backlog of investment.

The relatively low level of health-related signage, especially COVID-19-related health messaging (only 19.5%), NZ COVID Tracer App QR code signage (only 12.3%) and generic handwashing signage (only 1.8%), was a problematic finding for health promotion and disease control. These deficits are likely to represent both a long-term lack of public signage relating to handwashing and an inadequate response to the COVID-19 threat.

Also of note from a hygiene perspective was the limited extent of no-touch activation of devices (i.e., for handwashing water at 28.0% and for toilet bowl flushing at 18.5%). These should ideally be expanded with the potential long-term goal being to have maximally no-touch amenities (including automated door opening and locking via hand waving in front of a sensor; no-touch water and soap dispensing; and no-touch toilet flushing and hand-drier activation). Automation could extend to the toilet bowl lid being closed before flushing.

Ensuring that all toilet bowls have lids (missing for 32.8% in this survey, often by design) is also desirable, along with messaging to close the lids prior to flushing (see the introduction for the rationale for lid closing).

**Study strengths and limitations**

This is the largest such survey to date in New Zealand that we know of, and it was able to compare a sub-sample of the same toilet facilities after an eight-year period. It was also conducted at a time when there was heightened need for hygiene, due to the COVID-19 pandemic.

Nevertheless, the study was limited by only attempting to be complete in three contiguous council areas, with the rest being convenience sampling. This was owing to this being an unfunded study with no budget for travel. The convenience sampling is likely to have involved surveying facilities that were more accessible to the researchers by being on or near main roads. These may be relatively newer and have a better maintenance schedule than facilities in small rural towns. This may have resulted in some under-estimation from the convenience sample of the extent of the problems outside urban areas (e.g., with water and soap availability).

The study was also limited to male and unisex toilets. Internationally, there are indications that the quality of public toilet facilities for females may be poorer. The limitation may have had implications for the surveyed quality of facilities, especially for small town and rural areas, which had a smaller proportion of unisex toilets.

**Table 2:** Comparison of the same public toilet facilities in the two surveys (not including those demolished or closed at the time of the second survey; all facilities were in the lower North Island).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Previous survey in 2012/13(16)</th>
<th>This survey in 2020/21</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Water available for handwashing</td>
<td>123/128</td>
<td>96.1%</td>
<td>123/128</td>
</tr>
<tr>
<td>Soap available**</td>
<td>75/128</td>
<td>58.6%</td>
<td>110/128</td>
</tr>
</tbody>
</table>

* If a toilet complex had changed in the number of toilet facilities (e.g., expanded from two to three unisex facilities), we only compared the exact same number of facilities as in the original survey.

** In liquid, foam or bar/cake forms.
Potential research and policy implications

A fundamental research issue is to better quantify the risks of infectious disease transmission associated with use of public toilets (eg, from any aerosolisation of faeces and from touching contaminated surfaces). This is not only relevant to SARS-CoV-2 but also other infectious diseases (eg, norovirus infection and seasonal influenza).

Nevertheless, surveys such as this could be improved by being made fully random at the national level and collecting additional data on the facilities to compare them with local standards (eg, as per New Zealand ones, albeit from 1999) or more state-of-the-art Japanese designs. We suggest that regular (at least five yearly) nationwide surveys funded by the central government are needed to better establish the health and other risks, and as a way to audit compliance with current and future regulations. Research on ways to minimise the vandalism of public toilets is also needed, as in the past this has been reported as a barrier to using soap dispensers in New Zealand. Artwork inside toilets and on exterior walls is used in some New Zealand toilets (Supplementary File 1, Figure S1-1) and might be worth expanding if it is found to be effective against vandalism.

Some toilets are still without basic elements of hygiene. Policy goals for local government could be to ensure all facilities have water and soap, and to move towards designs that are maximally no-touch. Built-in redundancy (eg, two separate soap dispensers) may be desirable to minimise the risk of running out of soap, and cakes of soap should probably be avoided as these are more vulnerable to theft. If fully-automated taps are not installed, then tap levers or floor pedals for activating water flow could be an alternative. Levers allow users to use the back of their hands and can also be more suited than conventional taps for people with disabilities such as arthritis.

Central government could set and better enforce minimum standards for council-owned public toilet facilities and the extent of their provision. Currently, local government authorities largely regulate the quality of their own toilet facilities, although theoretically District Health Boards could use their powers under the Health Act 1956 to ensure that unhealthy facilities are improved. A possible way to ensure mandated national standards are established, monitored and maintained is through the central government’s current Three Waters Reform Programme. The underlying principles for standards of public toilet quality and provision have been discussed in a United Nations report, and the World Bank has reported on design, operation, management and regulatory guidelines.

Part of the required role for local authorities in communicable disease control could be regulations on the presence of standard health messages and signage in relevant public facilities, to help address the major deficit that we found. New Zealand’s national-level legislation requiring smokefree signs (eg, on school grounds) is an example that could be followed.

Central government could also boost funding support for the provision and quality of toilets, at least partly from border charges collected from international tourists (a funding system already in place in New Zealand). The extent of the funding needed should be seen in the context of the huge costs of COVID-19 and future pandemics, and from other respiratory viruses such as seasonal influenza and from norovirus infection.

Conclusions

To conclude, despite the serious threat and great costs of the COVID-19 pandemic, and although there has been some improvement in soap provision in the eight-year period since the previous survey, attempts by some local government agencies to increase such provisions need to be further augmented. There are also other design and maintenance deficiencies that would improve hygiene in public toilets. There is a major scope for improving health messaging at these sites, and this might be a quick, low-cost intervention to assist pandemic control in any future outbreaks.

Supplementary files

- View Supplementary File 1.
- View Supplementary File 2.
- View Supplementary File 3.
Competing interests:
Nil.

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Māori and Pacific people in New Zealand have a higher risk of hospitalisation for COVID-19

Nicholas Steyn, Rachelle N Binny, Kate Hannah, Shaun C Hendy, Alex James, Audrey Lustig, Kannan Ridings, Michael J Plank, Andrew Sporle

ABSTRACT

AIMS: We aim to quantify differences in clinical outcomes from COVID-19 infection in Aotearoa New Zealand by ethnicity and with a focus on risk of hospitalisation.

METHODS: We used data on age, ethnicity, deprivation index, pre-existing health conditions and clinical outcomes on 1,829 COVID-19 cases reported in New Zealand. We used a logistic regression model to calculate odds ratios for the risk of hospitalisation by ethnicity. We also considered length of hospital stay and risk of fatality.

RESULTS: After controlling for age and pre-existing conditions, we found that Māori have 2.50 times greater odds of hospitalisation (95% CI 1.39–4.51) than non-Māori non-Pacific people. Pacific people have three times greater odds (95% CI 1.75–5.33).

CONCLUSIONS: Structural inequities and systemic racism in the healthcare system mean that Māori and Pacific communities face a much greater health burden from COVID-19. Older people and those with pre-existing health conditions are also at greater risk. This should inform future policy decisions including prioritising groups for vaccination.

Up to 25 September 2020, New Zealand had reported 1,829 confirmed and probable cases of COVID-19, a disease caused by a novel coronavirus originating in Wuhan, China. The majority of these cases were associated with one of two outbreaks of sustained community transmission: the first in March/April 2020 and the second in August/September 2020. Up to 22 May 2020, there were 1,504 confirmed and probable cases, of which 573 had a recent history of international travel. Between 22 May and 11 August, there were 65 reported cases, all of which were detected in international arrivals and contained in government-managed isolation facilities. Between 11 August and 25 September, 260 cases were reported, with the majority linked to a large cluster in Auckland.

The August/September cluster differed substantially from the initial outbreak in March/April 2020. The vast majority of cases resulted from workplace, community, public transport and household transmission, rather than being associated with international travel. The August cluster had a higher proportion of cases in under-20-year-olds and a lower proportion of cases in over-60-year-olds than the earlier outbreak (Figure 1). It also contained a much higher proportion of cases among the Pacific and Māori populations than the first outbreak. Multigenerational living is proportionately greater in Pacific peoples as a population, but the lack of high-quality suitable housing means that their homes are often overcrowded. Pacific people also experience poorer access to healthcare and are at a greater risk of clinically severe outcomes from COVID-19 infection.

Historically, Māori and Pacific communities both in New Zealand and in the Pacific have had worse experiences of pandemics. During the 2009 H1N1 influenza pandemic,
the rate of infection for Māori was twice that for Pākehā and more severe. Our recent research estimated similar inequities would occur in the infection fatality rate for COVID-19. New Zealand’s effective public health response to the pandemic limited the number of COVID-19 fatalities during 2020 to 25, which corresponds to a fatality rate of five deaths per million people. This means that there are insufficient empirical data at present to reliably estimate differences in the infection fatality rate by ethnicity. Here, we aim to determine whether there are significant differences by ethnicity in the risk of clinically severe outcomes from COVID-19, measured by the hospitalisation rate and length of hospital stay. We take a data-driven approach by using information that is routinely collected for all cases of COVID-19 in New Zealand. The available data are imperfect, and the number of cases is relatively small, but they are nonetheless the best data currently available to understand differences in risk from infection of COVID-19 between ethnicities in New Zealand. The results are important for future policy decisions and pandemic planning: for example, identification of priority groups for vaccination against COVID-19.

**Methods**

We developed three separate risk models to quantify the risk of hospitalisation, length of hospital stay and fatality risk. Each model used the same methodology and set of predictor variables.

**Data**

Case data was obtained from the EpiSurv database on all 1,829 confirmed and probable cases.

**Figure 1:** Age–ethnicity structure of New Zealand’s two major outbreaks of COVID-19 using prioritised ethnicity. The plots on the right give the number of cases per 1,000 people in that age–ethnicity grouping. Population data from Census 2018.
cases of COVID-19 reported in New Zealand up to 25 September 2020. EpiSurv is New Zealand’s national notifiable disease surveillance database, operated by Environmental Science and Research (ESR) on behalf of the Ministry of Health.\(^8\) EpiSurv collates notifiable disease information, including case demographics, clinical features and risk factors, in real time. The data for COVID-19 cases include hospitalisation status and dates, clinical outcome (eg, recovered, death), age, sex, presence/absence of several underlying health conditions (see next paragraph), Stats NZ NZ meshblock of current home address and self-reported ethnicity (Table 1). Ethnicity information in EpiSurv is collected on the standard COVID-19 case report form,\(^9\) where it is described as ‘core surveillance data’.

The responses are then prioritised to a single response using the Ministry of Health’s Ethnicity Data Protocols.\(^10\) The ethnicity information in the Ministry of Health sourced data includes multiple ethnicity fields sourced by linking EpiSurv data to the National Health Index (NHI) data collection.

The data on underlying health conditions were simplified into a binary variable indicating whether the individual had at least one of the following conditions: chronic lung disease, cardiovascular disease, diabetes, immunodeficiency, asthma or malignancy. These conditions were chosen because they are all recorded in the EpiSurv dataset\(^8\) and are known to be associated with increased risk of COVID-19 hospitalisation.\(^11\) We did not consider the effects of multiple underlying health conditions, due to the limitations of analysing such small numbers (see section Discussion for the associated limitations). Of the 1,829 cases, 269 cases (14.7%) had one of the above conditions recorded; 55 cases (3.0%) had two conditions recorded; four cases (0.2%) had three conditions recorded; and two cases (0.1%) had four conditions recorded.

The meshblock numbers of residential addresses were used to allocate a measure of geographic and socioeconomic deprivation, based on the New Zealand Index of Deprivation (NZDep18).\(^12\) This was not available for 34 cases, so any models that include deprivation index had a sample size of 1,795 cases and 114 hospitalisations.

Total ethnicity data were used to assign individuals into one or more of the following groups: Māori, Pacific, Asian, NZ European/Other. Due to the limitations of analysing small numbers of cases and to avoid overfitting, individuals whose ethnicity was recorded as Middle Eastern/Latin American/African (n=49 cases, 1 hospitalisation) or Other (n=5 cases, 1 hospitalisation) were assigned to the NZ European/Other ethnicity group. Individuals for whom total ethnicity data was missing (n=29 cases, 1 hospitalisation) were assigned to the ethnicity recorded in the ‘prioritised ethnicity’ field in EpiSurv. Of the 29 cases with missing total ethnicity data, prioritised ethnicity was recorded as Māori for one case, Pacific for two cases, Asian for 11 cases and NZ European/Other for 15 cases. Of all 1,829 cases, 1,719 (94%) had a single ethnicity recorded, 102 (5.6%) had two ethnicities recorded and eight (0.4%) had three ethnicities recorded. A breakdown of the number of cases in the data set by ethnicities is shown in Appendix Table 1.

Of the 120 hospitalised cases, only 102 had listed discharge dates, which were required for analysis on the length of hospital stay. Five of the 18 cases without discharge dates resulted in death, so their discharge dates were set to the date of death. The remaining 13 cases (two who had not recovered by 25 September 2020 and 11 with no discharge date recorded) were excluded from the length of stay analysis. One additional case was excluded because the discharge date recorded was prior to the hospitalisation date. This resulted in a sample of 106 cases with a recorded length of stay in hospital (Figure 2). Of the 14 excluded cases, seven (50%) were Pacific people, despite Pacific people only making up 18% of hospitalisations. This reduced the sample size for Pacific people and likely biased the results.

**Model selection**

For each of the three models, we carried out a simple analysis to determine which predictor variables to include in the model. We used a logistic regression to determine which of ethnicity, underlying health conditions, sex, age and deprivation index should be included. We used Akaike information criterion (AIC) and the area under the receiver operating characteristic curve (AUC) for model selection. Using AIC is a standard, likelihood-based procedure for model selection that quantifies how parsi-
Table 1: Summary of case data. Deprivation index was used in its raw index form in the model but has been presented as quintiles for ease of interpretation, with the 1st quintile representing those that reside in a meshblock with the lowest socioeconomic deprivation and the 5th quintile the highest deprivation. Age is also presented in discretised brackets. The use of total ethnicity data means sums over these rows will be greater than the totals where some cases are recorded as having multiple ethnicities.

<table>
<thead>
<tr>
<th></th>
<th>Hospitalised</th>
<th>Mean length of stay (days)</th>
<th>Died</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>120 (6.6%)</td>
<td>8.2</td>
<td>25 (1.4%)</td>
<td>1,829</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td>18 (10.1%)</td>
<td>9.4</td>
<td>4 (2.2%)</td>
<td>178</td>
</tr>
<tr>
<td>Pacific</td>
<td>21 (10.0%)</td>
<td>11.6</td>
<td>1 (0.5%)</td>
<td>210</td>
</tr>
<tr>
<td>Asian</td>
<td>15 (5.0%)</td>
<td>4.1</td>
<td>0 (0.0%)</td>
<td>300</td>
</tr>
<tr>
<td>NZ European/Other</td>
<td>69 (5.5%)</td>
<td>7.8</td>
<td>21 (1.7%)</td>
<td>1,259</td>
</tr>
<tr>
<td><strong>Health Status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underlying condition</td>
<td>47 (14.2%)</td>
<td>9.0</td>
<td>13 (3.9%)</td>
<td>330</td>
</tr>
<tr>
<td>No underlying condition</td>
<td>73 (4.9%)</td>
<td>7.6</td>
<td>12 (0.8%)</td>
<td>1,499</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>57 (6.9%)</td>
<td>9.2</td>
<td>14 (1.7%)</td>
<td>823</td>
</tr>
<tr>
<td>Female</td>
<td>63 (6.3%)</td>
<td>7.3</td>
<td>11 (1.1%)</td>
<td>1,006</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–19</td>
<td>4 (1.7%)</td>
<td>2.8</td>
<td>0 (0.0%)</td>
<td>239</td>
</tr>
<tr>
<td>20–39</td>
<td>23 (3.1%)</td>
<td>2.6</td>
<td>0 (0.0%)</td>
<td>732</td>
</tr>
<tr>
<td>40–59</td>
<td>43 (8.0%)</td>
<td>8.1</td>
<td>2 (0.4%)</td>
<td>538</td>
</tr>
<tr>
<td>60–79</td>
<td>38 (13.6%)</td>
<td>8.6</td>
<td>10 (3.6%)</td>
<td>279</td>
</tr>
<tr>
<td>80+</td>
<td>12 (29.3%)</td>
<td>19.2</td>
<td>13 (31.7%)</td>
<td>41</td>
</tr>
<tr>
<td><strong>Deprivation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st quintile (least)</td>
<td>17 (4.0%)</td>
<td>10</td>
<td>3 (0.7%)</td>
<td>422</td>
</tr>
<tr>
<td>2nd quintile</td>
<td>35 (8.3%)</td>
<td>6.6</td>
<td>5 (1.2%)</td>
<td>421</td>
</tr>
<tr>
<td>3rd quintile</td>
<td>11 (3.7%)</td>
<td>9.2</td>
<td>2 (0.7%)</td>
<td>300</td>
</tr>
<tr>
<td>4th quintile</td>
<td>33 (8.8%)</td>
<td>6.5</td>
<td>1 (0.3%)</td>
<td>374</td>
</tr>
<tr>
<td>5th quintile (most)</td>
<td>18 (6.5%)</td>
<td>10.4</td>
<td>14 (5.0%)</td>
<td>278</td>
</tr>
<tr>
<td>Missing</td>
<td>6 (17.6%)</td>
<td>13.5</td>
<td>0 (0.0%)</td>
<td>34</td>
</tr>
</tbody>
</table>
moniously the model describes the data and penalises models with too many variables.\textsuperscript{13} AUC measures how accurately the model predicts the outcome of interest (in this case, hospitalisation) for cases in the dataset.\textsuperscript{14} The complete model was:

\[ \text{logit}( P(\text{hospitalised}) ) \sim \text{age} + \text{ethnicity} + \text{sex} + \text{has underlying conditions} + \text{dep index} \]

Ethnicity was treated as a categorical variable with individuals belonging to one of Māori, Pacific, Asian or NZ European/Other. In the case of multiple recorded ethnicities the standard Ministry of Health prioritisation was used\textsuperscript{10} for the model selection phase, as there was insufficient data to consider all ethnicity combinations (see section \textit{Estimating the effect of ethnicity} for estimation of effect sizes using multiple ethnicity data). The NZ European/Other group is used as the baseline group so that resulting odds ratios are interpreted as ‘difference in risk relative to NZ European/Other’. Because AIC requires all models to have the same sample size, the 34 records missing a deprivation index were removed during model selection.

\section*{Estimating the effect of ethnicity}

During the model selection phase, ethnicity (using prioritised ethnicity) was consistently identified as a significant predictor variable in all three models. Using priority ethnicity neglects important information on individuals who were in multiple ethnicity groups.\textsuperscript{15} For example, there were 19 individuals who were recorded as Māori and Pacific, none of whom were hospitalised. In the standard prioritisation routine, these individuals were classified as Māori and did not, therefore, contribute to model estimates for Pacific people. This undercounted Pacific cases potentially created age-related biases in the results for Pacific people, as younger Pacific people are more likely to report multiple ethnicities.\textsuperscript{16} To account for this, we reran each model using different ethnicity prioritisation orderings (Table 2). Odds ratios and confidence intervals on the odds ratios were obtained by exponentiating the coefficient estimates and confidence intervals on the coefficient estimates for each risk factor.

\section*{Length of stay and risk of fatality}

In addition to the risk of hospitalisation, we used a linear model to consider the effect of these variables on length of hospital stay:

\[ \text{length of hospital stay} \sim \text{age} + \text{ethnicity} + \text{sex} + \text{has underlying conditions} + \text{dep index} \]

\textbf{Figure 2:} Sankey diagram of case data that was included/excluded from the length of hospital stay analysis. Those with valid discharge dates or death dates (n=106) were included in the analysis. The remaining cases were excluded (n=14)—of these, one was Māori, seven were Pacific, one was Asian, five were NZ European/Other and zero had multiple ethnicities recorded. Data are for cases reported up to 25 September 2020.
Finally, despite very limited data, we also considered fatality risk under the same framework:

$$\text{logit}(P(\text{death})) \sim \text{age} + \text{ethnicity} + \text{sex} + \text{has underlying conditions} + \text{dep index}$$

Because there were no fatalities in Asian people, in this final model we combined the Asian and NZ European/Other ethnicity groups. For both these models, we used the same methodology as for the risk of hospitalisation model (i.e., we used standard ethnicity prioritisation to identify significant predictor variables then re-analysed the contribution of these predictor variables under different ethnicity prioritisation orderings).

**Sensitivity analysis**

To check how robust our conclusions were with respect to our assumptions about ethnicity data and other potential sources of bias, we performed a sensitivity analysis by re-running the preferred models for risk of hospitalisation and length of hospital stay under each of the following assumptions:

1. Cases with primary ethnicity recorded as Middle Eastern/Latin American/African (n=49 cases, 1 hospitalisation) or Other (n=5 cases, 1 hospitalisation) were excluded from the dataset.
2. Cases with missing total ethnicity data (n=29 cases, 1 hospitalisation) were excluded from the dataset.
3. Cases satisfying either one or two above were excluded from the dataset.
4. Cases with missing total ethnicity data were assumed to be Māori.
5. Cases with missing total ethnicity data were assumed to be Pacific.
6. Cases with missing total ethnicity data were assumed to be Asian.
7. Cases with missing total ethnicity data were assumed to be NZ European/Other.
8. Cases with a recent overseas travel history (n=707 cases) were excluded from the dataset.
9. Cases with missing length of hospital stay data were assumed to have a length of stay of zero days (the shortest stay in the dataset).
10. Cases with missing length of hospital stay data were assumed to have length of stay of 52 days (the longest stay in the dataset).

### Results

**Risk of hospitalisation**

For risk of hospitalisation, the model containing age, ethnicity and the presence of underlying health conditions as predictor variables gave the most parsimonious fit (lowest AIC). This model also has the same predictive power (similar AUC) as more complex models (Table 3). Including interaction terms did not improve the model fit as measured by AIC. Age was always the strongest predictor of hospitalisation and was included in all models. After age had been accounted for, the best two-variable model also included ethnicity.

Coefficient estimates associated with sex were always close to zero and had consistently large p-values, indicating that sex was not a strong predictor of hospitalisation in New Zealand’s COVID-19 cases. This is contrary to some international evidence that suggests men suffer worse clinical outcomes on average. Deprivation index was only statistically significant when considered alongside age, not ethnicity. Deprivation index and ethnicity were slightly correlated, so this suggests the effect of deprivation index was partially captured by ethnicity. Different age groups were represented differently across different indexes of deprivation, suggesting that a model containing a deprivation index–age interaction term may be suitable.

<table>
<thead>
<tr>
<th>Ethnicity effect being estimated</th>
<th>Prioritisation ordering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Māori</td>
<td>Māori, Pacific, Asian, NZ European/Other</td>
</tr>
<tr>
<td>Pacific</td>
<td>Pacific, Māori, Asian, NZ European/Other</td>
</tr>
<tr>
<td>Asian</td>
<td>Asian, Māori, Pacific, NZ European/Other</td>
</tr>
</tbody>
</table>
This was tested and the resulting coefficients were not statistically significant.

Māori and Pacific people are known to have higher rates of multi-morbidity and underdiagnosis of comorbid conditions. This suggests that including a term in the model for the interaction between ethnicity and presence of underlying health conditions could be important. However, this term was found to be not statistically significant.

Table 4 and Figure 3 show the results for the preferred model for risk of hospitalisation. Age was associated with a 4.5% increase in odds of hospitalisation per additional year. The presence of at least one underlying health condition increased the odds of hospitalisation by 1.74 times (95% CI 1.14–2.65, p=0.01). After controlling for age and underlying conditions, Māori and Pacific people had substantially higher odds of being hospitalised for COVID-19 than other ethnicities: Māori 2.5 times higher odds (95% CI 1.39–4.51, p=0.002) and Pacific people 3.06 times higher odds (95% CI 1.75–5.33, p=8×10^-5). Asian people were also at higher risk, with 1.35 times higher odds, although this result was not statistically significant (95% CI 0.74–2.48, p=0.33).

The odds ratios for different ethnicities shown in Figure 3 represent the increase in risk after controlling for underlying health conditions, which are present in higher rates in Māori and Pacific people. In the 1,829 cases in the data, there was only a very small correlation between having underlying conditions recorded and either Māori ethnicity (Pearson’s r-squared r^2=0.07) or Pacific ethnicity (r^2=0.02), so the results were not affected by multi-collinearity in these variables.

The model can be used to estimate the probability of hospitalisation following infection with COVID-19 for an individual of a given age and ethnicity and the presence/absence of underlying health conditions (see Figure 4 and see Appendix Figure 1 for confidence intervals). It can also be used to estimate the age at which Māori or Pacific cases had the same risk of hospitalisation as those at a specific reference age in the NZ European/Other group, after we controlled for the presence or absence of underlying health conditions (Table 5). This shows that, on average, there is a 20.7-year age gap between Māori and NZ European/Other, and a 25.2-year age gap between Pacific and NZ European/Other, at the same level of risk. These estimates should be used with caution because they assume that age has the same proportional effect in each ethnicity (see section Discussion for limitations and sources of bias).

The results of the sensitivity analysis (see Appendix Table 2) showed that the main conclusions were robust to different assumptions. The magnitude of the odds ratios for Māori and Pacific people could be slightly smaller than those in Figure 3 under different assumptions about missing ethnicity data or ethnicity groupings. For scenarios 1–7 described in Methods, the odds ratio for Māori was always statistically significant and varied between 2.15 (95% CI 1.20–3.86), if cases with missing total ethnicity data were assumed to be Māori, and 2.50 (95% CI 1.39–4.51), under the default model. The odds ratio for Pacific people was always statistically significant and varied between 2.78 (95 CI 1.61–4.80) and 3.06 (95% CI 1.75–5.33) under scenarios 1–7. If the EpiSurv ethnicity field (which is more up to date but only allows the priority ordering with Māori as priority ethnicity) was used instead of Ministry of Health total ethnicity data, the odds ratio for Māori was 2.68 (95% CI 1.48–4.83), which is larger than in Figure 3. Excluding cases with a recent international travel history (scenario 8) increased the odds ratio for Māori and for Pacific people to 2.51 (95% CI 1.28–4.93) and 3.20 (95% CI 1.73–5.94) respectively. The odds ratio for Asian people was not statistically significant under any of the scenarios tested.

### Length of hospital stay

For length of hospital stay, the model containing only age and ethnicity as predictor variables gave the most parsimonious fit (lowest AIC). Age was a more important factor than in the probability of hospitalisation model, with an additional year of age predicting an additional 0.22 days (95% CI 0.14–0.31 days, p=2×10^-6) in hospital on average. When used as the priority ethnicity, Māori are expected to spend 4.9 days (95% CI 0.02–9.7 days, p=0.052) longer in hospital than NZ European/Other, and Pacific people are
Table 3: AIC and AUC values for the eight models for risk of hospitalisation with lowest AIC, as well as the age-only and ethnicity-only models. Smaller values of AIC indicate a more parsimonious model fit; larger values of AUC indicate better predictive power.

<table>
<thead>
<tr>
<th>Model</th>
<th>AIC</th>
<th>AUC</th>
<th>Model</th>
<th>AIC</th>
<th>AUC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age + Eth + HasCond</td>
<td>755</td>
<td>0.762</td>
<td>Age + Eth + Sex</td>
<td>761</td>
<td>0.758</td>
</tr>
<tr>
<td>Age + Eth + HasCond</td>
<td>757</td>
<td>0.763</td>
<td>Age + Eth + Dep</td>
<td>761</td>
<td>0.757</td>
</tr>
<tr>
<td>Age + Eth + HasCond + Sex</td>
<td>757</td>
<td>0.762</td>
<td>Age + Eth + Sex + Dep</td>
<td>763</td>
<td>0.758</td>
</tr>
<tr>
<td>Age + Eth + HasCond + Sex</td>
<td>758</td>
<td>0.763</td>
<td>Age</td>
<td>779</td>
<td>0.728</td>
</tr>
<tr>
<td>Age + Eth</td>
<td>759</td>
<td>0.757</td>
<td>Eth</td>
<td>844</td>
<td>0.577</td>
</tr>
</tbody>
</table>

Table 4: Results of the preferred model (age, ethnicity, underlying conditions) for risk of hospitalisation under each ethnicity prioritisation ordering. Coefficient estimates for ethnicity that is not the priority (grey text) should be treated with caution. These models use the data from all cases (1,829 individuals).

<table>
<thead>
<tr>
<th>Priority ethnicity</th>
<th>AIC</th>
<th>Intercept</th>
<th>Age</th>
<th>HasCond</th>
<th>Māori</th>
<th>Pacific</th>
<th>Asian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Māori</td>
<td>789</td>
<td>-5.205</td>
<td>0.044</td>
<td>0.553</td>
<td>0.918</td>
<td>1.185</td>
<td>0.327</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(5 x 10^{-5})</td>
<td>(4 x 10^{-5})</td>
<td>(0.01)</td>
<td>(0.002)</td>
<td>(3 x 10^{-5})</td>
<td>(0.292)</td>
</tr>
<tr>
<td>Pacific</td>
<td>789</td>
<td>-5.204</td>
<td>0.044</td>
<td>0.548</td>
<td>0.985</td>
<td>1.118</td>
<td>0.327</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(6 x 10^{-5})</td>
<td>(4 x 10^{-5})</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(8 x 10^{-5})</td>
<td>(0.291)</td>
</tr>
<tr>
<td>Asian</td>
<td>788</td>
<td>-5.198</td>
<td>0.044</td>
<td>0.553</td>
<td>0.918</td>
<td>1.227</td>
<td>0.306</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(5 x 10^{-5})</td>
<td>(4 x 10^{-5})</td>
<td>(0.01)</td>
<td>(0.02)</td>
<td>(2 x 10^{-5})</td>
<td>(0.332)</td>
</tr>
</tbody>
</table>

Figure 3: Odds ratios and 95% confidence intervals for the considered risk factors. The odds ratio for underlying conditions was taken from the model with Māori as the priority ethnicity, but these results change very little under different prioritisations. In the same model, the odds ratio for an additional year of age was 1.045 (1.034, 1.057). Analysis based on cases reported up to 25 September 2020.
**Figure 4:** Estimated probability of hospitalisation by age and ethnicity, with and without underlying health conditions. Analysis based on cases reported up to 25 September 2020.

**Table 5:** Age differences between ethnicities at the same level of risk of hospitalisation. Each row shows a reference age for NZ European/Other and the corresponding age [95% CI] at which Māori and Pacific people have the same predicted risk of hospitalisation as NZ European/Other. Note that, after we control for underlying health conditions, the average age difference between NZ European/Other and Māori at the same level of risk is always 20.7 years and the average age difference between NZ European/Other and Pacific people at the same level of risk is always 25.2 years, but the size of the confidence intervals varies slightly with age.

<table>
<thead>
<tr>
<th>No underlying health conditions</th>
<th>At least one underlying health condition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NZ Euro/Other age</strong></td>
<td><strong>Māori age with same risk</strong></td>
</tr>
<tr>
<td>60</td>
<td>39.3 [26.2, 51.8]</td>
</tr>
<tr>
<td>65</td>
<td>44.3 [31.6, 57.0]</td>
</tr>
<tr>
<td>70</td>
<td>49.3 [36.8, 62.4]</td>
</tr>
<tr>
<td>75</td>
<td>54.3 [42.0, 68.0]</td>
</tr>
<tr>
<td>80</td>
<td>59.3 [46.9, 73.7]</td>
</tr>
</tbody>
</table>
expected to spend 5.2 days (95% CI 0.08–10.2 days, \(p=0.049\)) longer in hospital than NZ European/Other. Length of hospital stay for Asian people was not significantly different from NZ European/Other.

The sensitivity analyses (Appendix Table 3) showed that the difference in length of hospital stay for Māori was sometimes marginally statistically significant at the \(p=0.05\) level and sometimes not statistically significant, with average length of stay varying between 4.4 days and 6.1 days longer than NZ European. The average length of stay for Pacific people was sensitive to assumptions about cases with missing or invalid length of stay data (scenarios 9–10) because Pacific people were disproportionately represented in this cohort. If cases with missing data were assumed to have length of stay zero days (the smallest value in the data), the difference in length of stay for Pacific people was not statistically significant. If cases with missing data were assumed to have length of stay 52 days (the largest value in the data), the difference in length of stay for Pacific people was highly significant, with an average stay 14.9 days longer than NZ European. These two scenarios are opposite extremes and reality is likely to lie somewhere between them.

**Risk of fatality**

For risk of fatality, the model containing only age and deprivation index as predictor variables gave the most parsimonious fit (lowest AIC). In this model, an additional year of age increased the odds of fatality by 15.9% (95% CI 11.5%–20.4%, \(p=3\times10^{-14}\)). A unit increase in deprivation index was associated with a 0.80% (95% CI 0.33%–1.27%, \(p=0.001\)) increase in the odds of fatality. The difference in deprivation score between the 1st and 4th quintiles in the dataset was 146. This means that the model predicts that an individual at the 80th percentile of deprivation has 3.19 (95% CI 1.62–6.31) times the odds of fatality as someone at the 20th percentile in this dataset.

International evidence suggests a linear relationship between log infection fatality rates and age, with one paper estimating an increase in probability of death of 12.9% per year of age.\(^{20}\) This is comparable to our results (although changes in the infection fatality rate are not identical to changes in odds, they are close at small probabilities).

The number of fatalities was too small to draw any concrete conclusions on the relationship between risk of fatality and ethnicity. There were no models where ethnicity was a consistently statistically significant predictor of fatality risk. However, this is most likely due to inadequate statistical power of analysing such small numbers. Furthermore, the majority of fatalities are linked to aged care facilities, and so are not representative of the type of fatalities that would occur if COVID-19 were to become more widespread in the community.

**Discussion**

Structural bias and systemic racism are widespread in healthcare systems and are basic determinants of ethnic health inequities in New Zealand and internationally.\(^{4,21}\) New Zealand’s experience with the COVID-19 epidemic indicates that Māori and Pacific people are at much greater risk of hospitalisation following infection with COVID-19. It is widely understood from overseas experience that the risk of hospitalisation for COVID-19 increases rapidly with age. However, the effects of ethnicity in New Zealand are not as well understood. Our results show that an 80-year-old patient with COVID-19 in the NZ European/Other group without reported comorbidities has the same predicted risk of hospitalisation as a 59.3-year-old (95% CI 46.9–73.7 years old) patient in the Māori group without reported comorbidities. Similarly, an 80-year-old patient in the NZ European/Other group without reported comorbidities has the same predicted risk of hospitalisation as a 54.7-year-old (95% CI 43.6–67.7 years old) patient in the Pacific group without reported comorbidities. Similarly, an 80-year-old patient in the NZ European/Other group without reported comorbidities has the same predicted risk of hospitalisation as a 54.7-year-old (95% CI 43.6–67.7 years old) patient in the Pacific group without reported comorbidities. Similar differences are seen across all ages and for cases with at least one reported comorbidity (Table 6). These differences in age-specific risk are broadly consistent with earlier estimates of inequities in the COVID-19 infection fatality rate.\(^{5}\) Our analysis suggested that average length of hospital stay could be longer for Māori
and Pacific people than for NZ European/Other, but the data was insufficient to draw strong conclusions.

We have only considered the risk of being hospitalised given an individual was infected with COVID-19. The likelihood of hospitalisation will depend on prevailing admission policies in each hospital. These policies may vary across the country and over time, but we ignored this variation in this analysis. The overall risk of being hospitalised also depends on the likelihood of infection, which is specifically not included in our calculations. COVID-19 can spread quickly in communities with higher levels of workplace, community or whānau interaction, crowded housing, insecure employment and decreased access to healthcare or COVID-19 testing. These are frequently the same individuals, groups or communities that are at higher risk of hospitalisation and fatality if infected, meaning there is additional potential burden of the epidemic on these people.

When fitting each model, we assigned each individual to only one ethnicity, as the small number of cases precluded investigation of all combinations of ethnic identity. This means that our results cannot be used multiplicatively to estimate the risk of hospitalisation for an individual belonging to multiple ethnicities. Other effects are multiplicative in the odds. For example, an individual with reported comorbid conditions has odds of hospitalisation that are 74% greater than another individual of the same age and ethnicity without reported comorbid conditions.

We have presented the results of a simple analysis that ignores several potential sources of bias and additional inequities (Table 6). For example, the recording and the analysis of the effect of comorbid conditions are crude. Different health conditions have significantly different effects, and the presence of multiple health conditions may increase risk further. We did not have a sufficient number of cases to estimate the effect of individual health conditions or combinations of conditions. Māori and Pacific people have lower life expectancy, higher rates of multi-morbidity and respiratory illness, higher rates of under-reporting of comorbid conditions and typically experience adverse health outcomes at an earlier age. These factors have not been accounted for in the model and are likely to exacerbate the risk of clinically severe outcomes from COVID-19. It is possible that some of the observed risk of hospitalisation for Māori could be explained by unreported, undiagnosed or multiple comorbid conditions, in which case the odds ratios for ethnicity that we reported could be overestimates.

Testing rates and contact tracing were much higher in the second outbreak in August/September 2020 than in the first outbreak in March/April 2020, meaning that more mild cases of COVID-19 would have been identified in the second outbreak compared with the first. As this second outbreak disproportionately affected Pacific and Māori people, the model may underestimate their relative risk of hospitalisation. Our model is fitted to data from a period in which the prevalence of COVID-19 was low and healthcare services had adequate capacity. Systemic racism within the healthcare system could further exacerbate inequities in outcomes if COVID-19 prevalence were to increase and if healthcare capacity were overstretched. Deprivation index was assigned according to the meshblock of each individual’s home address. This may be a good proxy for general current socioeconomic deprivation on average, but the small number of cases in the dataset may not be sufficient for this to apply. Geographic measures of deprivation are widely used and useful because they simply require an address to provide the information. However, such information may not represent the socioeconomic experiences of an individual over their lifetime.

The level of ethnic group classification used here involved broad categories that define populations with diverse experiences, cultures, nationalities, exposure to racism and immigration histories. The level of ethnicity data available and the absence of migration information (other than recent overseas travel) precluded a more nuanced understanding of the hospitalisation risks within these broad ethnic categories. Understanding the potential impact of the epidemic and informing the delivery of the vaccination programme requires complete and detailed ethnicity information to be included in the routinely available data.
Table 6: Sources of potential bias and their likely direction of effect on model predictions for the hospitalisation odds ratio for Māori and Pacific people. ↑ and ↓ indicate that the source of bias is likely to mean that the model underestimates or overestimates respectively the odds ratios for Māori and Pacific people.

<table>
<thead>
<tr>
<th>Source of bias and likely direction of effect on hospitalisation odds ratio for Māori and Pacific people</th>
<th>Contextual remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdated or inaccurate total ethnicity data ↑</td>
<td>Using the EpiSurv ethnicity field (which is only prioritised ethnicity using the first priority ordering in Table 2) results in a larger estimated odds ratio for Māori.</td>
</tr>
<tr>
<td>Multimorbidity and underreporting of comorbid conditions ↓</td>
<td>Māori and Pacific people have higher rates of multi-morbidity and under-reporting of comorbid conditions. If Māori and Pacific cases in the dataset have multiple comorbid conditions or comorbid conditions that are not reported, the reported odds ratio could overestimate the relative risk of hospitalisation.</td>
</tr>
<tr>
<td>Change in COVID-19 testing over time ↑</td>
<td>In the first wave, which was dominated by NZ European cases, testing and contact tracing rates were lower, and testing was less accessible than in the second wave, which had more Māori and Pacific cases. If more mild cases were missed in the first wave than in the second, this could make the hospitalisation risk appear lower in the second wave. This could mean the model underestimates the risk for Māori and Pacific people.</td>
</tr>
<tr>
<td>Change in threshold for hospitalisation over time</td>
<td>There is no clear evidence that the threshold for hospitalisation with COVID-19 has changed over time. It is possible that the introduction of hotel quarantine facilities for community cases in the second wave meant mild cases were less likely to be hospitalised. If this were the case, the model could underestimate the risk for Māori and Pacific people.</td>
</tr>
<tr>
<td>Overrepresentation of international travellers in dataset ↑</td>
<td>Excluding overseas cases from the analysis increased the odds ratio for Māori and Pacific people.</td>
</tr>
</tbody>
</table>
This is currently not the case, yet these groups have high risks of poor outcomes from COVID-19 infection. Ideally, ethnicity information should be either collected at the time of testing or sourced from the existing NHI information. The collection of high-quality ethnicity information can be done quickly and simply, even in busy clinical settings. This study has also highlighted the differential impact of missing data on understanding the course and impact of the epidemic, which is important for informing interventions, including the vaccine delivery programme. Data completeness checks and follow-ups of missing data are simple quality control mechanisms for improving the reliability of routinely collected but essential information.

The results we have presented are from a relatively small number of cases that may not be representative of the New Zealand population, due to the limited spread of these outbreaks. Consequently, although our results are based on all cases for which data are available, caution should be used when generalising the results to other groups or the wider community. The small number of cases and hospitalisations also makes it difficult to separate the effects of different variables: for example, the effect of belonging to multiple ethnicities or having multiple comorbid conditions recorded. We have used a likelihood-based approach (AIC) that penalises the use of models with too many variables. The results we have presented are from very simple models that use only two or three predictor variables. This highlights the variables with the largest impacts on the results, but necessarily ignores factors that could have important effects on risk. If in future New Zealand has significantly more hospitalisations from COVID-19, the analysis should be rerun to take account of the additional data. With a larger number of cases, the model selection phase of our approach could include more variables in the model. Our approach uses information that is routinely collected for all cases of COVID-19 in New Zealand, so it would be straightforward to run with an updated dataset.

After controlling for age, presence of underlying health conditions and socio-economic deprivation, we conclude that Māori and Pacific people have substantially higher risk of hospitalisation for COVID-19. We have previously estimated that Māori and Pacific people would experience higher infection fatality rates from COVID-19. Our new results add to the imperative for New Zealand’s COVID-19 response to include a focus on measures to protect high-risk groups and to prevent the large-scale inequities in health outcomes that would result from widespread community transmission. Our results also have clear implications for identifying priority groups for vaccination against COVID-19, for which planning is currently underway. They demonstrate that it will be essential to account for ethnicity when targeting vaccination to age groups based on their risk of clinically severe infection.
Appendix

Appendix Table 1: Breakdown of the number of cases in the data set by ethnicity showing cases with a single ethnicity (bold numbers) and cases with two ethnicities (non-bold numbers). In addition to the 1,821 single and dual ethnicity cases represented in the table, there were 8 cases with three ethnicities, of which 6 were Māori, Pacific and NZ European/other, and 2 were Pacific, Asian and NZ European/other.

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Māori</th>
<th>Pacific</th>
<th>Asian</th>
<th>NZ Euro/other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Māori</td>
<td>99</td>
<td>13</td>
<td>1</td>
<td>59</td>
</tr>
<tr>
<td>Pacific</td>
<td>13</td>
<td>166</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>Asian</td>
<td>1</td>
<td>8</td>
<td>283</td>
<td>6</td>
</tr>
<tr>
<td>NZ Euro/other</td>
<td>59</td>
<td>15</td>
<td>6</td>
<td>1,171</td>
</tr>
<tr>
<td>Total</td>
<td>172</td>
<td>202</td>
<td>298</td>
<td>1,251</td>
</tr>
</tbody>
</table>

Appendix Table 2: Results of sensitivity analysis for the model for probability of hospitalisation. [View Appendix Table 2](#).

Appendix Table 3: Results of sensitivity analysis for the model for length of hospital stay. [View Appendix Table 3](#).

Appendix Figure 1: Model results including 95% confidence intervals for probability of hospitalisation by age and ethnicity for individuals without underlying health conditions (top row of plots) and with underlying health conditions (bottom row of plots).
Competing interests:
Mr Steyn, Dr Plank, Dr Lustig, Dr James, Dr Ridings, Dr Hendy, Dr Hannah and Dr Binny report grants from Te Pūnaha Matatini and the Ministry of Business, Innovation and Employment during the conduct of the study.

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Higher perceived stress and exacerbated motor symptoms in Parkinson’s disease during the COVID-19 lockdown in New Zealand

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ABSTRACT

AIMS: Stress plays a key role in Parkinson’s disease (PD) by acting on the dopaminergic system and worsening patients’ motor function. The impact of New Zealand’s strict lockdown measures to contain COVID-19 on perceived stress and PD motor symptoms remains unknown. Here we examined the relationship between perceived levels of stress, changes in physical activity levels and PD motor symptoms during lockdown.

METHODS: During lockdown, 134 participants with PD and 49 controls completed a survey assessing perceived stress, self-reported changes in PD motor symptoms and physical activity duration and intensity prior to and during lockdown.

RESULTS: Perceived stress was higher in PD than controls, and in those reporting a worsening of tremor, balance/gait, dyskinesia and bradykinesia compared to those indicating no change during the COVID-19 lockdown. These effects were not modulated by physical activity.

CONCLUSIONS: Reducing stressors may be an important adjunct treatment strategy to improve motor function in PD.

As the COVID-19 pandemic continues to grip the globe, there is concern for the increased vulnerability of those with chronic disease, including Parkinson’s disease (PD). New Zealand was placed under strict lockdown for 33 days. Residents were required to stay home except to exercise or access essential services. Although crucial to control the spread of the virus, these drastic measures had the potential to significantly impact on mental and physical wellbeing.

People with PD may have an impaired ability to cope with sudden changes to everyday life due to their cognitive and motor inflexibility, which stems from nigrostriatal dopamine depletion, a pathological hallmark of the disease. Stress also plays an important role in PD by acting on the dopaminergic system and worsening motor symptoms. Heightened stress can reduce the efficacy of levodopa treatment, resulting in further worsening of motor symptoms. However, physical activity can counteract the detrimental effects of stress and might even exert neuroprotective effects. The COVID-19 lockdown period may have therefore placed this cohort, relative to those without PD, at greater risk of experiencing higher stress, which, together with potential changes in physical activity, could exacerbate interactions between stress and their already compromised motor system. Our objectives were to examine whether during New Zealand’s stringent lockdown period (1) perceived stress was higher in PD than controls, (2) there was a direct relationship between...
higher perceived stress and worsening of PD motor symptoms and (3) these effects were modulated by physical activity.

Material and methods

Participants

Participants were recruited from the established PD longitudinal study at the New Zealand Brain Research Institute (NZBRI). One hundred and forty-nine participants with PD and 51 healthy controls were invited to take part in a survey during the nationwide lockdown, either online or by phone. Of the 200 people invited, 134 PD (M=72 years, SD=7) and 49 controls (M=78 years, SD=7) completed the survey (a response rate of 92%). All PD participants had previously completed comprehensive neuropsychological and MDS-UPDRS assessments as part of their participation in the NZBRI longitudinal PD study (Table 1).

Data collection occurred between 17 April and 14 May 2020, during New Zealand’s Alert Level 4 and Level 3 periods. At Alert Level 4 (commencing 25 March), New Zealanders were in strict lockdown unless providing an essential service. At Alert Level 3 (beginning 27 April and lasting 17 days), restrictions were slightly loosened, but vulnerable individuals (those over 70 years or immunocompromised) were advised to continue self-isolating where possible. At the commencement of data collection, Alert Level 4 had been in place for 22 days. As far as we are aware, none of our participants tested positive for COVID-19.

All participants gave informed consent. The study was conducted within an existing longitudinal PD study that was approved by the Health and Disability Ethics Committee of the New Zealand Ministry of Health.

Measures

Participants completed a suite of scales and questionnaires as part of the survey. Study data were collected and managed using REDCap electronic data capture tools15 hosted at NZBRI. We report findings from three scales: First, we created the PD motor symptom scale (PDMSS) to examine self-reported perceived changes in four motor symptoms since lockdown began: tremor, dyskinesia, balance/gait and bradykinesia. For each motor symptom, PD participants indicated whether they had noticed any changes in their symptom presentation during lockdown compared to before lockdown. If so, two further questions probed whether that symptom was ‘better’ or ‘worse’, and the magnitude of that change was measured on a four-point Likert scale (slight, mild, moderate, substantial).

Second, the perceived stress scale (PSS-10)16,17 assessed participants’ (PD and controls) perceived stress levels during lockdown. Participants self-reported how frequently they had felt a certain way on a five-point Likert scale (from 0 (‘Never’) to 4 (‘Very often’). For the present study, the wording of each question was intentionally altered from ‘In the last month’ to ‘Since lockdown began’. One further question required participants to report

Table 1: Percentage distribution of self-reported changes (worsening) in PD motor symptoms during the COVID-19 lockdown. Clinical characteristics of our patient cohort (n=134): mean disease duration 11 years (SD=6); Hoehn–Yahr score2 2.4 (SD=0.6); last pre-lockdown Part III MDS-UPDRS12 ‘ON’ PD medication 34.0 (SD=13.2).

<table>
<thead>
<tr>
<th>Motor Symptom (% reporting symptom)</th>
<th>No change</th>
<th>Slight</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tremor (89%)</td>
<td>70%</td>
<td>12%</td>
<td>7%</td>
<td>7%</td>
<td>4%</td>
</tr>
<tr>
<td>Dyskinesia (88%)</td>
<td>74%</td>
<td>11%</td>
<td>8%</td>
<td>7%</td>
<td>0%</td>
</tr>
<tr>
<td>Bradykinesia (98%)</td>
<td>64%</td>
<td>14%</td>
<td>10%</td>
<td>8%</td>
<td>4%</td>
</tr>
<tr>
<td>Balance/gait (98%)</td>
<td>53%</td>
<td>15%</td>
<td>15%</td>
<td>13%</td>
<td>4%</td>
</tr>
</tbody>
</table>

*These scores were obtained during each participant’s most recent assessment visit as part of the NZBRI longitudinal PD study, on average 12 months (SD=10) prior to the present data collection.
whether their stress levels were higher, lower or about the same compared to before lockdown began.

Third, we created the physical activity levels questionnaire (PALQ) to assess the frequency, duration and intensity of each participant’s physical activity during the preceding seven days (during lockdown) and in the seven days prior to lockdown. This questionnaire was based on items included in the International Physical Activity Questionnaire. PD participants also indicated whether they had participated in an exercise group, class or programme specifically for people with PD before the lockdown, and if so, whether they had been able to continue this in some form during lockdown.

**Statistical analyses**

Perceived stress, physical activity levels and self-reported changes in motor symptoms during lockdown were examined using Bayesian multilevel modelling. The probabilistic language Stan was used along with the R packages rstan (v2.19.3) and brms (v2.13.0) to fit Bayesian models and generate estimates within the R statistical environment (v4.0.1). First, group differences in perceived stress and physical activity levels (total hours active over the week and intensity) were analysed. In these models, group was included as a predictor and the intercept varied by participant. The total hours active and physical activity intensity models additionally included a group-by-timepoint interaction term (before versus during lockdown). Next, we examined whether there was a relationship between perceived stress, PD motor symptom changes and physical activity. For each symptom (tremor, dyskinesia, balance/gait, bradykinesia), scores of symptom worsening from the PDMSS were collapsed across ‘slight’ to ‘substantial’ levels to generate a summary score of ‘Worsened’ versus ‘No change’ in symptoms during lockdown. The resulting motor symptom change scores for each symptom were modelled with a primary predictor of PSS score. Results are reported as the means of the posterior distribution, together with 95% credible intervals (CI) and the probability of the parameter being greater than zero. Anonymised data that support the findings of this study will be shared by the corresponding author upon reasonable request from any qualified investigator.

**Results**

Mean perceived stress levels in both groups were relatively low (PD, M=12.1, SD=6.4; controls, M=8.6, SD=6.0); however, perceived stress was higher in those with Parkinson’s than controls (by 3.6 points, 95% CI [1.5, 5.7], probability of perceived stress being higher in Parkinson’s P>99%; Figure 1A). The majority of PD participants (69%) reported their stress levels were about the same during lockdown compared to the period immediately prior to lockdown. Twenty-two percent felt their stress levels were higher and 9% felt they were lower. Similar results were found for controls (stress levels about the same 67%; higher, 20%; lower, 12%).

Despite being in lockdown, both PD and controls continued being physically active, with no evidence of a difference in the overall amount of time spent being active in the current week compared to the week prior to lockdown, and no evidence of a difference between groups (Figure 1B). Almost half the PD participants (49%) considered their physical activity levels during lockdown to be light in intensity, 42% moderate in intensity and 7% vigorous, involving hard physical effort. Similar physical activity intensities were reported for controls (light, 51%; moderate, 42%; vigorous, 7%), as well as prior to lockdown. Twenty-three percent of PD participants indicated they were attending a PD-specific exercise group prior to lockdown, of which 37% said they were able to continue during lockdown via, for example, online classes. There was no evidence of a relationship between perceived stress and physical activity duration or intensity during lockdown for either group.

In those with PD, we examined any self-reported changes since lockdown in the motor symptoms of tremor, dyskinesia, bradykinesia and balance/gait. Of the 89% of PD participants who self-reported tremor, 70% indicated no changes in their tremor since lockdown began. The remaining 30% reported a worsening that ranged from slight to severe changes (Table 1). Dyskinesia and bradykinesia...
also showed similar patterns of change. Of the 98% of participants who self-reported balance/gait problems, almost half indicated these symptoms were exacerbated during lockdown.

Next we examined whether subjective motor symptom changes were associated with perceived levels of stress. As shown in Figure 1C–F, scores on the perceived stress scale were higher in those reporting a worsening of tremor (by 2.4 points, 95% CI [0.7, 4.2], probability of perceived stress being higher in those reporting a worsening of tremor P>99%), dyskinesia (2.1 points, 95% CI [0.1, 4], P=98%), balance/gait (1.8 points, 95% CI [0.2, 3.4], P=99%) and bradykinesia (1.6 points, 95% CI [-0.01, 3.17], P=97%) compared to those indicating these symptoms did not change during lockdown. Including physical activity duration and intensity as predictors in these analyses did not improve the model fits.

Discussion

Consistent with previous literature showing stress plays a key role in PD and alters motor system functioning,4–8 perceived stress was higher in PD than healthy controls and, importantly, higher in PD participants reporting a worsening of motor symptoms during lockdown compared to those reporting no impact of lockdown on motor symptoms. Over a quarter of PD participants reported changes in one or more motor symptoms during lockdown. A worsening of PD motor symptoms since the onset of the COVID-19 pandemic has been reported by others.20–24 Consistent with van der Heide et al,25 our results extend these findings to show a direct relationship between higher perceived stress and deterioration of motor function in PD; however, they cannot demonstrate causality (ie, whether increased symptom presentation increases stress or vice versa).

Interestingly, the levels of perceived stress reported here appear lower than that found in the general population across the globe during the pandemic.26–28 The low levels of stress in this study are consistent with our findings of no change in depression or anxiety levels in the same PD and control cohort during lockdown compared to pre-lockdown (unpublished observations), possibly due to the effectiveness of the New Zealand government’s policy and strategy to contain the virus.29 The relative success of this swift and stringent response may have contributed to the mental and physical wellbeing of residents and thus influenced the results we report here. However, the low perceived stress levels could also reflect the older age of our participants and a larger percentage of male responders (58%), as perceived stress during the pandemic is reported to be higher in females and younger people.26,28

New Zealand’s strict lockdown did not appear to impact on participants’ reported physical activity levels, perhaps in part because explicit provision for outdoor exercise was a feature of government guidelines. Moreover, the effects of stress on motor symptom presentation and the between-group differences in perceived stress during lockdown were not modulated by physical activity duration or intensity. These findings contrast with other reports that demonstrate reduced physical activity since the pandemic in PD,24,25 which was associated with worsening of symptoms (combining both motor and non-motor symptoms together).25 The lack of support for previous research showing beneficial effects of physical activity on stress9,10,30 may be explained by the already low average stress levels of our groups.

Given New Zealand’s unique pandemic response to COVID-19, our findings may not generalise to other PD and older-aged healthy control cohorts around the world. Nonetheless, monitoring and addressing stress levels, particularly as this pandemic continues, may be an important adjunct strategy to mitigate exacerbation of symptoms and improve motor function in PD.
Figure 1: (A) Total perceived stress scores (PSS) since lockdown began for PD patients and controls. (B) Duration of time spent being physically active over the week immediately prior to lockdown and one week during lockdown for patients and controls. Includes physical activity level intensities ranging from light to vigorous. Data for time (hours) were log transformed before analysis. (C-F) PSS scores for those participants reporting a worsening of their motor symptoms (Worsened) compared to those participants reporting no change in their symptom presentation (No Change), for (C) tremor, (D) dyskinesia, (E) bradykinesia and (F) balance/gait. Box plots illustrate the median and quartiles; individual patient and control data are also shown (grey circles).
Competing interests:
Nil.

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Life during lockdown:
a qualitative study of
low-income New Zealanders’
experience during the
COVID-19 pandemic

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ABSTRACT

AIM: This research explores the experience of low-income New Zealanders during the COVID-19 pandemic lockdown and their advice to the Government about addressing future pandemics. New Zealand had a rapid and effective lockdown that meant the virtual elimination of community transmission.

METHOD: Twenty-seven semi-structured interviews were undertaken with low-income people in June–July 2020, immediately after lockdown was lifted.

RESULTS: Life during lockdown was challenging for study participants. They were fearful of the virus and experienced mental distress and isolation. Most participants felt safe at home and reported coping financially while still experiencing financial stress. Participants were resourceful and resilient. They coped with lockdown by using technology, self-help techniques and support from others. New Zealand’s welfare state ensured participants had access to health services and welfare payments, but there were challenges. Welfare payments did not fully meet participants’ needs, and support from charitable organisations was critical. Participants were overwhelmingly positive about the Government’s response and advised the Government to take the same approach in the future. This is a particularly reassuring finding from some of the most vulnerable New Zealanders.

CONCLUSIONS: An early and hard lockdown, the welfare state, compassion and clearly communicated leadership were keys to a successful lockdown for the low-income people in this study. Research of the experience of low-income people during pandemics is critical to ensuring inequities in pandemic impact are mitigated.

The 2020 COVID-19 pandemic necessitated a global public health response resulting in unprecedented nationwide lockdowns. Research on the public's experience of pandemics is relatively limited, and until 2020 it did not address the scale of the current lockdowns. A rapid review of evidence of the psychological impact of quarantine prior to COVID-19 found that impacts were “wide-ranging, substantial and can be long lasting.” Key stressors were: “quarantine duration, infection fears, frustration, boredom, inadequate supplies, inadequate information, financial loss, and stigma.” Since the study reported here, there has been a proliferation of research on the impact of the COVID-19 lockdown that identifies harms to individuals' mental wellbeing and their ability to access medical and dental care, food and social support. Qualitative studies on people's experience have largely focused on people with specific health conditions or on specific aspects of their lives. Three qualitative studies from Aotearoa New Zealand focused on aspects of healthcare provision.

Public health is inherently political as it requires the organised efforts of society.
Globally, the pandemic has seen a range of political leadership and policy responses and subsequent public health outcomes. A key risk in any public health crisis (including COVID-19) is exacerbating existing inequalities. Understanding the COVID-19 experience of vulnerable people will assist in ensuring equitable pandemic responses. Given that people living in poverty suffer worse outcomes during pandemics and are more isolated in society, research examining their experience is needed to protect them during pandemics.


Context

New Zealand is a unitary welfare state with largely publicly funded healthcare and relatively simple institutional arrangements for health. The lead agency is the national Ministry of Health led by the Director-General of Health. Regional public health services are undertaken by district health boards. New Zealand’s economic policy has been strongly neo-liberal in the past three decades, which has resulted in welfare payments well below the living wage. The Labour-led government at the time of the crisis was clearly moving in a more social democratic direction, with budgets focused on wellbeing, growth in government and increased welfare benefits. Yet, prior to COVID-19, nearly 10% of working-age New Zealanders were receiving a ‘main benefit’. Table 1 outlines the context at the time of this study. See https://covid19.govt.nz/ for current information.

Work and Income New Zealand (WINZ) is the key government agency responsible for benefit allocation. WINZ played a key role in the COVID-19 response through the provision of existing benefits: Working Age Benefits (increased during lockdown), Winter Energy Payment (increased during lockdown), Hardship Assistance, Food Grants and the newly introduced COVID-19 Wage Subsidy. Community Services Cards enable people receiving low-income to get subsidies across a range of services, including general practitioner (GP) appointments and low-cost medical scripts (NZ$5). Many New Zealanders also rely on charitable organisations for their basic needs (eg, food banks and the City Mission). These services continued to operate during lockdown, adapting and augmenting their services as needed.

New Zealand had its first reported case of COVID-19 on 28 February 2020, a month after the first cases were reported in Europe. New Zealand’s initial approach to the pandemic followed the 2017 influenza pandemic response plan. It proved ineffective and an elimination strategy was developed. Prime Minister Jacinda Ardern announced a new Alert Level System on 21 March urging New Zealanders to “be strong, be kind, and unite against Covid-19.” Alert Levels 4 and 3 both involved lockdowns at home, colloquially termed the ‘bubble’. Housing was found for the homeless within days of the Alert Level System announcement.

These lockdown restrictions lasted seven weeks, from 25 March until 13 May 2020, at which time the country moved to Alert Level 2. Alert Level 2 was much less socially restrictive. On 8 June the country moved to Alert Level 1, which allowed unrestricted movement within New Zealand but tight border restrictions were retained. Throughout Alert Levels 4 and 3, daily 1pm updates were televised, usually featuring the Prime Minister and the Director-General of Health, who were the key government leaders in the COVID-19 response. New Zealand’s response has been characterised as relying on “science and empathy.” Ardern’s key messages included, “we must go hard, and go early,” and, “our team of 5 million,” referring to the efforts of the entire population.

The initiation of Alert Level 4 in New Zealand on 25 March brought widespread economic and social consequences. The Government provided the COVID-19 Wage Subsidy to employers so they could continue paying their staff during the lockdown. Despite this, the number of working-age people signing up to benefits during the
### Table 1: The New Zealand Context.

<table>
<thead>
<tr>
<th>Agencies</th>
<th>Description</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work and Income New Zealand (WINZ)</td>
<td>Government agency under the Ministry of Social Development that offers income support and provides training for job seekers and employers.</td>
<td><a href="https://www.workandincome.govt.nz/">https://www.workandincome.govt.nz/</a></td>
</tr>
<tr>
<td>City Mission</td>
<td>One of many charitable organisations that operates in major cities throughout New Zealand. Offers support to a wide range of people in hardship. Further information found at:</td>
<td><a href="https://www.aucklandcitymission.org.nz/">https://www.aucklandcitymission.org.nz/</a></td>
</tr>
<tr>
<td>Food Banks</td>
<td>Range of services and charities in New Zealand provide free food parcels to whānau (extended family). Many services remained open to support their communities as essential services. This range of services can be seen at:</td>
<td><a href="https://www.foodbank.co.nz/">https://www.foodbank.co.nz/</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Description</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter Energy Payment</td>
<td>From 1 May to 1 October WINZ provides additional weekly payments to beneficiaries to cover extra heating costs over the winter months, as many people on the benefit cannot afford to heat their homes. This was doubled in response to COVID-19 to NZ$40.91 singles NZ$63.64 for couples or people with dependents to acknowledge people would need to spend more on heating during lockdown.</td>
<td><a href="https://www.workandincome.govt.nz/products/a-z-benefits/winter-energy-payment.html">https://www.workandincome.govt.nz/products/a-z-benefits/winter-energy-payment.html</a></td>
</tr>
</tbody>
</table>
### Table 1: The New Zealand Context (continued).

<table>
<thead>
<tr>
<th>Service</th>
<th>Description</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food Grants</strong></td>
<td>Grant for people on low-income or a benefit who need help paying for food. Weekly rate is dependent on circumstance.</td>
<td><a href="https://www.workandincome.govt.nz/eligibility/urgent-costs/food.html">https://www.workandincome.govt.nz/eligibility/urgent-costs/food.html</a></td>
</tr>
<tr>
<td><strong>Community Services Card</strong></td>
<td>Allows people receiving low-income to have subsidised access to services such as GP appointments, medical scripts, pools and gyms.</td>
<td><a href="https://www.workandincome.govt.nz/products/a-z-benefits/community-services-card.html">https://www.workandincome.govt.nz/products/a-z-benefits/community-services-card.html</a></td>
</tr>
<tr>
<td><strong>Wage Subsidy</strong></td>
<td>Available to New Zealand businesses that experienced a greater than 40% decline in revenue during a 30-day period due to COVID-19. In return the businesses were expected to keep their employees at 80% of their usual wage. This scheme was initially for a 12-week period but businesses were then able to apply for another 8-week extension. Individuals who had lost employment due to COVID-19 were also able to apply for income relief payments of up to NZ$490 for up to 12 weeks.</td>
<td><a href="https://www.workandincome.govt.nz/covid-19/wage-subsidy/index.html">https://www.workandincome.govt.nz/covid-19/wage-subsidy/index.html</a></td>
</tr>
</tbody>
</table>

### Timeline*

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 February</td>
<td>• First case reported</td>
</tr>
<tr>
<td>14 March</td>
<td>• 14-days self-isolation at border (except Pacific)</td>
</tr>
<tr>
<td>19 March</td>
<td>• Border closed to all but returning New Zealanders</td>
</tr>
<tr>
<td></td>
<td>• 100-people gathering limit</td>
</tr>
<tr>
<td>21 March</td>
<td>• Four-level Alert Level System announced</td>
</tr>
<tr>
<td></td>
<td>• New Zealand at Alert Level 2</td>
</tr>
<tr>
<td>23 March</td>
<td>• New Zealand at Alert Level 3</td>
</tr>
<tr>
<td>25 March</td>
<td>• New Zealand at Alert Level 4</td>
</tr>
<tr>
<td></td>
<td>• National State of Emergency declared</td>
</tr>
<tr>
<td>27 April</td>
<td>• New Zealand at Alert Level 3</td>
</tr>
<tr>
<td>13 May</td>
<td>• New Zealand at Alert Level 2</td>
</tr>
<tr>
<td>8 June</td>
<td>• New Zealand at Alert Level 1</td>
</tr>
</tbody>
</table>

*Timeline reflects periods of heightened alert levels due to the COVID-19 pandemic.*
### Table 1: The New Zealand Context (continued).

#### Alert Level System at Time of First Lockdown *

<table>
<thead>
<tr>
<th>Alert Level 4: Eliminate</th>
<th>People instructed to stay at home</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Educational facilities closed</td>
</tr>
<tr>
<td></td>
<td>Businesses closed except for essential services (eg, supermarkets, pharmacies, clinics) and lifeline utilities</td>
</tr>
<tr>
<td></td>
<td>Rationing of supplies and requisitioning of facilities</td>
</tr>
<tr>
<td></td>
<td>Travel severely limited</td>
</tr>
<tr>
<td></td>
<td>Major reprioritisation of healthcare services</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alert Level 3: Restrict</th>
<th>Travel in areas with clusters or community transmission limited</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Affected educational facilities closed</td>
</tr>
<tr>
<td></td>
<td>Mass gatherings cancelled</td>
</tr>
<tr>
<td></td>
<td>Public venues closed (eg, libraries, museums, cinemas, food courts, gyms, pools, amusement parks)</td>
</tr>
<tr>
<td></td>
<td>Alternative ways of working required, and some non-essential businesses should close</td>
</tr>
<tr>
<td></td>
<td>Non-face-to-face primary care consultations</td>
</tr>
<tr>
<td></td>
<td>Non-acute (elective) services and procedures in hospitals deferred and healthcare staff reprioritised</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alert Level 2: Reduce</th>
<th>Border entry measures maximised</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Further restrictions on mass gatherings</td>
</tr>
<tr>
<td></td>
<td>Physical distancing on public transport (eg, leave the seat next to you empty if you can)</td>
</tr>
<tr>
<td></td>
<td>Limit non-essential travel around New Zealand</td>
</tr>
<tr>
<td></td>
<td>Employers start alternative ways of working if possible (eg, remote working, shift-based working, physical distancing within the workplace, staggering meal breaks, flexible leave arrangements)</td>
</tr>
<tr>
<td></td>
<td>Business continuity plans activated</td>
</tr>
<tr>
<td></td>
<td>High-risk people advised to remain at home (eg, those over 70 or those with other existing medical conditions)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alert Level 1: Prepare</th>
<th>Border entry measures to minimise risk of importing COVID-19 cases applied</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Contact tracing</td>
</tr>
<tr>
<td></td>
<td>Stringent self-isolation and quarantine</td>
</tr>
<tr>
<td></td>
<td>Intensive testing for COVID-19</td>
</tr>
<tr>
<td></td>
<td>Physical distancing encouraged</td>
</tr>
<tr>
<td></td>
<td>Mass gatherings over 500 cancelled</td>
</tr>
<tr>
<td></td>
<td>Stay home if you’re sick and report flu-like symptoms</td>
</tr>
<tr>
<td></td>
<td>Wash and dry hands, cough into elbow and don’t touch your face</td>
</tr>
</tbody>
</table>

one-month period from March to April changed at a rate almost double that of the previous 24 years. Hardship Assistance payments rose sharply. Food banks reported a 100% increase in demand during the lockdown period. Charitable organisations expressed concern over the rising number of those seeking support due to unemployment.

Methods

This qualitative study included a purposeful sample of 27 low-income New Zealanders aged 18 years or older. The research was planned during lockdown by a new research team working by Zoom. Interviews were undertaken immediately after lockdown, between 30 June and 31 July 2020. People were selected through community organisations, including the City Mission, in two cities in New Zealand (Auckland and Christchurch); Auckland population ~1.6 million and Christchurch population ~340,000 (www.stats.govt.nz/2018-census). Of the participants, 15 (56%) were female and 12 (44%) were male. Ethnicity was determined by self-identification, with some participants identifying with multiple ethnicities. In total, seven (26%) participants identified as Māori, 15 (56%) as New Zealand European, two as Dutch and one each as Cook Island Māori, Iranian, British, Indian, Fiji Indian and Filipino. The sampling strategy included over-sampling of Māori in order to ensure a strong Indigenous voice in the data. Participants' average age was 52 years, with the youngest being 30 and the oldest 64. All participants had a New Zealand Index of Socioeconomic Deprivation for Individuals (NZiDep) score of four or five (five is maximum deprivation) during the nationwide COVID-19 Alert Levels 4–3 lockdown. Twenty-three participants (85%) were on a government benefit prior to lockdown. Four participants lost their job during lockdown, two of whom commenced receiving a government benefit.

Participants lived in a wide range of circumstances typical of low-income communities. The sample includes sole parents, people seeking asylum or refuge in New Zealand and people with disabilities or long-term health conditions (eg, cerebral palsy, epilepsy, depression, arthritis). Some participants had experienced abuse, homelessness or drug addiction, or they had been through the justice system. All participants spent their lockdown at private dwellings, except for four, of whom one lived in a refugee trust home, one a City Mission home, one an institutional care home and one lived in their car.

Data were collected through semi-structured interviews (the interview guide is available from the authors on request). Questions focused on life during lockdown, how participants coped, what would have made lockdown easier, participants' views of the Government's COVID-19 response and its impact on their whānau (extended family) and their advice to the Prime Minister and Director-General of Health about how to deal with pandemics in the future. Interviews took around 30 minutes. They were audio-recorded with permission. Ethical approval for this study was obtained from the University of Otago Human Ethics Committee (D20/182).

This study is framed by political theory, particularly theory of political economy. Applying a political economy perspective requires an analysis of political discourse and action, including an analysis of the role of the state. Key to this is the extent to which the Government response was neo-liberal (centred on individual rights, the rights of the market and reduced state intervention) versus social democratic (centred on collective rights, addressing inequity, redistribution of resources and increased state intervention).

This paper explores the impact of the COVID-19 policy response from the perspective of some of the most vulnerable New Zealanders. It examines whether the Government's response protected the rights of these low-income New Zealanders and the participants' views of the response and their advice to the Government about how to deal with future pandemics.

Data were transcribed then coded and analysed using content analysis. Each transcript was coded independently by two researchers. Analysis involved discussion across the research team identifying key themes. The transcripts of Māori participants were independently coded and analysed by a Māori researcher (DL).
Results

Findings are presented below. Quotes are used to illustrate key points. Participant coding is as follows: M=Māori, NM=non-Māori, A=Auckland, C=Christchurch.

Impact of the outbreak on people’s lives

The majority of participants spontaneously discussed feelings of anxiety related to COVID-19 infection. In particular, people expressed anxiety around contracting COVID-19 and infecting vulnerable relatives in their bubble. While lockdown restricted almost all daily activities besides essential services, anxiety was felt during these essential interactions. It caused some people to restrict their activities even further: for example, not venturing past their letterbox for the entire lockdown.

“The fear of my partner, with him being sick... that was quite scary, you know, with him and how sick he is. Just having that fear of anyone being near him or coming near our house or even just walking up our shared driveway was enough to scare me.” (M, C4)

Most participants expressed sadness and hopelessness surrounding the impacts of COVID-19 around the world and the response of overseas leaders to the pandemic. A few stated they felt extremely distressed.

“[It was] like a war really, with an invisible enemy.” (NM, C12)

While a minority disengaged from the news, others found it made them appreciate New Zealand more when they compared themselves to people in other countries that were faring worse in the pandemic.

Experience of lockdown

Effects on wellbeing

The majority of participants found lockdown had a negative effect on their mental wellbeing. This included feelings of immense boredom, confinement and emotional volatility. However, the key effect identified across most participants was that of isolation. People felt isolated from their whānau, their communities and the day-to-day social interactions they had from their usual activities that they could no longer pursue.

“I just don’t think I could live like that, but we had, we just had to... ‘cause it’s the way it was.” (NM, C11)

“I would never want to be put in that situation ever again because that was hard, it was very stressful... when we need to see our families, they won’t open the door for us.” (M, A14)

One Māori participant commented on how difficult it was not being able to physically attend tangihanga (funerals) for whānau members who passed away during lockdown. Instead, they had to watch tangihanga on live stream.

As the lockdown continued, feelings of isolation resulted in significant mental distress for some individuals. This was particularly so for participants with pre-existing mental health conditions such as depression and anxiety, which were exacerbated by the lockdown. All but one of those participants in a solo bubble reported feelings of isolation, considerably more than those in joint bubbles. These feelings worsened as the lockdown and the length of isolation was extended.

“I think that with loneliness and depression, that’s what it is. It slowly creeps in... I think that’s how it is.” (NM, C14)

“So everyone, they got depressed, we probably got depressed, everyone that I knew was depressed. So it was a really really bad thing, ya know... but essential.” (NM, C12)

Although they still reported feeling isolated from loved ones, many long-term beneficiaries said they felt more prepared to cope with a life in lockdown. They noted that life on the benefit was similar to lockdown, as they did not work and interact with many people on a daily basis.

“It was a lot easier I think for beneficiaries during the lockdown, ‘cause we’re used to staying at home, ya know?” (NM, A2)

Similarly, those who suffered or who were suffering from loss and trauma noted that the impact of COVID-19 was less of a concern in contrast to their other problems. They expressed being prepared for trauma.

“I’m used to it. I’m used to a long and painful journey.” (NM, A7)
Participants who became unemployed as a result of the lockdown appeared to suffer considerable emotional distress due to loss of financial freedom and the social support they received from their participation in paid employment.

“I had physical support but no emotional or mental health support at all. No psychological support.”

(NM, C6)

However, a number of participants noted positive effects on their wellbeing. These included having less traffic on the road, more time to connect with their whānau and an opportunity to reflect on life and be appreciative of things they normally took for granted.

“[Lockdown] gave me an opportunity to think about a lot of things, especially about a lot of others who were a lot less fortunate than myself.”

(NM, C14)

“I like it actually, spending more time with the family… in a way it’s quite pleasing. Yeah, just more interaction, communication with the kids.”

(M, A16)

Most participants felt safe at home. For the few who did not, this came from insecurity in those they shared their bubble with, concerns over others’ adherence to COVID-19 restrictions, personality conflicts, homelessness or failure of the institution in which they lived to keep them safe. Although some expressed being previous victims of domestic violence, none disclosed such experience during lockdown—but participants were not asked directly about whether they experienced any domestic violence during lockdown.

One participant found themself homeless for the entire lockdown. They slept in their car because they did not feel safe in their previous place of residence, a shared boarding house for previous offenders. They also lost their job due to lockdown.

“My boss never rang me back… I don’t know what happened. I lost everything that day.”

(M, A5)

They experienced many hardships, including hunger, being cold, loneliness, isolation and stress over not knowing when help would come.

“I was just stressing out, hard out, stressing all day every day, just over food really, especially after having nothing, no help from anyone.”

(M, A5)

One participant, who spent their lockdown in an institutional care home, had an extremely negative experience of lockdown. They expressed feeling ill-treated by the staff and distrustful and fearful of the institution. “You don’t complain unless you’ve got somewhere else to go” (NM, C12). Although they felt the restrictions were necessary, they also felt negatively towards the Government’s communication of the pandemic. They felt unsupported by their institution during lockdown. “It was all up to individuals” (NM, C12).

Financial effects
The majority of participants stated that they coped financially during lockdown and were able to pay their bills and provide for themselves and their whānau. This was aided by reduced expenditure due to the restrictions, alongside the raised payment across all government benefits and the increased Winter Energy Payment. However, many stated they endured financial stress and had to juggle spending to pay the bills. This was the case for five of the seven Māori participants, considerably more than the proportion of non-Māori. Despite the increase to the Winter Energy Payment, this stress usually related to the power bill, which, due to the larger number of people staying at home, was more expensive. The financial stress also influenced some participants’ access to medical services. One participant found they had to choose between paying for their medical scripts or paying the bills.

“So we have to [be] careful. 15–20 dollars goes like this and we have to plan. On the benefit, we can only pay the rent, pay two [cell]phone bills, pay for wifi.”

(NM, A3)

There was a difference between those who had been receiving a benefit for a long period and those who had lost their job due to COVID-19. Those who were receiving a benefit prior to lockdown displayed financial resilience with comments such as, “we pretty much just lived as normal” (NM, C15),
and, “I’m always watching my money” (NM, C1). Those who became unemployed due to COVID-19 and fell into financial hardship appeared to struggle a lot more and spoke of a sense of loss over financial freedom they had previously taken for granted.

“That was my job gone and I had to survive on the [Wage] Subsidy and I had to sign up with the jobseekers [benefit] as well because what money I was getting from subsidy wasn’t paying my power and also my food and my rent. It wasn’t enough there.” (M, A14)

Access to food
Despite many people reporting that they coped financially, the majority of participants accessed food banks during lockdown. Two participants reported not being able to access food. Over half of participants made comments expressing stress when accessing food. Participants noted the difficulty of accessing supermarkets, such as waiting in long lines that deterred them from shopping.

“Ya have to shop differently, ya know? Which makes it hard, especially when you’re not too well yourself and you need proper food.” (NM, A2)

Some participants spoke of their financial restrictions and increased food prices. This resulted in some participants being unable to access healthy food or using up their existing food.

“[I] always had access to food but didn’t always have access to good food.” (NM, C6)

Some participants expressed distress over others hoarding supplies, whereas others found they were reassured by supermarkets being well stocked.

Access to services
Most participants accessed some form of service during lockdown. This included GP teleconsults (a largely new development in response to COVID-19), pharmacists, psychiatrists and other social services. A key concern for the participants was the lack of information around availability of health and social services. Some also expressed unwillingness to access services due to fear of contracting COVID-19, fear of burdening the health system and stigma around the use of such services. For example, some participants stayed home when they ran out of inhalers and others relied on self-coping mechanisms for mental distress rather than seeking external support.

“And you started wondering where do you go? Or who do you see? I suppose there’s help-lines and things like that, but I’m very wary of those sorts of things.” (NM, C14)

The participants who accessed health services reported mixed feedback on their experiences. Although some found it easier to access teleconsults and prescriptions sent electronically, others felt distressed when seeking support over the phone. One participant found accessing healthcare for their partner with a chronic health condition difficult because they had no personal vehicle, because of changes in the bus timetable and also because of perceived restrictions placed on tertiary healthcare.

“There was a few scared moments because with the lockdown, the access to the hospital wasn’t that easy... [my partner] needs oxygen now and then, so it was pretty hard to try and get an ambulance.” (M, C4)

The majority of participants used social services such as the City Mission, WINZ, refugee trusts and food banks. Participants who used these services commented they had been provided with accommodation, financial aid, food and employment. Social services also provided many with a sense of community, which they felt significantly disconnected from during lockdown.

“I was a real lost cause when I arrived [at the City Mission]. You know, homeless and everything, had lost everything really... if it wasn’t for the Mission, I don’t know where my life would be right now. I mean it’s like a big family here.” (NM, C2)

Three participants felt they were treated disrespectfully when accessing WINZ. One of these participants was homeless throughout the lockdown therefore their main concern was having access to food. Desperation was a barrier to being able to receive help and prevented them from wanting to reach out to WINZ again.

“WINZ just hung up on me and declined me... it might have been me, my voice. I was hungry. I was getting...
annoyed because they kept asking all these questions about work and work and work and I was hungry.” (M, A5)

Another participant, in a better financial position, persisted, after which they were able to get the help they needed.

“She made me feel that I shouldn’t deserve to have a food grant... when I hung up, I said, ‘I’m going to have to ring back and get someone to listen to the conversation I had with the lady’... the big boss lady (of WINZ) phoned me back and apologised.” (M, A14)

Two participants experienced stress surrounding the delay in visa applications or effects of unemployment on their eligibility to live in New Zealand.

Some participants had difficulty accessing food banks because they did not realise food banks were an essential service or because of the rules imposed by the food banks. Due to having no physical address or ability to drive his car, one participant who was homeless during lockdown could not access these services. They had to survive mainly off bread and water for the entire lockdown.

“I had no money. I had a vehicle but no gas. I tried to walk there [to a church supplying food parcels] and get food but they wouldn’t let me. Needed a vehicle, stay in the vehicle. They put [the food] in themselves... They said you can’t come in, you have to be at home... I didn’t have an address for them to drop it off to.” (M, A5)

Coping strategies

Although most participants experienced mental distress, very few mentioned accessing mental health services. The majority of participants coped using self-help techniques. These included methods such as self-talk and relaxation techniques to calm themselves when feeling overwhelmed. The self-talk techniques were described by participants with comments such as:

“[I’d] give myself lectures saying, ‘come on, come on, this is going to be okay’.” (NM, C1)

Participants mentioned using exercise, household chores and indoor hobbies to occupy themselves. Many participants mentioned their ability to get out of the house to go for a walk helped them to cope with feelings of isolation and confinement.

“I had to go for my walk... if I got stuck... not [able to] get some vitamin C [sic], some fresh air into me, I don’t know where I’d be today.” (NM, C8)

The majority of participants found staying connected to their whānau and communities was important to support themselves. Due to the social restriction of lockdown, technology played a key role in connecting people to their sources of support. Participants mentioned calling and texting their loved ones frequently. This was particularly important for those participants in solo bubbles or who had loved ones overseas.

“Ringing my mum yeah every day. I think that was the biggest, it was just having that support on the phone.” (M, C4)

Technology was key in enabling community groups to adapt to the lockdown. Religious groups were able to stream their services, and social support groups, like the City Mission, provided chat forums and daily activities for their communities.

“Our church started having online church... they were really good for getting people through.” (NM, C10)

Some participants commented that connecting through technology was not the same, stating they missed physical human interaction.

“I don’t know what that is, but it’s like an emotion aye, a feeling, a vibe... A human thing. It’s like when you meet someone and you shake hands... and I don’t know what it is, but you get this warm glow that comes over you.” (NM, C14)

Although not specifically asked, two participants noted they did not have access to the internet during the lockdown. For these participants it was a key concern and a barrier to connecting with whānau and accessing education.
Opinions of the Government’s response

Participants were overwhelmingly positive about the Government's response to COVID-19. Most expressed trust in the Government and appreciation for its rapid and effective handling of the pandemic. “I think they did a top job” (NM, C14).

Participants were quick to contrast New Zealand’s position in the global pandemic with other countries. This helped them reflect on the lockdown in a positive manner. Participants reflected that New Zealand’s response ‘led the world stage’. Many spoke as a member of the ‘team of five million’.

“We got to help the health of each other. Keep yourself healthy and then look after each other.” (M, A15)

Participants appeared to be reluctant to criticise the Government even when there were breaches at the border. Some participants expressed anger towards politicians who undermined the Government’s decisions. “Shut up, Simon [the leader of the opposition]” (NM, C2).

“I think we’re very blessed in New Zealand. You know, compared to the other countries, I think we’re very very lucky.” (NM, C1)

Many participants specifically praised Prime Minister Jacinda Ardern and Director-General of Health Dr Ashley Bloomfield. Positive comments centred around valuing individuals’ lives, feeling truly cared about and the calm, collected and personable manner displayed by Ardern and Bloomfield.

“I really [want to stress] the thankfulness, you know, and gratefulness for what Jacinda Ardern has done. For me, my family, my friends. Magnificent. So I’m very, very grateful for that.” (M, A14)

Participants overwhelmingly viewed the Government’s restrictions as necessary to prevent the spread of the virus, and they reported adhering to them to keep others in their bubbles and the community safe.

“If we keep to the social distance... then maybe we could come out stronger... the whole of New Zealand could come out stronger.” (M, A14)

However, a few participants did report breaking restrictions for mental health reasons: for example, visiting friends or whānau to socialise. Most expressed guilt and an understanding that this was wrong. But they felt they could no longer cope.

“You try not to break the rules, but, you know, I live on my own. So yeah. So sometimes I went and visited friends with a mask on ‘cause I’d just had enough, you know?” (NM, A7)

Only one participant reported not adhering to restrictions, due to their distrust in the Government.

The vast majority of participants were extremely happy with the communications from the Government through the lockdown. Most participants engaged with and appreciated having the daily 1pm televised media briefings and found the communication clear and up to date.

“I did follow everyday... everyday at one o’clock. That helped... that helped me understand it.” (NM, C11)

Participants for whom English was not their first language also reported that the television subtitles were sufficient to gather a clear picture of the situation. A couple of participants made negative comments. “Too much... not COVID [again], I’m sick of the news” (NM, A1).

Advice for future lockdowns or pandemics

The vast majority of participants were positive about the Government’s response to the pandemic. Hence, when asked whether they had any advice for future pandemics, the majority of participants called for the Government to continue with their current approach.

“Exactly how they did this. They did excellent.” (NM, C15)

Over a quarter of participants expressed concern over a resurgence of COVID-19 in the community because of border insecurity. Most of these participants wanted stricter border procedures and testing prior to travelling to New Zealand. One participant called for complete border closure. Others requested more financial and practical support.

“I’ll first say the Government should provide the basics first. Food, gloves,
masks. Because how can anyone be safe without these?” (NM, A3)

Some participants expressed gratitude at the increase in benefits over the winter months and advised for them to stay high throughout the year. A few participants suggested the need for more social services and mental health support during lockdown.

“For people like me, if somebody [did] ring up say, ‘how ya feeling what ya need? You need help?’, that would make me happy.” (NM, C5)

One participant, who stood out in their negative opinion towards the response, expressed deep distrust in the Government.

“T'd sack half of what's in Parliament”. They called the communication surrounding COVID-19 ‘propagram’, claiming that “[you] can’t trust them as far as you can kick [them]” (NM, A1).

Discussion

Life during the COVID-19 lockdown was challenging for the low-income New Zealanders in this study. Participants were fearful of the virus. Lockdown impacted negatively on their mental health, as reported elsewhere.1,3,6 Feelings of isolation were common. Beneficiaries reported feeling more prepared to cope with lockdown than others because they are ‘used to staying at home’, a finding that highlights the social isolation that beneficiaries routinely endure.17 A number of people noted ‘silver linings’ to the lockdown, as identified by Every-Palmer et al.3

Most people felt safe at home, except for one homeless person and one in institutional care, two key areas for critical attention. Although some participants had previously experienced domestic violence, they did not report further incidents during lockdown. However, Every-Palmer et al noted elevated levels of domestic violence during lockdown.3 Safety at home, or having a home at all, are key concerns. The Government's ability to house many of the homeless during this crisis proves that solutions can be found to seemingly intractable problems. It is hoped that effective solutions can be maintained and more easily found in future without being prompted by a crisis.

Financial stress was common, particularly for Māori, despite the majority of participants stating they coped financially. Food insecurity was common. Clearly the pre-existing and increased government welfare payments were critical; yet this research suggests they were still not sufficient. Participants who lost their jobs during lockdown reported struggling more than beneficiaries, both with the financial hardship and their sense of loss. This finding emphasises the gap in the standard of living between beneficiaries and those in employment. It also underscores the importance of government and employer commitment to maintaining people in work during a public health crisis, including the importance of the COVID-19 Wage Subsidy.

Participants were largely resourceful and resilient. They coped with lockdown by using technology, self-help techniques, health and social services and support from whānau and their communities. New Zealand’s lockdown allowed people to go outside for exercise, which helped manage their isolation and confinement. This research suggests that, if possible, people should be able to go outside during lockdown. While technology may not totally bridge lockdown’s social divide, it is a key resource that the vast majority of participants were able to use well. However, solutions are needed for those without internet access.

Most participants accessed some form of social or health service during lockdown—unsurprisingly, given participant recruitment was through community services. Some participants expressed concern about the lack of information about the available services and a reluctance to use services for a range of reasons, including infection fear and stigma (previously reported stressors during quarantine)1 and not wanting to burden the system. Government social services were insufficient for participants’ basic needs, and it was necessary for these critical functions to be augmented by charitable social services, including in the provision of food. There were a number of barriers to social service provision, including access, delays, rules that were difficult to negotiate and disrespect from staff. It is concerning that some participants were already experiencing such severe hardship that the pandemic lockdown was perceived as having only a moderate impact on their lives.
In relation to health services, some participants found the innovation of teleconsults and electronic prescriptions easier, but others found them distressing. Previous research suggests that telehealth is not suitable for all people or all issues. One participant found it hard to access tertiary healthcare for her partner with a chronic health condition. At a time of crisis in the health system, these low-income New Zealanders were able to access New Zealand’s publicly funded, largely free health services and utilise innovations, albeit not without some challenges. This may not be the case in more neo-liberal countries with privatised healthcare, such as the US.

These low-income New Zealanders were overwhelmingly positive about the Government’s response to COVID-19. They expressed high levels of trust, adhered to restrictions and willingly participated as part of the team of five million New Zealanders working together to beat the virus. This is a particularly reassuring finding from some of the most vulnerable New Zealanders. So too is the participants’ advice for the Government to take the same approach in any future pandemic. The study findings, and the specific advice participants had for the Government, suggest the need for stricter border controls, further financial and practical support for low-income New Zealanders and specific focus on the needs of particularly vulnerable people, such as the homeless and those in institutional care.

This research was undertaken relatively early in the global pandemic and therefore presents the immediate impacts of lockdown. It was conceived, funded and developed during the lockdown. Due to New Zealand’s success in controlling the virus, it was possible to undertake the research face-to-face soon after the end of the initial lockdown, which reduced the risk of recall bias but precluded assessment of the longer-term impacts of COVID-19. Recruiting participants through community organisations, particularly the City Mission, was effective and timely. However, not all low-income people access services. Therefore, it is likely that these results underestimate the impacts of lockdown on those unable to access services. Over-sampling of Māori participants ensured a stronger Indigenous voice in the data. Given the over-representation of Māori among low-income New Zealanders, it is likely that Māori bore a heavier burden than the non-Māori population. Although this paper presents a study from New Zealand, this research has valuable insights for other jurisdictions with marginalised populations.

This research demonstrates the importance of eliciting the views of society’s most vulnerable citizens during a public health emergency. Undertaking such research can yield valuable information for strengthening responses and better meeting the needs of vulnerable people during and between periods of crisis. Future research including Indigenous people, children and young people and people not connected to social services is needed. Also, this research suggests the needs of those in institutional care and those who become unemployed as a result of pandemics need to be better understood. Follow-up studies are required to explore the long-term impacts.

If the greatness of a nation can be judged by how it treats its most vulnerable members, Aotearoa New Zealand appears to have shown considerable strength during the COVID-19 pandemic, at least according to the participants in this research. The keys to this success were the policy of going hard and going early, the more social democratic policy direction and the compassionate and clearly communicated leadership.

Research on life during lockdown for people receiving low-incomes is essential to guide future responses to pandemics or other emergencies. Researching the experience of vulnerable members of society during and immediately after crises, such as pandemics, is critical to ensuring that their rights as citizens are protected and that inequities in the impact of such crises are mitigated.
Competing interests:
Nil.

Acknowledgements:
The COVID-19 pandemic and the Government's subsequent response has had ongoing impacts on the lives of all New Zealanders. The researchers gratefully thank all the participants who shared their time and personal stories in the middle of ongoing difficult times. We also thank all community group leaders and coordinators who helped us recruit the participants. This research was funded by a grant from the Health Research Council of New Zealand, Grant No 20/1066.

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Making sure the New Zealand border is not our Achilles heel: repeated cross-sectional COVID-19 surveys in primary care

Kyle Eggleton, Nam Bui, Felicity Goodyear-Smith

ABSTRACT

AIM: Quick COVID-19 Surveys are an international collaboration designed to rapidly analyse and disseminate a primary care perspective on the pandemic and associated health response. In this paper we present results from surveys relating to opening the New Zealand border.

METHOD: Three surveys were distributed to primary care practices between May and December 2020. A range of primary care member organisations distributed the survey augmented by snowballing. Quantitative data were analysed using descriptive statistics and qualitative data through an inductive process and grouped into themes.

RESULTS: Respondents became increasingly supportive of opening a trans-Tasman border but not internationally. Two broad themes were evident: (1) making sure that the border is not an Achilles heel and (2) effective strategies to reduce local transmission. These themes highlight primary care’s concerns around management of the border and the management of local spread respectively.

CONCLUSION: The results highlight concerns around border control from a primary care perspective. The border control issues raised by primary care have proven to be prophetic at times and reflect the role that primary care has as observers of society. The survey mechanism provides a template for rapidly eliciting a primary care voice for future health issues.

As is well-known, in December 2019 the Chinese authorities advised the World Health Organization of cases of pneumonia of unknown cause, originating in Wuhan, Hubei province. This was subsequently identified as caused by a severe acute respiratory syndrome coronavirus 2 (named SARS-CoV-2), and a pandemic of coronavirus 2019 (COVID-19) was declared on 11 March 2020.

In parallel with researchers from the United States, Canada and Australia, from May 2020 we conducted regular (fortnightly or monthly) surveys of New Zealand general practices on the impact of the pandemic on primary care. Each fortnightly or monthly survey was termed a ‘Series’ and sequentially labelled. Our surveys were supported by a number of primary care organisations, including the Royal New Zealand College of General Practice (RNZCGP), the Royal New Zealand College of Urgent Care (RNZCUC), General Practice New Zealand (GPNZ), the Rural General Practice Network (RGPN) and the Practice Managers and Administrators Association of New Zealand (PMAANZ). Summary findings were rapidly available after each survey closed and disseminated to key policymakers, including the Chief Science Adviser for the Ministry of Health and the Director-General of Health, and the New Zealand media.

The participants were not intended to be representative of all New Zealand primary care practices. As indicated above, there are...
many organisations that represent aspects of New Zealand primary care, as well as the 30 primary health organisations (PHOs) to which practices may belong, but no single organisation speaks for all. The overall aim of the project was to provide an opportunity for the voices of primary care practice staff to be heard by policymakers.

The first line of defence against COVID-19 is border control, and once elimination has been achieved, ongoing primary healthcare approaches (public health and primary care), particularly COVID-19 testing and contact-tracing, are required to prevent or address border breaches from incoming travellers.7

Our borders were restricted on 16 March 2020, and then closed to all but New Zealand citizens and residents on 20 March. By 23 May 2020 (Series 1) New Zealand had moved down to Alert Level 2 and the curve had flattened. There had been 1,473 community and 31 managed isolation and quarantine (MIQ) cases, with 21 deceased. By 5 June (Series 2) there had been no more community cases for two weeks, and the country moved down to Alert Level 1 on 9 June. In August a community cluster from a border breach led to the Alert Level being raised (Auckland to 3, the rest of the country to 2), until it returned to Alert Level 1 on 8 October. By 9 December (Series 10) community spread had again ceased, and all cases were in MIQ.6

The aim of this paper is to present the findings of responses from New Zealand primary care doctors, nurses and practice managers regarding border control issues on 23 May, 5 June and 9 December 2020.

Method

The overall project uses a repeated cross-sectional survey design with a mixture of quantitative and qualitative data.

Ethical approval

Approval was granted by the University of Auckland Human Participants Ethics Committee on 11/05/20 for three years. Reference 024659.

Participants

Participants were doctors, nurses, nurse practitioners and practice managers working in New Zealand general practice, urgent care or other primary care settings. Secondary care clinicians were excluded.

Participant recruitment

Links to the survey were disseminated via the RNZCGP, the RNZCUC, GPNZ, RGPN, the PMAANZ, the New Zealand Medical Association, several PHOs not aligned with GPNZ and Facebook groups, including GPs Down Under, New Zealand Women in Medicine, GPs for GPs and Health Forum NZ. Respondents could also sign up for alerts to be sent each new survey link. A snowballing method was used—participants are invited to pass the link on to their primary care colleagues. Should they receive invites from multiple sources, they were asked to complete the survey only once.

Survey design

The survey in each series was based on the United States core questions plus one to three additional (‘flash’) questions determined by local contexts. Both quantitative responses, such as Likert scales and free-text options, were included. Demographics included their professional role (doctor, nurse, nurse practitioner, practice manager) and the size and nature of the practice (general practice, urgent care, rural or urban).

Survey delivery

The participant information sheet was accessed at the start of the survey. Completing the survey was implicit consent. Surveys were launched by the United States team at the Larry A Green Center using SurveyMonkey. No stored information is identifiable. Secure results were shared in a password-protected file using Filelocker. All analyses of New Zealand data were conducted by the New Zealand research team.

Questions analysed in this paper

Series 1, Series 2 and Series 10 surveys included the flash question, ‘Do you think it is safe to open up the country?’ In Series 1 the options were ‘No’, ‘Yes’, ‘It depends’, and ‘Unsure’. In Series 2 and Series 10, the choice of answers was refined to ‘No’, ‘Yes for domestic travel’, ‘Yes for trans-Tasman travel’, ‘Yes for Pacific Islands travel’ and ‘Yes for all international travel’. In all cases a free-text box was available for comments regarding the reasons for their response.

The surveys started after the New Zealand State of Emergency had been lifted on 14 May and community spread had been virtually eliminated. Series 1 was launched when New
Zealand was under Alert Level 2 (23 May); Series 2 when stepping down from Alert Level 2 to 1 (5 June); and Series 10 after New Zealand had been under Alert Level 1 for some weeks, following a second community outbreak in August (9 December). At Alert Level 1, the disease is contained in New Zealand but uncontrolled overseas, with sporadic imported cases and possible occasional isolated community transmission. Key events are shown in Figure 1.

**Analyses**

The quantitative responses were analysed using descriptive statistics. The free-text responses to the question about opening up the border in the three surveys were collated and coded independently by two researchers (KE and FG). An inductive content analysis approach was taken to coding with text categorised and then organised into themes through an abstraction process. Differences in coding were discussed between KE and FG before finalising the themes.

**Results**

There were 170, 153 and 64 participants in Series 1, Series 2 and Series 10 respectively (Table 1), with free-text responses to the question made in 100%, 65% and 30% of their responses.

Quantitative responses to the question about whether it was safe to open up the country are shown in Table 2. Free-text responses to the option ‘It depends’ in Series 1 led to qualifying ‘Yes’ with ‘domestic’, ‘trans-Tasman’ or ‘international travel’ in Series 2, and in Series 10 a Pacific Islands option was also added. It can be seen that by December 2020 just over a quarter were comfortable to open up to Australia and 42% to the Pacific, but none wished to open the border further.

During analysis of the qualitative data, two main themes were identified: (1) making sure that the border is not an Achilles heel and (2) effective strategies to reduce local transmission.

**Making sure that the border is not an Achilles heel**

Participants were uniformly opposed to opening up the country to international travel (Table 2). The border was generally seen as a significant risk in allowing COVID-19 to re-enter the country. There were three broad approaches, or sub-themes, to managing the border suggested by participants:

- stopping it before the border
- strengthening border controls
- opening with restrictions.

‘Stopping it before the border’ related to participants’ concerns that there is too much COVID-19 overseas or that global control needs to occur first before New Zealand can allow people to enter: for example, “International situation still unstable, NZ locally stable” [GP participant]. Often participants expressed fear, uncertainty or anxiety that our health system would not cope with another wave of COVID-19: “We are not ready for the second wave” [GP participant]. The experiences from the first wave of COVID-19 in New Zealand meant that participants would prefer to avoid further lockdowns, maintain a strict border and wait until vaccination enabled more open travel.

“Too risky to lose the gains we have made. Not sure the country could cope with a level 4 lockdown again.” [GP participant]

This latter quote, pertaining to losing the gains, related to other concepts of sacrifice or suffering that led to greater outcomes, and that opening the border would undo the hard work done by so many people.

“The risk of bringing a covid case to NZ is too high. It will jeopardise all we have sacrificed and achieved so far.” [Practice manager participant]

Concerns around the permeability of the border led to calls for greater strengthening of border controls for returning residents and border workers. Air crew and people entering on special work visas were identified as risks. The importance of strict quarantine procedures for everyone, as well as ongoing monitoring of returnees after leaving quarantine, was highlighted.

“I do not believe quarantine or self isolation is monitored appropriately in Auckland. There are many anecdotal instances... of the laxity of Auckland quarantine. Is close ongoing monitoring of these people occurring after they leave quarantine/isolation?” [Practice manager participant]
Figure 1: Key events relating to New Zealand border controls and social restrictions.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>29 Dec 19</td>
<td>2019 Chinese authorities advise the WHO of cases of pneumonia of unknown cause, originating in Wuhan, Hubei province</td>
</tr>
<tr>
<td>7 Jan 20</td>
<td>China isolates a novel coronavirus, at first called 2019-nCoV and later SARS-CoV-2</td>
</tr>
<tr>
<td>30 Jan 20</td>
<td>WHO declares the epidemic a global health emergency</td>
</tr>
<tr>
<td>3 Feb 20</td>
<td>NZ temporarily bans entry of foreigners from, or who have travelled through, mainland China. Homecoming NZers exempt but must self-isolate for 14 days</td>
</tr>
<tr>
<td>7 Feb 20</td>
<td>Ministry asks arrivals from or via China to register their 14-day self-isolation with Healthline</td>
</tr>
<tr>
<td>12 Feb 20</td>
<td>Disease renamed COVID-19</td>
</tr>
<tr>
<td>20 Feb</td>
<td>6 NZers enter quarantine facility after evacuation to NZ by air from the Diamond Princess cruise ship in Japan. 4 NZers from the ship admitted to hospital in Japan with the virus</td>
</tr>
<tr>
<td>28 Feb 20</td>
<td>NZ’s 1st confirmed case reported to Ministry of Health. Entry ban on foreigners from/via China extended to Iran. Returning NZers exempt but must self-isolate</td>
</tr>
<tr>
<td>2 Mar 20</td>
<td>People arriving from northern Italy and South Korea must self-isolate for 14 days</td>
</tr>
<tr>
<td>11 Mar 20</td>
<td>WHO declares the outbreak a pandemic</td>
</tr>
<tr>
<td>16 Mar 20</td>
<td>All passengers arriving in NZ, except those arriving from 17 Pacific Island countries/territories, must self-isolate for 14 days. Government bans non-essential outdoor gatherings of 500-plus people; schools and universities exempt</td>
</tr>
<tr>
<td>19 Mar 20</td>
<td>Government bans indoor events with more than 100 people; exemptions for workplaces, schools, supermarkets and public transport. Advises NZers not to travel overseas and urges those travelling overseas to consider returning home immediately</td>
</tr>
<tr>
<td>20 Mar 20</td>
<td>Border closed to most foreigners. Exempted categories include essential health workers</td>
</tr>
<tr>
<td>21 Mar 20</td>
<td>Alert Level system announced. NZ at Level 2</td>
</tr>
<tr>
<td>23 Mar 20</td>
<td>Government lifts country to Alert Level 3</td>
</tr>
<tr>
<td>25 Mar 20</td>
<td>Alert Level 4 lockdown</td>
</tr>
<tr>
<td>27 Apr 20</td>
<td>Alert Level reduced from 4 to 3</td>
</tr>
<tr>
<td>14 May 20</td>
<td>Alert Level 2. State of National Emergency expires</td>
</tr>
<tr>
<td>9 Jun 20</td>
<td>New Zealand steps down to Alert Level 1</td>
</tr>
<tr>
<td>12 Aug 20</td>
<td>Community cluster means Auckland goes to Alert Level 3, and rest of NZ to Level 2 for 3 days</td>
</tr>
<tr>
<td>14 Aug 20</td>
<td>Alert Levels extended</td>
</tr>
<tr>
<td>31 Aug 20</td>
<td>Auckland steps down to Alert Level 2, informally called Level 2.5 because of smaller permitted gathering sizes than the rest of the country</td>
</tr>
<tr>
<td>23 Sep 20</td>
<td>Auckland down to Alert Level 2 without restrictions on travel and gatherings, rest NZ Alert Level 1</td>
</tr>
<tr>
<td>8 Oct 20</td>
<td>Auckland moves down to Alert Level 1 - all of NZ now at Alert Level 1.</td>
</tr>
<tr>
<td>15 Feb 21</td>
<td>Auckland puts into Alert Level 3 lockdown and the rest of the country raised to Level 2 in response to three community cases shown to be UK variant</td>
</tr>
<tr>
<td>18 Feb 21</td>
<td>Auckland drops down to Alert Level 2, the rest of the country to Level 1</td>
</tr>
<tr>
<td>19 Feb 21</td>
<td>NZ's 1st vaccination against COVID-19, using Pfizer-BioNTech vaccine Comirnaty. Vaccinators are 1st recipients</td>
</tr>
<tr>
<td>23 Feb 21</td>
<td>Auckland drops to Level 1, all of NZ now at Level 1</td>
</tr>
<tr>
<td>28 Feb 21</td>
<td>Auckland moves backs to Alert Level 3 lockdown, rest of NZ Level 2</td>
</tr>
</tbody>
</table>

Table 1: Participants in Series 1, 2 and 10.

<table>
<thead>
<tr>
<th></th>
<th>Series 1</th>
<th>Series 2</th>
<th>Series 10</th>
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<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Qualitative responses</td>
<td>Total</td>
</tr>
<tr>
<td>GPs and urgent care doctors</td>
<td>123 (72%)</td>
<td>121 (71%)</td>
<td>85 (55%)</td>
</tr>
<tr>
<td>Nurse practitioners</td>
<td>2 (1%)</td>
<td>2 (1%)</td>
<td>0</td>
</tr>
<tr>
<td>Practice nurses</td>
<td>21 (12%)</td>
<td>21 (12%)</td>
<td>16 (11%)</td>
</tr>
<tr>
<td>Practice managers</td>
<td>27 (16%)</td>
<td>27 (16%)</td>
<td>58 (40%)</td>
</tr>
<tr>
<td>Total*</td>
<td>170 (100%)</td>
<td>170 (100%)</td>
<td>153 (100%)</td>
</tr>
</tbody>
</table>

*There are several respondents who indicate multiple roles.

Table 2: Responses to, ‘Do you think it is safe to open up the country?’

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<tr>
<th></th>
<th>Series 1</th>
<th>Series 2</th>
<th>Series 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>71 (42%)</td>
<td>18 (12%)</td>
<td>10 (16%)</td>
</tr>
<tr>
<td>Yes</td>
<td>23 (14%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>It depends…</td>
<td>68 (40%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Unsure</td>
<td>7 (4%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Yes, domestic</td>
<td>-</td>
<td>116 (76%)</td>
<td>47 (73%)</td>
</tr>
<tr>
<td>Yes, trans-Tasman</td>
<td>-</td>
<td>15 (10%)</td>
<td>17 (27%)</td>
</tr>
<tr>
<td>Yes, Pacific Islands</td>
<td>-</td>
<td>-</td>
<td>27 (42%)</td>
</tr>
<tr>
<td>Yes, international</td>
<td>-</td>
<td>4 (2%)</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>170 (100%)</td>
<td>153 (100%)</td>
<td>64</td>
</tr>
</tbody>
</table>
The risks of the border were identified by one participant as being the Achilles heel of New Zealand’s elimination strategy: “the border is the Achilles heel of the plan for elimination failing” [GP participant].

Despite proposals to open travel bubbles with Australia and Pacific nations, the majority of participants were hesitant and wanted to see restrictions in place before opening. Key to this was ensuring that there was adequate control in Australia before a travel bubble could be considered. Ongoing sporadic cases in Australia meant a general reluctance to allow travel, and, when combined with the fatigue caused by lockdowns that many of the participants were seeing in the public, this meant that the risks of further COVID-19 cases arising from Australia were perceived as being too high.

“I’d like to see a trans-Tasman/Pacific bubble, but with ongoing new infections in Australia, and a significant relaxation/fatigue with lockdown, not sure this will be achieved.” [GP participant]

A further concern for at least one participant was the prospect of New Zealanders spreading COVID-19 into the Pacific and the impact that might occur on a fragile health system.

“Would be scared of NZ taking it into Pacific Islands after measles problems.” [GP participant]

Although overseas travel within bubbles was seen as potentially fraught, a few participants in Series 2 felt that it was necessary to open up travel in order to protect the economy.

Effective strategies to reduce local transmission

This theme related to three interconnected areas, or sub-themes, of eliminating COVID-19 in the community before border opening could be considered:

- community control
- tracing and testing individuals
- vaccinating population.

Participants’ views of community control were around ensuring that COVID-19 was effectively eliminated, primarily by being certain that adequate time occurred between decisions around Alert Level changes.

“We need to be clear about the effects of going to Level 2, particularly in opening bars to ascertain if that will flush out further cases and possibly lead to clusters as has happened in overseas countries with similar low to zero numbers at the time. We need 2 x 2 weeks of zero cases to be certain because of the incubation/duration of infection period.” [Practice manager participant]

Workplaces and general practice waiting rooms were potential sites where ongoing transmission could occur and participants were reluctant to see a delayed spike in cases occurring: “We don’t want a delayed spike” [GP participant]. Of concern to a couple of participants was the observation that New Zealanders had become quite complacent towards COVID-19 and this could lead to further outbreaks.

“Those of us who have worked throughout can see that so many people have relaxed their standards already, so we could have an outbreak quite easily.” [Practice manager participant]

Effective tracing and testing individuals was deemed a critical component of reducing local transmission prior to border opening. One important element that related to this was gold standard contact tracing: for example, “Contact tracing needs to be perfect” [Practice manager participant].

Other elements included ongoing surveillance testing and strict guidelines on when to self-isolate and get tested. One participant identified the need for adequate provision of sick leave to enable people to self-isolate and not feel pressured to come into work.

“Government leadership to ensure workers/population supported to self-isolate with even minor respiratory symptoms (eg, extended access to sick-leave).” [GP participant]

The final sub-theme of effective strategies was vaccination. Participants did not see any hope on the horizon with opening up the border until an effective vaccination programme had been rolled-out. Opening the border in the absence of vaccinations...
would mean that the sacrifices would be for nothing.

“I would expect a vaccine and a better funded and structured healthcare system first. We have no immunity and no vaccine; the risks would be the same for our population as at the beginning of the pandemic. If they open up before any of the above, then the lockdown and it all entailed was for nothing.” [GP participant]

Discussion

The importance of border control, along with quarantine, to curb the spread of pandemics has been recognised throughout history. Rapid border control is seen as the front-line strategy. Border control measures enforced in China have been shown to dramatically limit spread, and not instituting travel restrictions is likely to have led to accelerated spread in Spain, Italy and Central Europe.

A study of different implementation strategies in seven Western-Pacific countries (Hong Kong Special Administrative Region, Japan, Malaysia, Shanghai, Singapore, South Korea, Taiwan) found that implementation of border control measures, along with case-finding by rapid tests and social distancing measures, was associated with bringing outbreaks under control, and a Taiwanese study records eliminating an early outbreak using border control along with enhanced surveillance, case detection with contact tracing, quarantine and population-based interventions, such as the use of face masks.

New Zealand researchers recognise that the border is our Achilles heel, and incoming cases may lead to re-emergence of community transmission. Kvalsvig et al recommend increased risk management with strategies that minimise incoming infections, risk of missed cases or contacts and consequences of infected or susceptible individuals mixing with and infecting others. Other researchers identify that a surveillance system with a very high level of routine testing is required to detect ongoing breaches at our borders.

Concerns around the Achilles-heel nature of the border has also led primary care practices to reflect on the sacrifices that have occurred to eliminate COVID-19. Participants viewed the sacrifice in fragile terms, reflecting their position as observers of society. This framing is consistent with the proposition that solidarity becomes more tenuous when sub-groups of the population feel invulnerable and fail to adhere to public health messaging (eg, failure to social distance or border breaches) or are given certain privileges (eg, air crew).

New Zealand academics have not been unanimously supporting border controls and social restrictions, and since February 2020 a small group of scientists and clinicians have advocated ‘COVID-19 Plan B’, protesting that New Zealand should not ‘hunker in a bunker’ and shut ourselves off from the rest of the world. They continue to maintain a Facebook page promoting full opening of borders. Results from our study indicate that general practice staff are not convinced by the data promulgated by this group. Given that COVID-19 Plan B now also advocates against government roll-out of the COVID-19 vaccination programme, it is important to note that this vocal group appears to have had little influence on GP opinion.

Strengths and limitations

Our repeated Quick COVID-19 Surveys give primary care practices a voice. Rapid analyses and dissemination to key ministry officials, primary care organisations and the media has given them opportunity to impact on policy. Findings have been disseminated through TV, radio and written media and have included Ministry of Health responses on how some of the expressed concerns will be addressed, such as access to tests and personal protective clothing and funding for additional workload: for example, testing or vaccination delivery (see https://covid-19-pc.auckland.ac.nz/media/). However, it should also be noted that the sample size is relatively small and not representative of the whole practice staff population, and the rapid analyses are inevitably ‘rough and ready’.

Implications

Our participants have proved to be prophetic on occasion. For example, their concern that New Zealanders are too
relaxed about the possibility of community spread has recently come to pass, with the February/March 2021 lockdown due to those told to self-isolate breaking the rules. Other examples are their caution towards opening up to Australia (which also continues to have community outbreaks) and needing to keep borders closed with Pacific countries to protect them. Primary care health professionals are at the interface between the public and government. Utilising rapid surveys, such as the Quick COVID-19 Surveys, provides an opportunity for policymakers to understand a primary care perspective that is often grounded in pragmatic reality.

Conclusion

These Quick COVID-19 Survey results have highlighted concerns around border control from a primary care perspective. The border control issues raised by primary care have proven to be prophetic at times. Often a primary care perspective is lacking in policy decisions and the rapid analysis and dissemination of the surveys has the potential to address this to some degree. Greater attention could be applied to the use of rapid, repeated primary care-based surveys in the future, in order to understand a primary care position on an evolving public health matter.

Competing interests:
Nil.

Acknowledgements:
We would like to acknowledge our international colleagues, Prof Kirsty Douglas, Drs Kathleen O'Brien, Katelyn Barnes and Sally Hall from Australia; Dr Rebecca Etz, Ms Sarah Reves and Mr Jonathan O'Neal from the United States; and Dr Sabrina Wong from Canada. Our appreciation to all individuals and organisations who have delivered our survey links and disseminated our results, and lastly a big thanks to everyone who have completed our surveys, either once or on multiple occasions.

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REFERENCES


An NP-led pilot telehealth programme to facilitate guideline-directed medical therapy for heart failure with reduced ejection fraction during the COVID-19 pandemic

Andy McLachlan, Chris Aldridge, Mary Morgan, Mayanna Lund, Ruvin Gabriel, Valerio Malez

ABSTRACT

AIMS: Heart failure with reduced ejection fraction (HFrEF) is associated with poor outcomes. While several medications are beneficial, achieving optimal guideline-directed medical therapy (GDMT) is challenging. COVID-19 created a need to explore new ways to deliver care.

METHODS: Fifty consecutive patients were taught to identify fluid congestion and monitor their vital signs using BP monitors and electronic scales with NP-led telephone support. Quantitative data were collected and a patient experience interview was performed.

RESULTS: The majority (76%) of the cohort (male, 76%; Māori/Pacific, 58%) had a new diagnosis of HFrEF, with 90% having severe left ventricular (LV) dysfunction. There were 216 contacts (129 (60%) by telephone), which eliminated travelling, (time saved, 2.12 hours per patient), petrol costs ($58.17 per patient), traffic pollution (607 Kg of CO2) and time off work. Most (75%) received contact within two weeks and 75% were optimally titrated within two months. Improvements in systolic BP (SBP) (124mmHg to 116mmHg), pulse (78 bpm to 70 bpm) and N-terminal pro-brain natriuretic peptide (NT-proBNP) (292 to 65) were identified. Of the 43 patients who had a follow-up transthoracic echocardiogram (TTE), 33 (77%) showed important improvement in left ventricular ejection fraction (LVEF).

CONCLUSIONS: Patients found the process acceptable and experienced rapid titration with less need for clinic review with titration rates comparable with most real-world reports.
The heart failure service at Counties Manukau District Health Board (CMDHB) includes a multidisciplinary team and has a strong focus on titrating evidence-based medications to guideline-directed doses. Timely titration may be limited by a variety of factors, such as clinic volumes or barriers to patients attending clinics or filling prescriptions.

Different models of care have been attempted to improve GDMT, with multidisciplinary, HFrEF-specific clinics being effective. Telehealth has also shown promise, particularly in patients with complex comorbidities and socioeconomic barriers to access.

On the 23 March 2020, as the COVID-19 pandemic swept across the globe, Aotearoa New Zealand went into level 3 lockdown, and then a full level 4 lockdown two days later. The future of healthcare was uncertain. With a cohort of patients currently in hospital being treated for acute heart failure, normal outpatient titration of GDMT could not continue as usual. Both patients and healthcare providers, anxious about the risk of spreading the virus, limited face-to-face contact. Telephone support for titration of heart failure (HF) therapy was suggested. Although neither new nor novel, it had never been attempted in our department as a method of titrating HF medications. Under lockdown, a rapid and pragmatic response was required, with early reports suggesting that the pandemic was having a significant negative impact on patients attending for care.

Remote management raised concerns regarding an inability to safely optimise GDMT without vital sign measurements and laboratory results. A clinical care plan was developed to manage patients safely during this period.

This paper describes the feasibility of telephone support by the HF team with the use of scales and blood pressure (BP) monitoring devices to augment decision-making.

Methods

Using the latest decision pathway for optimisation of heart failure treatment, our aims were to facilitate titration while limiting in-person clinic visits by using patient self-monitoring with a package that included funded home BP monitors and electronic scales alongside nurse practitioner (NP)-led telephone support for patients with HFrEF.

The goal was to titrate medications safely with a target of two weeks between enrolment and first contact and two weeks between medication changes. This had to be achieved within the existing workflow and be acceptable for patients. Pragmatic criteria were developed to identify patients who had a clinical indication for titration and would be able to engage with this approach.

Patients were identified during an acute HF admission by the cardiology team and asked to participate if they met the inclusion criteria. A commitment to engage with the home monitoring system was agreed by the patient and the HF team.

Inclusion criteria:

- Patients willing to participate with symptomatic HFrEF (left ventricular ejection fraction (LVEF) <40%) and requiring titration
- Ability to collect prescriptions from a community pharmacy and have blood tests collected every two weeks
- Patients who can understand instructions in English
- Arm diameter between 22cm and 42cm
- Weight <200kg

Exclusion criteria:

- Chronic kidney disease (CKD; eGFR <30 ml/min/1.73m²)
- Hyperkalaemia (K+ >5.4mmol/l)
- Hypotension (SBP <90mmhg)
- More than first degree heart block with no pacemaker
- Severe aortic stenosis
- End stage heart failure and not for active titration
- Atrial or Ventricular arrhythmia that could interfere with the accuracy of the BP and HR monitor

The team introduced the process and discussed the need for frequent dose adjustments and blood tests following dose adjustments. Self-help material included ‘How has your breathing been in the last 2–3 days’ (a visual scale) and the book *Living Well with Heart Failure* (available...
from www.heartfoundation.org.nz), which facilitates monitoring symptoms and vital signs. A HF action plan and guidance for daily checks looking for signs and symptoms of decompensated HF was introduced. The blood pressure monitors (Omron HEM-RML31) and electronic scales (capacity 200kg) were given to each patient following a practical demonstration.

A booked fortnightly telephone call from the NP or clinical nurse specialist (CNS) was agreed. Clinical support and guidance were available from a consultant cardiologist. The first New Zealand lockdown was coming to an end by the time we started; but contact was still uncertain because patients preferred not to come to outpatient reviews, and health teams were still being advised to maintain virtual reviews, where possible. However, we relaxed the non-contact rule, and a face-to-face option was made available if required. Each patient, where possible, met the HF team member who would support them at the beginning of the trial. Some patients preferred email contact and text, although telephone support was the most common way of communicating.

Up-titration was facilitated by a new electronic ePrescription and eLabform process that had been fast tracked into clinical use.

Data was statistically analysed using excel and a QI Macro with support from the statistics team from Ko Awatea, CMDHB’s centre for health innovation and improvement. For each hypothesis test, we set an alpha value of 0.05 and used a paired t-test to compare the variables before and after the trial participation, after having verified that the difference between pairs were normally distributed.

Quantitative data was collected in a secure database, and a patient experience telephone interview was conducted by Ko Awatea, independently of the cardiology team.

Patient symptoms, clinical findings and any change in the HF plan were notified in real time using a secure, electronic template that communicated directly to the designated primary care provider.

The accessibility benefits to the patient from the virtual consultation was calculated based on distance travelled from the patient’s home address to the outpatient department (Google Maps was used to calculate distance). Standard car petrol usage was used to calculate petrol costs. The travel time was based on off peak traffic volumes to calculate a conservative estimate of time saved.

Data collected include:
- Baseline
  - Demographics
  - Vital signs and weight
  - NT-proBNP, renal function and electrolytes
  - Date of HF recent hospitalisation
  - Transthoracic echocardiogram (TTE) assessment of LVEF
  - Baseline medication use/doses
- Follow-up
  - Number of contacts
  - Time to contact
  - Time to maximal tolerated GDMT
  - Reason for variation in titration
  - Hospitalisations/deaths
  - Change in clinical parameters

**Results**

Between 7 March and 5 August 2020, 52 patients were enrolled with HFrEF and agreed to take part in the trial. Two patients accepted but died before any outpatient contact was initiated and were excluded, leaving 50 patients in the cohort for analysis.

Support for medication concordance, alcohol harm reduction and smoking cessation support was offered to all.

Table 1: Demographics.

<table>
<thead>
<tr>
<th>Total =50 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Mean age (all)</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Māori</td>
</tr>
<tr>
<td>Pacific Islanders</td>
</tr>
<tr>
<td>Others</td>
</tr>
</tbody>
</table>

Compared to the population of CMDHB: Māori 16%, Pacific 34% and others 63%.


Each participant had an assessment of their left ventricular ejection fraction (LVEF) either at the time of hospital admission or prior to clinic referral. Almost all (90%) were classified as having severe left ventricular dysfunction (LVEF <30%), with 48 (96%) reporting being symptomatic, New York Heart Association (NYHA) class 2 or above. This is a high-risk cohort of patients with significant HFrEF with a prognosis worse than most cancers.

Time to first contact
The time to contact was consistent, with low standard variation (5 days over a mean of 10.8 days): 50% were contacted within 9 days, 75% contacted within 14 days and all were contacted by 28 days.

The majority (60%) of enrolled patients had been in hospital within the last six months with a primary diagnosis of decompensated HF: 50% of patients were enrolled within two months from their most recent hospitalisation and 75% within four months.

The virtual consultation effect
During the period of the trial, 216 contacts were made: 129 (60%) by telephone and 87 (40%) face to face.

By eliminating the need to travel to the outpatient department, we estimated each patient saved on average 2.12 hours and travelled 73.6 fewer kilometres. This equates to savings in travel costs of $2,908 during the pilot, or $58.17 per patient. Total CO₂ emissions were reduced by 607 Kg, which would have required 27.9 medium-sized trees to absorb this amount within one year.

GDMT summary
Within two months of entering the trial (56 days), 75% of patients were deemed to be optimally titrated, with 88% achieving ≥50% of target dose of renin angiotensin blocker, 74% achieving ≥50% of target dose of beta blocker and 62% being on spironolactone (MRA).

The use of Entresto (ARNI), a novel nepri-sylin inhibitor/angiotensin receptor blocker agent, increased from 12% to 40% and diuretic use fell from 46% to 26%.

Reasons for variation in GDMT
Over one third (17 (38%)) of patients were up titrated in a step-like fashion with regular monitoring and tolerated the process uneventfully. A resting heart rate consistently less than 60bpm limited titration in 11 patients (22%). A resting systolic blood pressure less than 90mmhg or symptomatic hypotension limited titration in nine (18%), and a further four (8%) developed significant hyperkalaemia or a deterioration in eGFR, requiring stopping or reducing the dose of GDMT. Two patients (4%) had significant comorbidity related to cancer therapy, which delayed contact due to frequent hospitalisations. Despite multiple attempts, five (10%) patients were either unable to be consistently contacted or declined to optimise any therapy. Cardiology outpatient clinic non-attendance rates are approximately 20%.

Table 2: Baseline characteristics.

<table>
<thead>
<tr>
<th></th>
<th>Total=50, (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New diagnosis of HFrEF</td>
<td>38 (76%)</td>
</tr>
<tr>
<td>History of CVD</td>
<td>21 (42%)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>34 (68%)</td>
</tr>
<tr>
<td>Atrial fibrillation/flutter</td>
<td>12 (24%)</td>
</tr>
<tr>
<td>Obstructive sleep apnoea</td>
<td>6 (12%)</td>
</tr>
<tr>
<td>Type 2 diabetes</td>
<td>22 (44%)</td>
</tr>
<tr>
<td>HbA1c (mmol/l)</td>
<td>Mean 64 (range 43–100)</td>
</tr>
<tr>
<td>Body mass index (kg/m2)</td>
<td>Mean 32 (range 18–59)</td>
</tr>
<tr>
<td>CKD (eGFR &lt;50 ml/min/1.73m²)</td>
<td>11 (22%)</td>
</tr>
<tr>
<td>Implantable defibrillator (ICD) in situ</td>
<td>4 (8%)</td>
</tr>
<tr>
<td>Reported non-concordance</td>
<td>8 (16%)</td>
</tr>
<tr>
<td>Current smoking</td>
<td>10 (20%)</td>
</tr>
<tr>
<td>Harmful alcohol use</td>
<td>8 (16%)</td>
</tr>
</tbody>
</table>

Table 3: Baseline left ventricular ejection function.

<table>
<thead>
<tr>
<th>LVEF</th>
<th>N =50 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 20%</td>
<td>23 (46%)</td>
</tr>
<tr>
<td>21–30%</td>
<td>22 (44%)</td>
</tr>
<tr>
<td>31–35%</td>
<td>5 (10%)</td>
</tr>
</tbody>
</table>
HF outcomes
With a mean of 203 days (range 140–264 days) follow-up, there were no deaths during the course of the pilot.

Twenty-five admissions in 19 patients (38%) were recorded with four admissions (8%) related to HF.

Clinical outcomes
During the evaluation there were significant reductions in systolic blood pressure (p = 0.004), heart rate (p = 0.002) and NT-proBNP (p = 0.001) (Figure 1). Other indicators, such as eGFR, serum potassium and NYHA class, showed no significant changes (p = 0.2).

Assessment of LVEF
Forty-three patients (86%) received a follow-up TTE after titration to maximum tolerated GDMT.

Ten patients (20%) had continued severe left ventricular (LV) dysfunction and were referred back into the HF clinic for device therapy or further GDMT optimisation. Thirty-three patients (66%) showed improved LV function with 10 (20%) moving from severe LVEF <30% to moderate LVEF >35% and 23 (46%) improving to mild dysfunction, defined as LVEF >40% (p = 0.0001).

Patient experience
Fourteen patients consented to a telephone interview: half female, half male, four Māori, four Pacific, five Pākehā and one Asian (Appendix Figure 1). The majority of patients expressed confidence in using and reading the BP monitor from home. Patients reported feeling empowered and having increased motivation to manage their health conditions since participating in the trial. Patient experience with clinicians was positive, with the majority describing appreciation for the interaction and rapport. They expressed an understanding of the changes to their medication and felt that the alterations were beneficial to their health. The booklet provided by the service facilitated patients' understanding and acceptance of changes to medication. There were a few patients who specifically needed more support, including a better understanding of the detail of what they needed to do, when they needed to do it and what to expect.

Table 4: Cause of heart failure.

<table>
<thead>
<tr>
<th>Condition</th>
<th>N=50 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiomyopathy</td>
<td>50 (100%)</td>
</tr>
<tr>
<td>Ischaemic</td>
<td>14 (28%)</td>
</tr>
<tr>
<td>Non-ischaemic</td>
<td>36 (72%)</td>
</tr>
<tr>
<td>Dilated (not further defined)</td>
<td>17 (34%)</td>
</tr>
<tr>
<td>Accelerated heart rate</td>
<td>9 (18%)</td>
</tr>
<tr>
<td>Alcohol</td>
<td>4 (8%)</td>
</tr>
<tr>
<td>Valvular</td>
<td>3 (6%)</td>
</tr>
<tr>
<td>Anthracycline</td>
<td>2 (4%)</td>
</tr>
<tr>
<td>Sarcoid</td>
<td>1 (2%)</td>
</tr>
</tbody>
</table>

Table 5: Optimal tolerated titration dose of GDMT.

<table>
<thead>
<tr>
<th></th>
<th>ACE/ARB/ARNI</th>
<th>Beta blocker</th>
<th>MRA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target</td>
<td>28 (56%)</td>
<td>16 (32%)</td>
<td>24 (48%)</td>
</tr>
<tr>
<td>50–99% of target dose</td>
<td>16 (34%)</td>
<td>21 (42%)</td>
<td>7 (14%)</td>
</tr>
<tr>
<td>Low/none</td>
<td>6 (12%)</td>
<td>13 (26%)</td>
<td>19 (38%)</td>
</tr>
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</table>

Discussion
In New Zealand, approximately 5,500 patients generate about 12,000 hospital admissions for HF each year. The average length of stay is five days, and the overall costs associated with HF account for 1.5–2% of the total health budget, most of which is for inpatient care. It is estimated that approximately 20% of the population will develop HF in their lifetime, which places a significant burden on individuals, communities and health services. Having skilled teams provide gold-standard and individualised HF assessment and management is vital work, but many patients remain underserved. During the COVID-19 pandemic, this became even more challenging, and the HF team introduced an inexpensive, home-based approach to heart failure care. We achieved rates of timely GDMT optimisation—at least as good as many contemporary clinical studies—and we managed to do this within existing workloads and good engagement from most patients.
It is projected that the number of people with heart failure will increase as people live longer and can access more effective treatments for coronary heart disease associated with a reduction in mortality. Inequality persists, with the mortality rate from heart failure for male and female Māori aged over 65 years being significantly higher than for non-Māori. Rates of hospitalisation for heart failure among Māori in this age group are also significantly higher than for non-Māori. Māori are significantly younger on admission to hospital for heart failure than New Zealand Europeans (62 years compared to 78 years). Morbidity and mortality from heart failure for Pacific peoples is approximately twice as high compared to the total population.

Over half (58%) of our pilot group were Māori or Pacific and we were able to show active engagement and equitable outcomes compared to the non-Māori or non-Pacific participants.

A recent New Zealand-wide cohort study of patients with acute coronary syndrome (ACS) showed that rates of GDMT in those with reduced LVEF was low at one year post discharge—only 34% and 35% received ≥50% target doses of ACEi/ARB and beta-blockers respectively. Suboptimal use of GDMT therefore persists despite its association with improved patient mortality and reduced heart failure hospitalisations.

Technological advances have allowed increasingly sophisticated methods to remotely monitor and manage heart failure. Simple telephone-based remote assessments, stand-alone home-based systems, implanted devices with advanced haemodynamic monitoring features and now wearable technologies have opened up a range of opportunities to facilitate patient management. It is relatively easy to collect data remotely, but it has been a challenge to find a way to integrate continuous data streams into already overloaded systems of care, and to convert remote data into better decision-making that improves the outcome or experience of care.

Both structured telephone support and telemonitoring have been reported as being effective in reducing all-cause mortality and heart failure related hospitalisations, as well as improving quality of life, reducing healthcare costs and enhancing GDMT. A positive effect was noted using telehealth to monitor heart failure patients in a home environment, with patients showing an increased self-awareness around managing their condition and increased empowerment and confidence. Essential characteristics of effective telehealth include clinical feedback in the form of 'teachable

Figure 1: Comparison between BP, HR and BNP at baseline compared to follow-up.
moments’, a system which is easy and quick to use and patients perceiving tangible benefits from the system.\textsuperscript{33}

Interviews suggest that telehealth is generally acceptable to most patients, including Māori and their whānau.\textsuperscript{34} Despite this, there is a high rate of telehealth refusal among patients, which is not well understood.\textsuperscript{35} The perception for many, particularly older and less tech-aware people, is that telehealth is remote, cold and distant, and many people prefer a more personal touch from their healthcare provider.\textsuperscript{36} However, we did not find this to be a significant issue, perhaps as the COVID-19 environment increased acceptability of alternative models of care.

The benefits of telemonitoring are dependent on a number of factors. Researchers have not consistently shown positive outcomes, which has led commentators to criticise speed of uptake and implementation.\textsuperscript{37} Increased costs and clinical workloads have also been reported.\textsuperscript{38} It is possible the benefits seen in telemonitoring trials could be due to enhancement of the underpinning clinical service rather than the telemonitoring communication itself.\textsuperscript{39}

Because of increased communication with patients, which often occurs outside of formally booked clinic times, the CMDHB pilot resulted in additional workload for the clinicians. This was offset by fewer face-to-face appointments during and immediately after lockdown. This additional workload will likely be unsustainable when face-to-face clinics are again running to full capacity. Additional staff and monitoring device resources will be required for a sustainable programme. The patients accepted the process and appreciated the efforts of the HF team to reassure and support them through these challenging times.

**Limitations**

This was a small feasibility pilot project, delivered rapidly and in very uncertain times by an enthusiastic team of HF focused clinicians. The patients were a selected cohort and may not represent the entire HF cohort.

The strengths of this report are the inclusion of participants representative of our HF cohort and the wider community. We performed telephone interviews to understand the patient experience and a further follow-up telephone interview is planned.

The exclusion of non-English speaking participants impacted on our ability to provide an equitable service, and we have since explored the use of interpreters using three-way telephone conversations. The majority of patients were able to be contacted, although access to mobile phones was inconsistent for some and did limit engagement.

Further research is needed to understand the components of this observational

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**Figure 2**: LVEF at baseline compared to follow-up.
study that can be used as an adjunct to good
quality heart failure care.

Conclusion

For most patients, the home monitoring/
telephone process resulted in rapid titration
and less need for clinic review. Patients
found the process acceptable and 60%
of clinic visits were able to be held remotely,
saving patients both time and money.
Titration rates and markers of improved
outcomes improved across cardiac imaging,
biochemical and clinical findings, and were
comparable to most real-world clinical
reports. Although this is not a novel or inno-
native process, it is not usual care in New
Zealand. This simple and straightforward
process could be replicated across DHBs.
Appendix

Appendix Figure 1: Patient experience questionnaire page one. View the complete Appendix Figure 1.

Blood pressure monitoring questions for telephone interviews

Proposed telephone interviews with patients at approximately day three (to identify immediate concerns) and follow-up interviews at the date that drop outs tend to occur

Patient details

Anonymised Name: Age: Suburb you live in: Ethnic group/s: Zoom or Telephone Interview: Contact Number: Zoom Link: Availability for interview (Fill in details below) Date: Time:

Elevator pitch

Hello/Kia ora/Talofa/ Malo e lelei/ Namaste/ Ni hao/ Fakaa alofa lahi atu my name is... from Counties Manukau Health. I am calling to see how you are finding doing your own blood pressure and weight checks from home? Are you happy to speak with me in an interview about how it is going?

• No... is there another time that would be better for me to call you?
• No... ok thank you for your time, take care and stay safe, goodbye.
• Yes... ok thank you... Are you available for 20 minutes now or would you like me to call you back?

Thank you, we will continue.

For the first time we are helping patients to check their own blood pressure and weight from home, while also making sure that you are safe and your health is not getting worse. Our patients' feelings are important to us, so we need to make sure we support you as best we can, this interview will help us to do this. We would like to know your thoughts about checking your own blood pressure and weight changes from home and have some questions we would like to ask you. Your thoughts will also help us to understand what is going well, and not so well and how it may work better.

We are asking patients to take part in telephone interviews lasting around 20 minutes of your time.

We will not be audio recording our conversation, but will write notes as we are speaking. The information you share with us will be confidential and no one involved in your care will know that you have spoken with us. All information you provide is confidential and will not include your name or other personal details that identify you in any of our reports.
Competing interests:
Dr Lund reports other from Amgen inc and personal fees from Novartis outside the submitted work.

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Empty waiting rooms: the New Zealand general practice experience with telehealth during the COVID-19 pandemic

Geraldine Wilson, Olivia Currie, Susan Bidwell, Baraah Saeed, Anthony Dowell, Andrew Adiguna Halim, Les Toop, Ann Richardson, Ruth Savage, Ben Hudson

ABSTRACT

AIM: The primary care response to the coronavirus disease 2019 (COVID-19) pandemic in early 2020 required significant changes to the delivery of healthcare by general practices. This study explores the experiences of New Zealand general practice teams in their use of telehealth during the early stages of the COVID-19 pandemic in New Zealand.

METHOD: We qualitatively analysed a subtheme on telehealth of the General Practice Pandemic Experience New Zealand (GPPENZ) study, where general practice team members across the country were invited to participate in five surveys between 8 May 2020 to 27 August 2020.

RESULTS: 164 participants enrolled in the study during survey one, with 78 (48%) completing all surveys. Five telehealth themes were identified: benefits, limitations, paying for consults, changes over time and plans for future use. Benefits included rapid triage, convenience and efficiency, and limitations included financial and technical barriers for practices and patients and concerns about clinical risk. Respondents rapidly returned to in-person consultations and wanted clarification of conditions suited to telehealth, better infrastructure and funding.

CONCLUSION: To equitably sustain telehealth use, the following are required: adequate funding, training, processes communicated to patients, improved patient access to technology and technological literacy, virtual physical examination methods and integration with existing primary health care services.

The primary care response to the coronavirus disease 2019 (COVID-19) pandemic in early 2020 required significant changes by general practices throughout New Zealand. A major part of this change was the swift move to telehealth consultations, replacing a large proportion of in-person consultations.

A switch to virtual consulting was recommended by the Royal New Zealand College of General Practitioners (RNZCGP) just days before the government announcement of the country moving to Alert Level 4 (lockdown) on 25 March 2020 due to increasing community transmission of COVID-19. Telehealth has been described as the provision of remote healthcare through use of telecommunication devices, such as phones and smart-phones, sometimes containing video. Over 48 hours, many practices rapidly adopted telehealth consultations, managing people virtually at home where possible, to reduce the transmission of COVID-19 within healthcare centres. A single-practice retrospective audit from Dunedin, New Zealand, during the first two weeks of Alert Level 4 lockdown found an increase in virtual consultations, to 79% from 30% in the same two-week period the year prior, with a five-fold increase in phone consultations.

Current literature on telehealth use in COVID-19 consists largely of opinion pieces...
or single-institution findings. However, qualitative interview findings from a large group of Finnish general practitioners explored the telehealth experience under person-centred care. Importantly, a New Zealand study exploring patient experiences during COVID-19, including their experience of telehealth through an online survey and focus groups, provides a complementary insight into telehealth during this time. No published New Zealand data have as yet qualitatively explored the impact of this swift change to telemedicine on primary care practice teams. This is the first qualitative analysis of the experience of telehealth from a large group of primary healthcare professionals throughout a country’s health system.

**Methods**

General practitioners (GP), nurse practitioners (NP), practice nurses (N) and practice managers (P) were invited to participate in the General Practice Pandemic Experience New Zealand (GPPENZ) study, which followed the same group of participants through a series of five online surveys from 8 May 2020 to 27 August 2020 (Figure 1). The invitation was distributed widely through the RNZCGP, New Zealand Nurses Organisation (NZNO), primary health organisations (PHOs), peer groups and medical and social media. Recruitment was also targeted through Māori, Pasifika and rural medical organisations to encourage representation from these groups.

The surveys were designed using Qualtrics software. The surveys consisted of open-ended questions allowing for free-text responses about participants’ experiences during the COVID-19 pandemic in New Zealand. Questions requiring numerical answers were also included to explore the extent to which telehealth was used. The surveys explored participants’ personal and professional experiences of the pandemic and included prompts about changes to the delivery of patient care, use of telehealth, challenges, innovations, personal and professional supports, health and safety preparedness for staff and patients, staff wellbeing and business and financial aspects.

Participant textual responses and comments were extracted from Qualtrics and analysed using NVivo as a coding framework. A team of researchers (GW, SB, AD, BS and AH) conducted the analysis of the data using simple descriptive statistics and a thematic analysis within a constant comparative approach. First the responses were read in their entirety to develop a structured framework and identify emerging themes. This was conducted in multiple rounds with independent coding of themes by the researchers and final blinded input by AD until all coders were satisfied with each code definition. A codebook was developed. For this paper, telehealth content was specif-

**Figure 1:** Timeline of General Practice Pandemic Experience New Zealand (GPPENZ) study 2020.
ically coded for by GW and BS (with each peer-reviewing the other’s coding). The primary analysis for this paper consisted of questions directly related to telehealth (see Appendix), and further secondary analysis was performed where telehealth was coded for in more general survey questions. A framework for analysis was developed by GW, SB and TD, who also conducted a thematic content analysis drawn from the relevant codes. This analysis was reviewed by the authors.

Ethical approval was obtained from The University of Otago Human Ethics Committee (reference number D10/114).

Results

Participant characteristics and demographics from survey one is shown in Table 1. There was consistent participation from all occupations over the five surveys. Participants from practices in Canterbury were over-represented in the sample, at 37.8% of survey one. Responses were received from throughout New Zealand from participants affiliated with 80% of all PHOs. We defined five major telehealth themes: benefits, limitations, paying for telehealth consultations, changes over time and perceived future use. Excerpts from survey responses are identified by the discipline of the respondent and an index number (eg, ‘GP80’ is the eightieth general practitioner).

Key benefits of telehealth during COVID-19

The aim and key benefit of the swift change to virtual consultations forced by the lockdown was to ensure that practices were able to keep providing healthcare while reducing the spread of illness through avoiding in-person contact, especially in waiting rooms. Some were already well prepared to offer telehealth options; GP80 commented that “we have been using phone, email and text for many years.” Others were taken by surprise and scrambled to get appropriate systems and equipment in place.

Although the speed and urgency of the transition was stressful for some, there was early recognition of the benefits for both practices and patients. Triaging all patients became standard practice, further increasing the number that could be managed virtually and identifying those who needed in-person consultations. Telehealth permitted staff in some practices to take turns working from home to minimise infection risk. Use of patient portals increased, with one practice reporting around 1,000 new patients joining up. People who were well connected electronically and younger populations “embraced the technology” (N19) and were able to benefit most:

“Most people have no issues. The majority of our patient population fortunately have access to suitable technology.” (GP35)

Convenience, saving time and the lack of transport costs were also advantages for rural people and those with work or family commitments:

“There is definitely a cohort of patients who love this model due to being rural and the vast distances needed to travel... It most certainly has a place in delivering patient care.” (P6)

Respondents also mentioned specific presenting issues that could be discussed remotely. Sending through photos of skin lesions or injuries was a notable success for some. Another benefit was the increased efficiency for following-up patients who were well known, including being “very useful for mental health issues especially when one can see the patients” (GP65).

Changes to previous health and social welfare processes supported telehealth, enabling a wider reach than would otherwise have been possible. Accident Compensation Corporation (ACC) and Work and Income (WINZ) reviews and nurse practitioner prescribing were all opened to telehealth rather than, as previously, being limited to in-person appointments:

“(Previously) to Covid, restrictions around my prescribing practice included that I could only prescribe in face-to-face situations. This has been changed over Covid to support e-health options for consultations.” (NP10)

“Telehealth was used proactively by practices to contact patients they were concerned about. Special efforts were made for ‘patients
Table 1: Participants.

<table>
<thead>
<tr>
<th>Total (%)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey 1</td>
<td>164</td>
</tr>
<tr>
<td>Survey 2</td>
<td>136 (82.9%)</td>
</tr>
<tr>
<td>Survey 3</td>
<td>118 (72%)</td>
</tr>
<tr>
<td>Survey 4</td>
<td>112 (68.3%)</td>
</tr>
<tr>
<td>Survey 5</td>
<td>91 (55.5%)</td>
</tr>
<tr>
<td>Completed all surveys (1–5)</td>
<td>78 (48%)</td>
</tr>
</tbody>
</table>

**Demographics**

- Mean age (SD, range): 49.9 (SD 10.65, 25–71)
- Female: 125 (76.2%)

**Ethnicity (total count*)**

- European: 144 (87.8%)
- Māori: 9 (5.5%)
- Pacific Peoples: 5 (3.0%)
- Asian: 12 (7.3%)
- MELAA: 2 (1.2%)

**Occupation**

- General practitioner: 93 (56.7%)
- Practice nurse: 38 (23.2%)
- Nurse practitioner: 11 (6.7%)
- Practice manager: 18 (11%)
- Practice manager and nurse (dual role): 4 (2.4%)

**Type of practice**

- Urban: 115 (70.1%)
- Rural: 34 (20.7%)
- Other (eg, mixed): 14 (8.5%)

**Practice size**

- Full time equivalent GPs mean (range): 5.1 (0–20)

**Employment status**

- Employees: 72 (43.9%)
- Owner or partner: 45 (27.4%)
- Contractor: 28 (17.1%)
- Other: 9 (5.5%)

* Total count of ethnicities will be greater than the number of respondents because one person can identify as belonging to multiple ethnicities.

# Consistent with RNZCGP national GP workforce data.14

MELAA = Middle Eastern/Latin American/African.
with complex, chronic conditions to develop tailored plans with them and their whānau and ensure their medical needs were catered for and that there was a plan in place.”

(GP32)

Telehealth was used in specific healthcare initiatives for Māori, with one practice proactively contacting Māori through their marae clinic:

“We texted all our marae clinic patients to advise how they could access healthcare. We set up a closed [Facebook] group to communicate with marae clinic patients.” (P3)

Another advantage of telehealth for Māori was that family groups could participate from home:

“Māori have used telehealth frequently as enabled whānau participation in their own whare.” (N10)

The limitations of telehealth

The financial and technical barriers to telehealth were perceived as a major limitation by many respondents. Many practices reported patients who could not ring for an appointment or access messages. There were reports of patients sharing phones with others, or only being contactable through social media:

“Many have no data and cannot use virtual care. Many others change phone numbers or have no credit so cannot access texts or messages.” (GP1)

There were difficulties with slow internet, poor sound or picture quality, incorrect phone numbers and calls that went unanswered at the time the practice had arranged to call:

“Around 50% have poor quality internet or devices, and/or difficulties using (eg, no sound or picture). Consultations slow and very limited.” (GP51)

Technical issues were not confined to patients; practices everywhere had technical issues, with cameras and other equipment being in short supply, systems that were not enabled for video calling and systems that would not link-up to work together. Rural areas had generally poor infrastructure for both internet and cell phone connections and so presented equal difficulties for both practices and patients:

“Due to being rural and some of our patients not having great internet or cellphone coverage (or none), getting in contact with patients at the time of their scheduled call has proved a challenge. We have sometimes had to make multiple calls to get in contact.” (P6)

Additionally, certain patient groups were reported as being excluded from using telehealth successfully. Many older people did not have smartphones or internet connections, and it was unsuitable for patients with cognitive impairment, hearing difficulties and those with limited English:

“…very difficult to understand accents etc over the phone… [a] lack of body language in these patients who often have poor health literacy makes this very difficult…” (GP5)

Respondents reported that some patients across all age ranges asked for in-person consultations for greater confidentiality, a better feeling of rapport or being able to express themselves more coherently.

There were numerous concerns about the clinical risk of not seeing patients in person. Video calling was described as being “a poor substitute for face-to-face clinical examination” (GP8). There was a “fear of missing something that might have been picked up at in person visit” (GP20) and it was “difficult to assess severity without pulse and temp checks” (GP83). Virtual consultations were also said to have a “lack of rapport... particularly difficult for patients with language barriers” (GP76) and patients who were new or not well known. Others noted that, even though telehealth was promoted for its time saving and convenience, it was “inefficient if patient subsequently needs to be seen” (GP20). Moreover, some issues would always need to be addressed in person:

“A lot of screening cannot be done over the phone (eg, smears, vaginal examinations, blood pressure, diabetes foot examination, before school check, proper cardiovascular checks, plus various acute assessments, cancer assessments).” (GP89)
Paying for telehealth

Patients who benefitted the most from not having to take time off work or travel long distances were reported to pay readily and promptly for the greater convenience and efficient use of their time:

“We had little objection to paying for telehealth and we are actively trying to promote this method of delivering healthcare as it allows both patient and healthcare worker more flexibility. Last week I had two consults with patients on their long commute to work!” (GP47)

However, there were also many comments about patient resistance to paying for telehealth consultations. Respondents reported that telehealth appeared to be viewed as an inferior form of appointment and that some patients didn’t understand “the time and level of care that a health professional can take to deal with a patient’s health” (N7). Telehealth appeared to be viewed as an inferior form of appointment:

“Patients are complaining and refusing to pay for telephone consults as they feel they should only have to pay if they see the doctor face to face. There seems to be an expectation that telephone consults are the same as Dr triage and should be free even if they are a full consult.” (GP4)

Practices learned quickly that it was necessary to give a clear explanation about payment before the appointment and make payment easy:

“We noticed early on patients complaining about paying for telehealth services, and so now the reception team explains every booking that there is the same costs as a face-to-face consult, so there is no confusion or surprise.” (GP80)

Nonetheless, there were complications in certain situations. The same patients who had no internet access were unable to pay by online banking. Charging for email exchanges with patients was also difficult to standardise:

“I find it really hard to charge for email questions and that can take up a lot of time—the work required varies so much it is hard to have a standard fee. A simple question can lead down an email trail and it is hard to know when to mention a fee.” (GP7)

Another issue arose when an in-person visit was needed after a telehealth appointment. There was a perceived level of resistance from patients to pay for both:

“A problem though if in fact they need to come in after the telephone consult. Do we charge twice?” (GP62)

Changes in use of telehealth over time during the pandemic

Respondents reported a decline in the proportion of consultations conducted by telehealth between survey two and survey three, corresponding with the change from COVID-19 Alert Level 2 to 1. There was no subsequent change in proportion during survey four. There was a strong feeling from respondents that they needed to catch-up on concerns that patients had put on hold because they wanted to discuss them in person:

“...rebound effect—things that could have waited during Level 4 but now have become more urgent for in-person consult.” (GP72)

Moreover, as respondents pointed out, the ability to undertake telehealth work had initially been aided by having good data on patients:

“We were able to manage most things remotely precisely because we have high-quality data on our patients—most had up-to-date BP, height, weight and bloods, so it was not hard to make do for three months. Now we are having to update those for patients, so that when there is a recurrence of COVID in the community we will be able to do it again.” (GP63)

Apart from these purely clinical considerations, some respondents reported that they tended to prefer seeing patients in person and believed many patients felt the same way, as “face-to-face appointments are in demand” (GP54). One GP succinctly remarked:

“People crave human contact. Don’t you? Never underestimate its value.” (GP81)
Nevertheless, there was a generally positive expectation that telehealth would have a place in the future as a “useful tool in the toolbox” (GP87).

**Perceived future use of telehealth**

Most respondents agreed that telehealth had proved its usefulness, and that over time it would become a normal component in the primary care model. Its greater flexibility and convenience were considered a major driving factor:

“It is going to be a permanent part of our practice moving forward, as the general feedback from patients has been that they like the accessibility of it, and the lesser time it takes, instead of waiting in a GP waiting room.” (N18)

However, comments showed that, to consolidate and enhance the benefits that telehealth demonstrated, further changes would be necessary. Firstly, practices needed to clarify exactly what they offered via telehealth, so that “patients have a better understanding of what can be done” (GP50).

These included:

“...non-acute consultations that do not require physical examination, point-of-care testing, etc... telehealth will eventually become the norm.” (NP8)

Secondly, better infrastructure, more reliable technology for practices and improved access for patients was needed before telehealth could be implemented equitably:

“There is a place for this, but better technology is needed and better support for when problems happen— for example, [the telecommunications provider] lost our connection and we had no phones for three days!” (N27)

Thirdly, the additional costs to practices of implementing telehealth options needed to be adequately recognised by funders:

“We would need built in funded cameras and video software funded by the DHB/PHO.” (GP16)

“Funding grant for improved IT, video consulting and patient portals.” (GP62)

Finally, having telehealth capability available was an important part of being pandemic ready:

“We are also preparing for the next wave of COVID so needed to keep the expectation that some consults would be via phone.” (N20)

**Discussion**

Based on a nationwide sample, this paper describes the experiences of general practice teams in New Zealand who used telehealth as an emergency response tool during the COVID-19 pandemic to provide healthcare while minimising the potential spread of infection.

Telehealth consultations were reported as being most successful where there was a pre-existing relationship between healthcare provider and patient, which was also found in a New Zealand patient experience study performed at a similar time during early stages of the pandemic. Another finding that parallels that study is the need for healthcare providers to clearly communicate to their patients the process and cost of telehealth. Many similar barriers were highlighted by patients, including technological challenges, communication difficulties for those with hearing impairments, concern regarding the cost and difficulty in making online payments.

The experience described through this study is consistent with other international work showing that telehealth risks increasing inequity. Potential healthcare benefits of telehealth can be seen in those who are already well connected to technology; however, it can create extra barriers for those who are already disadvantaged, such as those in rural areas, those with hearing impairment or cognitive decline and refugee and migrant populations who may have language barriers.

Ultimately, despite initially high optimism from general practice teams about the ongoing use of telehealth, when COVID-19 Alert Level restrictions eased, we found its use fell rapidly. The rapid move back to in-person care and ‘business as usual’ was felt by the GP teams to be driven by patient choice. So although telehealth may play an increasing role in the future, it is unlikely to fully replace in-person care. The cost of telehealth placed further financial stress on the business model of many of these practices during the COVID-19 pandemic. Additional
technology costs were largely borne by practices.

The strengths of this study include reporting from not only GP respondents, but also nurses, nurse practitioners and practice managers. We followed the same large group of participants through various stages of the initial COVID-19 pandemic in New Zealand and Alert Level changes from the end of lockdown. Limitations include data collection being largely by textual survey only. However, from a logistical viewpoint commencing during a pandemic lockdown with busy healthcare teams, this was deemed the most feasible. Although participant sampling was not stratified, we sought to have a variety of representation and geographical spread from throughout New Zealand.

COVID-19 has thrown into sharp focus the question of how telehealth can be further integrated into general practice models of healthcare. Recent literature has discussed key requirements for long-term sustainability of telehealth post COVID-19, through “(a) developing a skilled workforce; (b) empowering consumers; (c) reforming funding; (d) improving the digital ecosystems; and (e) integrating telehealth into routine care.”\(^1\) Based on the findings of our study, we recommend the following:

- The effective use of telehealth depends on both individual practice and patient capabilities, and we recommend good communication with patients regarding expectations, processes and costs.
- Provision and enablers for telehealth need to be considered when primary healthcare funding is revised following the New Zealand Health and Disability System Review 2020.\(^1\) This could include suitable funding to reduce barriers and innovative ways of improving patients’ access to technology and their technological literacy, especially for older patients and those with disabilities.\(^1\)
- For practices, we suggest a focus on being technology ready and developing protocols and training in telehealth for the GP team to ensure quality. New methods of doing virtual physical examinations could be developed with a new vocabulary for this.
- For telehealth implementation to be most successful, we envisage integration of telehealth with existing primary care health services (aiding continuity of care and whanaungatanga (relationships)), beneficial sharing between networks and a strong emphasis on reducing inequity.

New Zealand general practices showed agility and adaptability in embracing telehealth during the initial stages of the COVID-19 pandemic. It is important to reflect on their experience and then ensure adequate funding and practice processes are in place so telehealth can not only be swiftly used in future pandemics, but also become an integral part of the model of care in everyday general practice.
Appendix

Primary qualitative analysis of telehealth survey questions

- What limitations have your patients experienced in the use of technology for telehealth?
- What place do you think telehealth will have in your practice for delivering patient care in the future?
- What is your impression of patients’ willingness to pay for telehealth services?
- Our recent survey responses have revealed low levels of ongoing use of telehealth since dropping down to Alert Level 1. Why do you think this has occurred?

General GPPENZ survey questions for secondary analysis

Note: Those with * not included in secondary analysis for this telehealth paper.

Survey 1
Date: 8 May to 4 June 2020

These questions relate to the last two months of the Covid-19 Pandemic in New Zealand.

- Can you describe how the Covid-19 pandemic has affected your feelings until now?*
- What changes have you and your team made to how you practice in response to the Covid-19 pandemic?
- What opportunities have you experienced over this time?
  Including the use of virtual consultations and new technology.
- What challenges have you experienced over this time?
- What do you think has been successful so far?
- If you knew what you know now, what might you have done differently?*
- Do you have any comments regarding the information you have received about Covid-19 and which sources you have found most reliable and useful?*
- What has the practice you work in done to protect the health and wellbeing of staff? e.g. personal protective equipment (PPE), stress management, anxiety reduction.*
- What effect has the Covid-19 pandemic had on staffing levels at your main practice?*
- Do you have any comments on the overall health system response to the Covid-19 pandemic over the last few months?*
- Do you have any further thoughts or comments?*

Survey 2
Date: 28 May to 18 June 2020

These questions relate to the Covid-19 Pandemic in New Zealand.

- What are your impressions about non-Covid 19 related health conditions during this pandemic for your patients and your practice?
- What changes have you and your team made to support Māori, Pasifika and high health needs groups since the beginning of the Covid-19 pandemic?
- Have you had any significant events, incidents or near misses that have (or could have) caused harm to a patient, as a result of the Covid-19 pandemic?
- If yes, you can describe the event in the question below.
  Please describe any events:
  Since you completed the last GPPEC or GPPENZ survey, what changes have you and your team made to how you practice?
  Including changes associated with the move to Alert Level 2.
- What do you see are the issues for your practice as you move through the winter months?
- Do you have any further thoughts or comments?
Survey 3
Date: 18 June to 9 July 2020

These questions relate to Alert Level 1 during the Covid-19 Pandemic in New Zealand.

• Since the move to Alert Level 1, how have you been feeling about the Covid-19 pandemic?
• Since the move to Covid-19 Alert Level 1, what changes have you and your team made to how you practise?
• Please describe how respiratory and non-respiratory patients are currently streamed in your practice?
• Please include challenges this has posed.

These questions relate to the Covid-19 Pandemic in New Zealand.

• What changes have been made at your practice to the way prescriptions are managed, since the beginning of the Covid-19 pandemic until now? *
• What experience have you and your patients had with access to and management from secondary care during the Covid-19 pandemic?
• What was the immediate and longer term financial impact of the Covid-19 pandemic on yourself and your practice?
• Do you have any further thoughts or comments?

Survey 4
Date: 9th July to 30th July 2020

These questions relate to the Covid-19 Pandemic in New Zealand.

• Do you have any comments about the personal and/or professional support you have received since the beginning of the Covid-19 pandemic? Please include whether it was helpful or not.
• What additional personal or professional support would you have liked to receive during the Covid-19 pandemic so far? *
• In your patient interactions and consultations, what common issues have you observed about the financial effects of the Covid-19 pandemic on their healthcare?

These questions relate to the time since the move to Alert level 1 in the Covid-19 pandemic (12am 9th June 2020).

• Since Alert Level 1, what has the main practice you work in done to promote stress reduction or maintain psychological wellbeing for staff? *
• Since the move to Alert level 1, do you have any comments regarding the clarity and consistency of information you have received, and which sources you have found the most useful? *
• Now that we are in Alert Level 1, have staffing levels at your main practice returned to pre-Covid levels? If not, please comment on how it is different. *

These questions relate to the change in Ministry of Health case definition for Covid-19 from Wednesday 24th June 2020.

• Since the most recent case definition change, what changes have you made to how you practice and access patient Covid-19 testing.
• Please include any challenges this has posed.
• Since the most recent case definition change, how are you managing patients with low risk respiratory illness, including any PPE you use?
• Do you have any further thoughts or comments?
**Survey 5**  
*Date: 6th August to 27th August 2020*

These questions relate to the Covid-19 Pandemic in New Zealand.

- From your experience during the Covid-19 pandemic, what learning, changes or innovations would you like to see embedded in future general practice, in your practice and/or generally?
- Do you have any thoughts on if and how Māori, Pasifika and high needs health groups have been particularly affected over the last few months of the Covid-19 pandemic?
- In what ways have you and your team adapted to support Māori, Pasifika and high health needs groups since the beginning of the Covid-19 pandemic?
- Have you had any other significant events, incidents or near misses that have (or could have) caused harm to a patient, as a result of the Covid-19 pandemic?
- If yes, you can describe the event in the question below. Please describe any events:
  - In the last month, have you been aware of any of your patients delaying seeking care, or presenting late due to the ongoing effects of the Covid-19 pandemic? If so, please describe further.
  - How do you think the healthcare system should be organising surveillance testing for Covid-19 at this time (with no evidence of community transmission)?

These questions relate to a potential second wave of Covid-19 infections.

- In your main practice, do you feel adequately prepared for a potential second wave of Covid-19 community transmitted infections?
- If yes, how have you and your practice prepared?
- If ‘maybe’ or ‘no’, what do you feel you and your practice would need to do to be prepared?
- Have you considered and discussed as a practice how much PPE you would require to store for a potential second wave of Covid-19 infections? If so, please estimate this.
- What changes to General Practice funding would you like to see to help deal with a potential second wave of the Covid-19 pandemic?
- What do you believe the wider New Zealand healthcare system should be doing now to prepare for a second wave of Covid-19 in New Zealand?
- How concerned are you about a second lockdown as a consequence of uncontrolled community transmission of Covid-19, and the effect that a second lockdown would have on you, your practice and your patients?
- Do you have any further thoughts or comments?
Competing interest:
Nil.

Acknowledgments:
Thank you to medical students Umaya Ranaweera and Harrison Beadel for their help with survey design and data collection. We thank Pegasus Health (Charitable) Ltd for providing statistical and quantitative analysis and consultation with the Director of Hauora Māori and Equity, Irihāpeti Mahuika. Lastly, we thank the large number of primary healthcare professionals who gave their time and insights by participating in this study during such a busy time in their working and personal lives.

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Emergency COVID-19 funding to general practices in early 2020: lessons for future allocation to support equity

Vanessa Selak, Sue Crengle, Matire Harwood, Samantha Murton, Peter Crampton

ABSTRACT

AIM: To (1) describe the distribution of Ministry of Health (MOH) COVID-19 emergency funding to general practices in March and April 2020 and (2) consider whether further funding to general practices should be allocated differently to support equity for patients.

METHODS: Emergency funding allocation criteria and funding amounts by general practice were obtained from the MOH. Practices were stratified according to their proportion of high-needs enrolled patients (Māori, Pacific or living in an area with the highest quintile of socioeconomic deprivation). Funding per practice was calculated for separate and total payments according to practice stratum of high-needs enrolled patients.

RESULTS: The median combined March and April funding for general practices with 80% high-needs patients was 28% higher per practice ($36,674 vs $28,686) and 48% higher per patient ($10.50 vs $7.11) compared with the funding received by general practices with fewer than 20% high-needs patients. Although the March allocation did increase funding for high-needs patients, the April allocation did not.

CONCLUSIONS: Emergency support funding for general practices was organised by the MOH at short notice and in exceptional circumstances. In the future, the MOH should apply pro-equity resource allocation in all emergencies, as with other circumstances.

General practitioners (GPs) operate out of general practices, most of which are privately owned and funded by a combination of patient fees and government subsidies. The vision of the 2001 Primary Health Care Strategy included that “primary health care services will focus on better health for a population, and actively work to reduce health inequalities between different groups.” A key mechanism for supporting health equity is reducing access barriers to primary healthcare services. The Primary Health Care Strategy recognised that patient fees were a significant barrier to general practice services for low-income families. The strategy sought to reduce these by increasing government subsidies to general practice.

Funding to general practices from the Ministry of Health (MOH) for the delivery of primary care services has mainly been in the form of capitation payments since the early 2000s. These payments are determined by the enrolled practice population and the capitation funding formula, which has evolved over time. Currently, practices are entitled to receive a standard capitation payment that varies according to the number and characteristics of their enrolled patients (age group, gender, whether or not the patient has a High Use Health Card [HUHC]) and whether or not the practice is an Access practice. Practices can opt to receive the following additional capitation payments according to the following funding schemes:

• Very low-cost access (VLCA): If at least 50% of patients enrolled in the practice are high-needs (ie, Māori, Pacific or living in an area with the highest quintile of socioeconomic deprivation) and the practice agrees to charge zero fees for their patients aged 0–13 years, and no more than a specified upper limit for older patients.

• Community services card (CSC) (for non-VLCA practices): If the practice agrees to charge no more than a specified upper limit for patients aged 14 years and older.

• Zero fees for under 14s or 6s (for non-VLCA practices): If the practice agrees to charge zero fees for their patients aged 0–13 or 0–5 years, respectively.

Despite increasing government subsidies to general practice, cost continues to be a significant barrier to general practice services. In 2018/2019, 13.4% of New Zealand adults reported that in the previous year they had a medical problem for which they hadn’t visited a GP due to cost. The proportion reporting GP cost access barriers is higher among Māori (21.9%, 95% CI 19.7–24.2%) and Pacific people (19.4%, 95% CI 16.4–22.7%) than among Europeans (12.7%, 95% CI 11.8–13.6%). GP cost access barriers are also higher among people living in areas with the most socioeconomic deprivation (quintile 5: 19.2%, 95% CI 17.4–21.1%) than those living in areas with the least deprivation (quintile 1: 9.5%, 95% CI 7.9–11.3%).

The first case of COVID-19 was confirmed in New Zealand on 28 February 2020. There was considerable activity and anxiety among GPs and general practices as they struggled to keep up with frequent changes of advice from the MOH, to obtain adequate supplies of personal protective equipment (PPE) and influenza vaccines amid supply and distribution issues, and to contain the potential risks of COVID-19 to their staff and patients. General practice faced further considerable challenges when, on Saturday 21 March, the Royal New Zealand College of General Practitioners (RNZCGP) recommended that GPs switch from face-to-face to virtual consultations. Just as the switch to virtual consultations was being implemented on Monday 23 March, New Zealand went into Alert Level 3 (Restrict) because community transmission of COVID-19 was suspected, and after a further 48 hours, on Wednesday 25 March, New Zealand was in Alert Level 4 (Lockdown). Virtually overnight there was a 50–80% reduction in GP consultations and, consequently, patient fees and cash flow too. This was likely due to fear and anxiety about catching COVID-19 and the (false) perception that general practices were overwhelmed by patients with COVID-19. The MOH agreed to provide emergency funding to support general practices in March and April 2020 due to serious concerns about their financial sustainability.

The aims of this study were to describe the distribution of MOH COVID-19 emergency funding to general practices in March and April 2020, and to consider whether future emergency funding to general practices should be allocated differently to better support equitable access for the patients experiencing the greatest financial access barriers to GP services.

Methods

The following information was obtained from the MOH regarding the emergency funding that had been distributed by the MOH during March and April 2020 to support general practices in their COVID-19 response:

• Total amount distributed
• Amount by general practice
• Criteria used to allocate the funding, in particular any patient and/or practice characteristics that were taken into consideration
• Practice primary health organisation (PHO) affiliation and funding scheme (VLCA, CSC, zero fees for under 14s or 6s)
• Number of patients enrolled within each practice by each of the following variables: ethnicity (prioritised, level 1), socioeconomic deprivation quintile, age group, CSC holder status, HUHC status, high needs

Practices were categorised according to the proportion of their patients who are high-needs enrolled patients: 0–19%, 20–39%, 40–59%, 60–79%, 80%+. Funding per
enrolled patient was calculated for separate and total payments according to practice stratum of high-needs enrolled patients. All funding figures were exclusive of goods and services tax (GST). Thirty-six practices were excluded from the analysis (see results).

The information was requested under the Official Information Act (Ref H202003461) on 18 May 2020 and was received on 16 June 2020.

Results

General practices received three sources of emergency COVID-19 funding, with a total value of $45.22 million, from the MOH during March and April in 2020 (Table 1). Two payments were distributed by the MOH: $15 million in March and $22.42 million in April. The payment in March was to support capacity and capability in primary care. That payment was based on the characteristics of the enrolled practice population ($4.50 per targeted patient [ie, Māori, Pacific, NZDep quintile 5 and/or >65 years of age], $1.50 per non-targeted patient), with a minimum payment of $2,500 per practice and an additional payment of $5,000 for practices with 50% or more targeted patients. The payment in April was to support general practices’ business sustainability and was based on the rurality of the practice ($4.69 per patient in non-rural practices and $4.92 per patient in rural practices). The third payment, $7.8 million in March, was distributed by district health boards (DHBs) to practices on a fee-for-service basis to fully fund general practice-based COVID-19 assessments. Details of the third payment were not able to be provided by the MOH and are therefore not included in this analysis.

Data were provided for a total of 951 practices, of which 915 (96%) were included in this analysis. Of the 36 excluded practices, eight (0.8%) were excluded because the practice received funding in March but did not have enrolment data in April, three (0.3%) because they did not receive both March and April MOH payments and 25 (2.6%) because they only received the

Table 1: General practice emergency funding, by package and allocation criteria.

<table>
<thead>
<tr>
<th>Funding package</th>
<th>Amount</th>
<th>Allocation criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Allocated by the Ministry of Health</strong></td>
<td></td>
<td><strong>Patient</strong></td>
</tr>
<tr>
<td>March 2020: Primary Care Support – Capacity and Capability Funding</td>
<td>$15 million</td>
<td>• $4.50 per targeted EP (Māori, Pacific, NZDep quintile 5 and/or &gt;65 years)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• $1.50 for other EPs</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Practice</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• $2,500 minimum payment per practice</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• $5,000 additional payment per practices with 50% or more targeted EPs</td>
</tr>
<tr>
<td>April 2020: Additional immediate funding support for general practice business sustainability</td>
<td>$22.42 million</td>
<td>• $4.69 per EP (non-rural practice)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• $4.92 per EP (rural practice)</td>
</tr>
<tr>
<td><strong>Allocated by DHBs</strong></td>
<td></td>
<td><strong>Provided to DHBs on a PBFF basis to fully fund general practice assessments and testing. DHBs set nationally consistent funding criteria and provided funding to PHOs and to general practices on a fee-for-service basis.</strong></td>
</tr>
<tr>
<td>March 2020: General Practice based COVID-19 Assessments</td>
<td>$7.8 million</td>
<td>Provided to DHBs on a PBFF basis to fully fund general practice assessments and testing. DHBs set nationally consistent funding criteria and provided funding to PHOs and to general practices on a fee-for-service basis.</td>
</tr>
</tbody>
</table>

DHB = district health board, EP = enrolled patient, NZDep = New Zealand socioeconomic deprivation index, PHO = Primary Health Organisation, PBFF = population-based funding formula.
minimum MOH payment ($2,500) in March. Of the included practices, VLCA was the funding scheme for 271 (30%), CSC and free under 14 year olds for 587 (64%), free under 14 or 6 years olds for 38 (4%), CSC only for 12 (1%) and seven (1%) had elected not to receive any additional funding. Most practices (377, 41%) had under 20% high-needs patients, with 287 (31%) having 20–39% high-needs patients, 109 (12%) having 40–59%, 73 (8%) having 60–79% and 69 (8%) having 80% or more high-needs patients. The proportion of VLCA practices increased from 4% (n=16) among practices with under 20% high-needs patients, up to 97% (n=67) among practices with 80% or more high-needs patients.

In April 2020, a total of 4,721,710 patients were enrolled in practices included in this study (Table 2). Most patients (40%) were enrolled in practices with under 20% high-needs patients, with 33% enrolled in practices with 20–39% high-needs patients, 12% in practices with 40–59%, 8% in practices with 60–79% and 7% of patients enrolled in practices with 80% or more high-needs patients. The proportion of younger patients (aged 0–19 years) increased from 24% among patients enrolled with practices with under 20% high-needs patients, up to 34% among patients enrolled in practices with 80% or more high-needs patients. The proportion of Māori and Pacific patients enrolled with practices with under 20% high-needs patients was 6% and 2%, respectively, increasing to 40% and 36%, respectively, in practices with 80% or more high-needs patients. Similarly, the proportion of those living in an area in the highest socioeconomic deprivation quintile and those with a CSC increased from 5% and 15%, respectively, in practices with under 20% high-needs patients, up to 64% and 38%, respectively, in practices with 80% or more high-needs patients. The proportion of patients with a HUHC card was low across all strata of practices.

The total March amount (capacity and capability funding) paid to practices was $14,849,697, and $22,311,373 was paid in April (business sustainability funding) (Table 3). Practices with fewer than 20% high-needs patients (with 40% of all enrolled patients) received 30% of the March funding, 40% of the April funding and 36% of the combined funding. Practices with 80% or more high-needs patients (with 7% of all enrolled patients) received 12% of the March, 7% of the April and 9% of the combined funding.

The median March funding was $2.38 per patient ($9,264 per practice) for practices with fewer than 20% high-needs patients. For practices with 80% or more high-needs patients, the median March funding was $5.77 per patient ($20,092 per practice). The median April funding was $4.69 per patient irrespective of the proportion of high-needs patients. The median April funding per practice ranged from $16,354 for practices with 80% or more high-needs patients and $20,022 for practices with fewer than 20% high-needs patients.

The median combined March and April funding for practices with fewer than 20% high-needs patients was $28,686 per practice and $7.11 per patient; corresponding figures for practices with 80% or more high-needs patients were $36,674 per practice and $10.50 per patient, respectively. The median combined March and April funding for practices with 80% high needs patients was 28% higher per practice and 48% higher per patient than the practices with fewer than 20% high-needs patients.

**Discussion**

The median combined March and April MOH COVID-19 emergency funding for general practices with 80% high-needs patients was 28% higher per practice ($36,674 vs $28,686) and 48% higher per patient ($10.50 vs $7.11) compared with the funding received by general practices with fewer than 20% high-needs patients. Although the March allocation did increase funding for high-needs patients, the April allocation did not, thereby attenuating the pro-equity distribution of emergency funding to general practices in terms of the needs of Māori, Pacific patients and those living in areas of the highest socioeconomic deprivation.

While the burden of COVID-19 in New Zealand has remained modest to date, likely largely due to the national elimination strategy,6 commentators have noted that “the health impact of COVID-19 will be greater for Māori” and “the strong focus on numerical age as a risk factor is to the
Table 2: Patient characteristics by practice stratum of high-needs enrolled patients.

<table>
<thead>
<tr>
<th>Characteristics of patients enrolled in the practice in April 2020</th>
<th>% high-needs patients enrolled in the practice in March 2020</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-19%</td>
<td>20-39%</td>
</tr>
<tr>
<td>Number of people*</td>
<td>1,894,575 (40%)</td>
<td>1,561,350 (33%)</td>
</tr>
<tr>
<td>Age group (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-19</td>
<td>463,519 (38%)</td>
<td>392,945 (32%)</td>
</tr>
<tr>
<td>20-39</td>
<td>467,718 (38%)</td>
<td>409,412 (33%)</td>
</tr>
<tr>
<td>40-59</td>
<td>515,327 (43%)</td>
<td>396,429 (33%)</td>
</tr>
<tr>
<td>60-79</td>
<td>366,847 (43%)</td>
<td>298,197 (35%)</td>
</tr>
<tr>
<td>80+</td>
<td>81,164 (45%)</td>
<td>64,367 (36%)</td>
</tr>
<tr>
<td>Ethnicity (prioritised)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td>118,172 (6%)</td>
<td>201,147 (13%)</td>
</tr>
<tr>
<td>Pacific</td>
<td>39,367 (2%)</td>
<td>65,695 (4%)</td>
</tr>
<tr>
<td>Asian</td>
<td>278,840 (15%)</td>
<td>224,232 (14%)</td>
</tr>
<tr>
<td>European</td>
<td>1,414,910 (75%)</td>
<td>1,036,471 (66%)</td>
</tr>
<tr>
<td>Other / not stated</td>
<td>43,286 (2%)</td>
<td>33,805 (2%)</td>
</tr>
<tr>
<td>Socioeconomic deprivation quintile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 (most deprived)</td>
<td>90,863 (5%)</td>
<td>243,172 (16%)</td>
</tr>
<tr>
<td>4</td>
<td>231,393 (12%)</td>
<td>363,270 (23%)</td>
</tr>
<tr>
<td>3</td>
<td>366,343 (19%)</td>
<td>347,434 (22%)</td>
</tr>
<tr>
<td>2</td>
<td>501,693 (26%)</td>
<td>299,919 (19%)</td>
</tr>
<tr>
<td>1 (least deprived)</td>
<td>649,353 (34%)</td>
<td>263,202 (17%)</td>
</tr>
<tr>
<td>Missing</td>
<td>54,930 (3%)</td>
<td>44,353 (3%)</td>
</tr>
<tr>
<td>High needs</td>
<td>231,098 (12%)</td>
<td>434,833 (28%)</td>
</tr>
<tr>
<td>CSC holders</td>
<td>281,640 (15%)</td>
<td>336,088 (22%)</td>
</tr>
<tr>
<td>HUHC holders</td>
<td>2,452 (0%)</td>
<td>4,722 (0%)</td>
</tr>
</tbody>
</table>

| Practice funding scheme | | | | | | |
| VLCA | 87,923 (5%) | 320,118 (21%) | 341,997 (62%) | 361,069 (99%) | 334,360 (97%) | 1,445,467 (31%) |
| CSC and free <14y | 1,662,325 (88%) | 1,181,961 (76%) | 210,923 (38%) | 4,675 (1%) | 10,058 (3%) | 3,069,942 (65%) |
| Free <6y or <14y | 115,652 (6%) | 56,411 (4%) | 2,401 (0%) | - | - | 174,464 (4%) |
| CSC only | 6,303 (0%) | 1,421 (0%) | - | 195 (0%) | - | 7,919 (0%) |
| None | 22,372 (1%) | 1,439 (0%) | - | 107 (0%) | - | 23,918 (1%) |

Number of patients (%), % within columns (ie, within practice stratum of high-needs enrolled patients, or across total patients) unless otherwise specified.
* % across rows.
CSC=Community Services Card, High needs = Māori, Pacific or living in an area with the highest quintile of socioeconomic deprivation, HUHC=High Use Health Card, VLCA=Very low-cost access.
### Table 3: Funding by practice stratum of high-needs enrolled patients.

<table>
<thead>
<tr>
<th>% high-needs patients enrolled in the practice in March 2020</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–19%</td>
<td></td>
</tr>
<tr>
<td>20–39%</td>
<td></td>
</tr>
<tr>
<td>40–59%</td>
<td></td>
</tr>
<tr>
<td>60–79%</td>
<td></td>
</tr>
<tr>
<td>80–100%</td>
<td></td>
</tr>
</tbody>
</table>

#### Total funding, $ (% across rows)

<table>
<thead>
<tr>
<th>Month</th>
<th>0–19%</th>
<th>20–39%</th>
<th>40–59%</th>
<th>60–79%</th>
<th>80–100%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>March</td>
<td>$4,516,647 (30%)</td>
<td>$4,513,993 (30%)</td>
<td>$2,305,574 (16%)</td>
<td>$1,742,475 (12%)</td>
<td>$1,770,938 (12%)</td>
<td>$14,849,627</td>
</tr>
<tr>
<td>April</td>
<td>$8,942,201 (40%)</td>
<td>$7,380,727 (33%)</td>
<td>$2,625,340 (12%)</td>
<td>$1,737,385 (8%)</td>
<td>$1,625,720 (7%)</td>
<td>$22,311,373</td>
</tr>
<tr>
<td>Total</td>
<td>$13,458,848 (36%)</td>
<td>$11,894,720 (32%)</td>
<td>$4,930,914 (13%)</td>
<td>$3,479,859 (9%)</td>
<td>$3,396,658 (9%)</td>
<td>$37,160,999</td>
</tr>
</tbody>
</table>

#### Funding by practice (not adjusted by practice size)

<table>
<thead>
<tr>
<th>Month</th>
<th>Median (Q1,Q3)</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>March</td>
<td>$9,264 ($5,726, $15,626)</td>
<td>$11,980 ($8,314)</td>
</tr>
<tr>
<td>Mean (Q1,Q3)</td>
<td>$11,738 ($7,216, $19,306)</td>
<td>$15,728 ($13,041)</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>$18,078 ($11,983, $25,033)</td>
<td>$24,265 ($17,374)</td>
</tr>
<tr>
<td>April</td>
<td>$19,271 ($11,022, $31,493)</td>
<td>$23,719 ($16,961)</td>
</tr>
<tr>
<td>Mean (Q1,Q3)</td>
<td>$18,022 ($10,778, $28,651)</td>
<td>$25,717 ($21,830)</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>$16,471 ($9,186, $28,464)</td>
<td>$25,277 ($22,322)</td>
</tr>
<tr>
<td>Total</td>
<td>$28,686 ($16,434, $47,307)</td>
<td>$38,947 ($23,015, $53,363)</td>
</tr>
<tr>
<td>Median (Q1,Q3)</td>
<td>$29,662 ($18,369, $51,720)</td>
<td>$33,971 ($20,940, $56,223)</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>$20,022 ($10,778, $28,651)</td>
<td>$25,777 ($22,322)</td>
</tr>
</tbody>
</table>

#### Funding by patient enrolled in April

<table>
<thead>
<tr>
<th>Month</th>
<th>Median (Q1,Q3)</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>March</td>
<td>$2.38 ($2.21, $2.54)</td>
<td>$3.56 ($15.61)</td>
</tr>
<tr>
<td>Mean (Q1,Q3)</td>
<td>$2.75 ($2.61, $2.90)</td>
<td>$3.45 ($5.30)</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>$4.40 ($4.00, $5.33)</td>
<td>$5.51 ($4.23)</td>
</tr>
<tr>
<td>April</td>
<td>$4.69 ($4.69, $4.69)</td>
<td>$4.73 ($0.09)</td>
</tr>
<tr>
<td>Mean (Q1,Q3)</td>
<td>$4.69 ($4.69, $4.69)</td>
<td>$4.73 ($0.09)</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>$4.69 ($4.69, $4.69)</td>
<td>$4.73 ($0.09)</td>
</tr>
<tr>
<td>Total</td>
<td>$7.11 ($6.91, $7.30)</td>
<td>$8.29 ($15.61)</td>
</tr>
<tr>
<td>Median (Q1,Q3)</td>
<td>$7.47 ($7.31, $7.66)</td>
<td>$8.18 ($5.30)</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>$9.14 ($8.71, $10.02)</td>
<td>$10.24 ($4.23)</td>
</tr>
</tbody>
</table>

CSC=Community Services Card, High needs = Māori, Pacific or living in an area with the highest quintile of socioeconomic deprivation, HUHC=High Use Health Card, Q1=first quartile, Q3=third quartile, SD=standard deviation, VLCA=Very Low Cost Access
detriment of Indigenous populations”.7 A modelling study that sought to disentangle the effects of age structure and comorbidity has estimated that, if there were widespread community transmission in New Zealand, the infection fatality rate of COVID-19 for Māori is likely to be at least 50% higher than for non-Māori.8 The authors of that study consider that inequities in the burden of COVID-19 for Māori and Pacific compared with Europeans could be even greater because 2009 influenza H1N1 pandemic hospitalisation and fatality rates were higher for Māori and Pacific people than for Europeans, and Māori and Pacific people are more likely to experience multi-morbidity, avoidable hospitalisations and racism than Europeans. Further, inequities in the infection fatality rate of COVID-19 could be even greater if differences by ethnicity in age-specific health outcomes or unmet healthcare needs are underestimated in available data.8

These predictions of the likely inequitable burden of COVID-19 according to ethnicity have already become manifest in other countries. Black, Latinx and Indigenous populations in the United States, as well as black, Asian and minority ethnic (BAME) groups in England are experiencing an increased burden of COVID-19 compared with whites.9,10 An international study across 13 countries also found inequities in the burden of COVID-19 according to ethnicity and income.11

We acknowledge that the emergency support funding for general practice was organised by the MOH at short notice and in exceptional circumstances. However, although the March tranche was allocated in a way that was pro-equity, the April tranche was not. In the future, the MOH should apply pro-equity resource allocation in all emergency circumstances. Understanding the reasons for the differences in allocation between the March and April tranche would be useful and may help to support better implementation of equity policy imperatives. Ideally reasons for these differences in allocation would be proactively shared by the MOH in the first instance. Alternatively, or in order to obtain more in-depth understanding, the reasons for these differences could be ascertained through case study research.

The limitations of our study are that we were not able to include the DHB funding for practice-based COVID-19 assessments. We were also unable to take into account baseline practice financial vulnerability. Further, as noted by Hauora, the Waitangi Tribunal Health Services and Outcomes Inquiry report on primary healthcare claims, “In relation to the capitated funding formulas, we have found that the formulas disadvantage primary health organisations and providers that predominantly service high-needs populations and particularly impact on Māori-led primary health organisations and providers that predominantly serve these populations.”12 Māori providers, some of which have general practices, “have been underfunded from the outset,”13 and the Crown (represented by the MOH) has now committed to “engagement on a methodology for assessing the extent of underfunding of Māori primary health organisations and providers”.14 Finally, while we assume that additional funding is needed with higher proportions of patients with high health needs, we have not considered how much additional funding is required according to additional need. Further research exploring how much additional funding is required according to additional need is required to ensure funding is truly pro-equity.
Competing interests:
There was no external funding source for preparing this article. The views, opinions, findings and conclusions or recommendations expressed in this paper are strictly those of the authors. They do not necessarily reflect the views of the institution where the authors currently work. The paper is presented not as policy, but with a view to inform and stimulate wider debate. Dr Murton is President of the RNZCGP and she also has an academic appointment at the University of Otago; the views expressed here are her own and not those of the College. Prof Crengle reports other from New Zealand Ministry of Health, personal fees from RNZCGP and other from WellSouth PHN, outside the submitted work.

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REFERENCES

COVID-19 and the impact on urology service provision at Capital & Coast District Health Board

Simon Lambracos, Lance Yuan, Andrew Kennedy-Smith

ABSTRACT

AIM: To determine the impact on the Capital & Coast District Health Board (CCDHB) urology service of the implementation of nationwide healthcare restrictions in response to the COVID-19 pandemic.

METHODS: This is an observational retrospective study over a 21 working day period during the implementation of National Hospital Response Framework Alert (NHRFA) level 2. We obtained patient data during this period and a corresponding control period prior to the pandemic. The data was focussed on the volume of operating theatre cases, outpatient consultations, procedural clinic appointments and the estimated avoided outpatient travel.

RESULTS: Total urology admissions decreased by 27% during the 21-day NHRFA level 2 period. However, acute surgical procedures increased by 30% whereas elective surgical procedures decreased by 32%. Outpatient consultations overall decreased by 32% during NHRFA level 2 despite virtual phone consultations increasing by 274%. Procedural clinic appointments decreased by 85%. The virtual platform also saved each patient an estimated 22.7km of average travel.

CONCLUSION: The data demonstrate the effects of restrictions in response to a crisis and set a precedent for future management in such scenarios. The data also show how service efficiency can be optimised while providing an environmentally friendly alternative for routine clinical practice.

The coronavirus disease 2019 (COVID-19) pandemic has impacted on societies and health systems across the world. Governmental responses to the crisis and the direct effects of the disease have been expressed differently across countries. Health services in societies that experienced high disease incidence have been challenged or overwhelmed by the clinical problems of patients with COVID-19.

On 25 March 2020, the New Zealand government initiated a national level 4 lockdown, when case numbers were still small, in response to the international COVID-19 pandemic and after confirmation of community transmission within New Zealand. Consequently, the New Zealand Ministry of Health introduced a parallel COVID-19 National Hospital Response Framework, consisting of four alert levels (Figure 1) that are structured according to the severity of impact on healthcare services.1

Since the start of the national lockdown, all district health boards (DHBs) have been escalated to National Hospital Response Framework Alert (NHRFA) level 2. As far as the surgical specialties in Capital & Coast DHB (CCDHB) are concerned, this has had four major ramifications:1

1. migration of outpatient clinic appointments to a virtual setting or an off-site setting as necessary
2. deferral of non-urgent pre-assessments and non-urgent clinic patients according to urgency
3. activation of any outsourcing arrangements reached and engagement with options for supporting ‘cold trauma’ cases and less-complex urgent cancer surgery
4. prioritisation of planned care surgery and other interventions based on urgency while continuing health service delivery for patients not expected to require ICU/HDU.
This report has been set out to demonstrate the impact NHRFA level 2 and national level 4 has had on the service provided by the urology department at CCDHB and report on innovative service delivery within the constraints of national lockdown and hospital reorganisation in preparation for the anticipated COVID-19 crisis. While the impending epidemic threatened to collapse existing service delivery, potentially with negative outcomes from disease unrelated to COVID-19, the local response partially maintained continuity of urology services. Moreover, the changes in practice triggered some unforeseen improved outcomes.

We have focussed on four aspects of the service that we believe have been significantly affected by the changes made secondary to NHRFA level 2 implementation. These four aspects include:

1. the volume of operating theatre cases (acute and elective), including outsourced public elective cases during NHRFA level 2
2. the volume of outpatient consultations (virtual and face-to-face)
3. the volume of procedural clinic appointments (flexible cystoscopy, TRUS prostate biopsy and urodynamics clinics)
4. the avoided journeys (km) by outpatients travelling to clinic by using a virtual interface.

Method

The urology service at CCDHB, Wellington, is a public health service that directly serves a population of 500,000 people and provides secondary care services and a tertiary level urology service for the wider lower North Island of New Zealand. The delivery of care is provided by four to five specialist urologists/senior medical officers (SMOs) and five junior staff/resident medical officers at varying levels of experience and supported by nursing, allied health and administrative staff.

Outpatient and inpatient urology services are delivered through Wellington and Kenepuru hospitals. Community urology care is provided by the network of primary care general practitioners and the community nursing service that are distributed across the region.

During the COVID-19 lockdown and NHRFA level 2, the urology service was reorganised in anticipation of significant numbers of COVID-19 patients in Wellington regional Hospital, but not without recognising that the outcome of the national level 4 lockdown may effectively abort the epidemic locally too. The service was reconfigured thus:

- The urology department was divided into two teams maintaining strict separation from each other.
- Outpatient clinics were converted wholesale from face-to-face consultations to telemedicine consultations where possible.
- Elective office procedures were suspended during the lockdown period.
- General anaesthetic urology surgery was substantially relocated to a nearby private hospital facility, designated a ‘non-COVID-19 hospital’ and performing cases with urgent clinical priority.
- Some general anaesthetic urology surgery was continued at Wellington Regional Hospital: this included acutely presenting patients and some elective cases with urgent clinical priority.
- Teams alternated weekly between the Wellington Regional Hospital campus and the remote private hospital campus.
- In the event of a member of one team becoming ill, that team would be stood down.

The intention of this reorganisation was to achieve continued delivery of urology service through the COVID-19 pandemic, whether or not there were significant numbers of COVID-19 cases.

This is an observational retrospective study over a period of 21 working days (ie, excluding weekends and public holidays) from the start of the national level 4 lockdown (25 March to 27 April 2020). The service volumes during this time were compared with a similar 21 working day period in March 2019 (15 March to 12 April 2019). The control period was adjusted to exclude the period of junior doctor strike.
Figure 1: Detailing the first two alert levels of the National Hospital Response Framework implemented by all DHBs in response to the COVID-19 pandemic.
activity in late April 2019 and the control period was considered a typical workload for the urology service at CCDHB.

Coding data was retrieved from the CCDHB information system for details regarding urology patients admitted acutely and electively under the urology service within the two time periods.

Data on scheduled outpatient urology consultations and office procedures were collected manually during the two time periods. Telephonic advice and informal consultations were not assessed. Scheduled outpatient consultations included:

- face-to-face consultations
- telemedicine/telephone consultations (virtual clinic)
- office procedures.

The carbon impact of virtual clinic consultations by negating travel to and from the hospital clinic is recognised. To estimate the average travel saved (km) by outpatients consulted using the virtual clinic interface, compared to attending face-to-face outpatient clinic consultations, patients’ domiciles were obtained using data from CCDHB coding. We used Google Maps to estimate the distance from each patient's domicile to Wellington Regional Hospital.

Results

There were no episodes of staff illness during the study period resulting in both teams being able to continue work commitments as planned. However, through the planned retirement of one SMO, the department workforce was reduced to four SMOs in 2020 from five SMOs in 2019. This left one SMO post vacant during the lockdown period. Data are presented in absolute numbers and, where appropriate, calculated on a per-SMO ratio to better determine the impact of the reduced SMO workforce.

During the study period (25 March to 25 April 2020) there were 77 urology admissions, of which 26 were acute admissions and 51 elective admissions. All elective admissions proceeded with surgery, of which 31 were operated on at the outsource private hospital. This equates to 12.75 elective cases per SMO.

Of 26 acute presentations, 12 patients required acute surgery, which were performed at Wellington Regional Hospital.

During the control period in 2019 there were 106 admissions, of which 75 admissions were for elective surgery, equating to 15 elective cases per SMO. There were 31 acute admissions during the control period, nine of which required acute surgery.

Figure 2: The number of admissions and operative cases for the control 2019 and study 2020 cohorts.
The data indicate a 27% overall decrease in elective and acute admissions during the national level 4 lockdown period in comparison to the corresponding 2019 period. However, acute surgical procedures increased in both absolute numbers and in percentage, an increase of 30% from the control period. Elective surgery decreased 32% during the level 4 lockdown period compared to the control period. These outcomes are presented in Figure 2.

Data on the specific surgeries was examined and is presented in Figure 3.

The specific case data indicate a deferment of non-urgent elective stone surgery and some other non-urgent surgery, but a relative increase (25%) in cancer surgery during the NHRFA level 2, compared to the 2019 cohort (Figure 4).

Standard outpatient consultations decreased during the COVID-19 lockdown period. As expected from the reorganisation, there was a marked shift from face-to-face consultations to virtual consultations during the lockdown. There were 391 urology outpatient consultations for the 2020 cohort (97.75 consultations per SMO), of which 373 were virtual and 18 were contact consultations. This compared to a total of 578 urology outpatient consultations for the 2019 cohort (115.6 consultations per SMO; 136 virtual and 442 contact consults). This represented a 32% decrease in the total number of outpatient consultations during level 4 lockdown when compared with the 2019 data, although only an 8% decrease in outpatients per SMO. Face-to-face consultations decreased by 96%, but there was a notable 274% increase in virtual consultations during the national level 4 lockdown period compared to the 2019 time period.

Office procedure consultations were significantly affected, as expected from the reorganisation. The urology service at CCDHB had already integrated urinary biomarker assessment (CxBladder) to manage demand for flexible cystoscopy. CxBladder testing continued during the period of COVID-19 lockdown but did not influence the data on flexible cystoscopy procedures in either time period. There were 192 office procedures performed in the 2019 cohort compared to 28 office procedures in the 2020 cohort (Table 1).

The total travel distance saving for outpatients consulted in the 2020 cohort using a virtual platform was 6,828km. This equates

Figure 3: The raw data of acute and elective operative cases performed for the control 2019 and study 2020 cohorts.
Figure 4: The proportion of cancer and non-cancer procedures performed for both 2019 and 2020 cohorts.

![Bar chart showing the proportion of cancer and non-cancer procedures performed for both 2019 and 2020 cohorts.](image)

Figure 5: The number of patients attending contact, virtual and procedural clinics for the control 2019 and study 2020 cohorts.

![Bar chart showing the number of patients attending different types of clinics for 2019 and 2020.](image)
to an average 22.7km of travel saved per patient during the national level 4 lockdown as a result of the virtual clinic interface (Table 2).

Discussion

The urology service review of clinical activities during the COVID-19 lockdown demonstrates an overall reduction in service delivery and a reorientation to non-contact outpatient consultations. The impact on throughput of the hospital-wide preparations for the epidemic, closures and reorganisation were mitigated by proactive outsourcing of elective surgery to a private hospital and a dramatic shift to virtual consultations. This reorganisation was conceived and implemented simultaneously with the national lockdown. The outcomes from this experience set a precedent for crisis response management within the department for the future.

Admissions

The total number of admissions decreased by 27% during the NHRFA level 2 period in comparison to the corresponding 2019 period. It appears that the reduction in elective operating cases was largely responsible for this decrease and that, despite outsourcing elective cases to the private hospital, the service was unable to match the usual workload. Furthermore, there was only a 16% decrease in acute admissions during NHRFA level 2. The volume of acute admissions is likely to vary regardless of the circumstances, but it could also be explained by a reduction in patients presenting to hospital due to the perceived

Table 1: A breakdown of the number of patients attending procedural clinic consultations for the 2019 and 2020 cohorts.

<table>
<thead>
<tr>
<th>Cohort</th>
<th>TRUS biopsy</th>
<th>Flexible cystoscopy</th>
<th>Urodynamics</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>65</td>
<td>107</td>
<td>20</td>
<td>192</td>
</tr>
<tr>
<td>2020</td>
<td>2</td>
<td>26</td>
<td>0</td>
<td>28</td>
</tr>
</tbody>
</table>

Table 2: Number of patients from the various regions serviced by urology at CCDHB with clinic appointments during NHRFA level 2 and the distances these patients would have to travel to attend clinic appointments at the Wellington Regional Hospital. Distances averaged for satellite towns and calculated individually for patients within Wellington City.

<table>
<thead>
<tr>
<th>Suburb</th>
<th>Number of patients</th>
<th>Distance to hospital (km)</th>
<th>Total distance (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Featherston</td>
<td>2</td>
<td>65</td>
<td>130</td>
</tr>
<tr>
<td>Lower Hutt</td>
<td>86</td>
<td>19</td>
<td>1,634</td>
</tr>
<tr>
<td>Martinborough</td>
<td>1</td>
<td>83</td>
<td>83</td>
</tr>
<tr>
<td>Masterton</td>
<td>2</td>
<td>101</td>
<td>202</td>
</tr>
<tr>
<td>Otaki</td>
<td>2</td>
<td>76</td>
<td>152</td>
</tr>
<tr>
<td>Paekākāriki</td>
<td>3</td>
<td>43</td>
<td>129</td>
</tr>
<tr>
<td>Paraparaumu</td>
<td>20</td>
<td>53</td>
<td>1,060</td>
</tr>
<tr>
<td>Porirua</td>
<td>29</td>
<td>23</td>
<td>667</td>
</tr>
<tr>
<td>Upper Hutt</td>
<td>32</td>
<td>37</td>
<td>1,184</td>
</tr>
<tr>
<td>Waikanae</td>
<td>12</td>
<td>63</td>
<td>756</td>
</tr>
<tr>
<td>Wainuiomata</td>
<td>3</td>
<td>26</td>
<td>78</td>
</tr>
<tr>
<td>Wellington Central</td>
<td>109</td>
<td>Calculated individually</td>
<td>753</td>
</tr>
<tr>
<td>Total</td>
<td>301</td>
<td></td>
<td>6,828</td>
</tr>
</tbody>
</table>
risk of contracting COVID-19 in hospital, and therefore this may represent an unmet need.

Operating theatre cases

There was a 33% increase in acute operating theatre cases during NHRFA level 2 compared to the control 2019 period. This is most likely explained by the fact that NHRFA level 2 did not impose any restrictions on acute theatre cases, and this would therefore represent the acute surgical requirement at the given time.

Despite a 25% increase in urgent cancer cases during NHRFA level 2, there was, as expected, a decrease in general elective operating. This was calculated as 32% but there are confounding factors that potentially exaggerate this difference:

Firstly, 7% of the elective cases for the 2019 cohort occurred in Kenepuru Community Hospital (KCH), a regional hospital in Porirua catering for low-risk elective cases only. The availability at KCH normally allows for simultaneous elective lists both there and at Wellington Regional Hospital. However, during NHRFA level 2, KCH was closed.

Secondly, in 2019 there were five consultants working in the urology department as opposed to four consultants in 2020. This provided the opportunity for an increased elective surgical capacity in 2019. It therefore seemed more representative to demonstrate the difference in elective case workload by calculating the number of cases per consultant. For the 2019 cohort this was 15 cases per consultant compared to 12.75 for the 2020 cohort. Each consultant was therefore averaging 2.25 elective cases less during NHRFA level 2, which, considering the severe restrictions placed on elective case workload, suggests a less significant difference between the cohorts than was initially indicated.

Finally, it is also worth noting that, despite the decrease in elective case workload, over 60% of elective cases during NHRFA level 2 were outsourced to the private hospital. Of these, 45% were urgent cases treating potential or confirmed cancer diagnoses. This represented a 25% increase in urgent cases during NHRFA level 2 compared to the 2019 period. This demonstrates that, even with severe restrictions on performing elective cases in the public sector, over 30 patients could still receive essential elective care in a safe environment. Not only does this mean that patients can receive elective surgical care in a timely manner, but also that a backlog of elective cases does not develop once NHRFA level 2 is de-escalated.

Outpatient clinics

As per the NHRFA level 2 restrictions, all outpatient clinics should be deferred to a virtual or offsite setting and all non-urgent appointments should be deferred. As a result, in the urology department at CCDHB, the vast majority of outpatient consultations were rescheduled as virtual phone consultations and, where possible, non-urgent face-to-face consultations were deferred until normal service resumes. A select few urgent face-to-face appointments were retained where physical examination or in-clinic investigations were required.

These alterations to the outpatient service were demonstrated by a 274% increase in virtual consultations under NHRFA level 2 compared with the corresponding period in 2019. Consequently, this correlated with a 96% decrease in contact consultations for the 2020 cohort.

Procedural clinics

The major difficulty in implementing NHRFA level 2 within the department was attempting to accommodate the patients that were due for procedural clinic appointments. As our data suggest, procedural clinic consultations were down by 85% for the 2020 cohort compared to the 2019 cohort. Only two TRUS prostate biopsy procedures and 26 flexible cystoscopies were performed during NHRFA level 2, all of which were subacute cases. Standard procedural clinics had to be deferred due to their non-urgent nature. This in turn resulted in a significant backlog of procedural clinic appointments for after NHRFA level 2 and a significant number of patients with delayed investigations.

Avoided travel

We have previously assessed the acceptability to patients of virtual clinic consultations (unpublished) and the actual travel savings. Although virtual consultations limit the possibility of physical examination and in-clinic procedures, it does provide a significant economic and environmental benefit to the community.
As stated previously, by consulting with patients in a virtual setting and avoiding face-to-face consultations at the hospital, travel reduced by an estimated 6,828km. This equates to an average 22.7km of travel per patient saved, which would have had significant repercussions on the environment as well as on travel expense and journey time for outpatients.

**Conclusion**

Our data provide a snapshot interpretation of the altered workload relating to admissions, operating theatre cases and outpatient clinics in the CCDHB urology department during the implementation of NHRFA level 2. They provide us with an insight into which aspects of the service are most heavily affected by the imposed restrictions and how best to manage these to moderate the overall impact of healthcare provision for the community. The data also set a precedent for major crisis response management going forward and highlights which areas might require particular attention in these scenarios. Furthermore, with regard to the virtual consultation platform, the data also suggest ways in which our practice can be adapted on a routine basis in the future, in order to increase efficiency and to provide a service that is both economic to the patient and environmentally prudent.

**Competing interests:**

Nil.

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Impact of the COVID-19 pandemic lockdown on public sector ophthalmic work by New Zealand’s ophthalmologists

Daniel A R Scott, Peter W Hadden, Graham A Wilson

ABSTRACT

AIM: In response to the COVID-19 pandemic, the New Zealand government enforced a nationwide ‘alert level 4’ lockdown from 26 March to 27 April 2020. We assessed the impact of this lockdown on New Zealand’s public ophthalmology service.

METHOD: An anonymous online survey was sent to all New Zealand-based fellows of the Royal Australian and New Zealand College of Ophthalmologists (RANZCO) after lockdown. Respondents provided retrospective assessment of practice patterns and their personal health during the COVID-19 lockdown. This was supported by national-level administrative data, allowing survey findings to be contextualised.

RESULTS: Fifty-seven respondents (response rate 49%) working in the public health system participated. A large majority of respondents reduced elective clinic and surgical volumes by at least 75% (82% and 98%, respectively). National-level information confirmed clinic reduced to 38.2% of normal and elective operating volumes to 11.5%, with virtual visits increasing 17.9-fold. Elective clinic and elective operating volumes promptly recovered to usual volumes on the second month post lockdown. Most respondents (58%) followed the RANZCO triaging guideline, and 28% triaged emergencies only. At a personal level, respondents reported a significant physical health benefit (p<0.001) associated with the lockdown experience, but no change in mental health or social wellbeing.

CONCLUSIONS: Publicly employed ophthalmologists experienced dramatic reductions to elective clinic and operating volumes during the COVID-19 lockdown. The prompt recovery of service delivery volumes back to pre-lockdown levels supports the value of a COVID-19 elimination strategy in New Zealand. Virtual visits for selected patients allowed ongoing management without risking virus transmission.

The virus SARS-CoV-2 (the cause of COVID-19) began circulating in Wuhan, China, in November 2019. It subsequently spread across the world, becoming a global pandemic. Physical distancing was the main strategy of limiting the spread of COVID-19, leading to a number of nationwide lockdowns. In April, approximately one-third of the world’s population was under COVID-19 lockdown orders or similar movement restrictions. New Zealand adopted an evidenced-based strategy of virus elimination. After a small number of cases were identified in New Zealand, a nationwide ‘alert level 4’ lockdown period began on 26 March, which eventually relaxed into a less intense alert level 3 lockdown on 28 April.

Compared to other countries, New Zealand was fortunate to have a number of distinct advantages that favoured an elimination strategy. First, COVID-19 had a relatively late arrival to New Zealand, allowing us time to plan and learn from the experiences of countries like China, Korea, the United Kingdom, Iran and Italy; as a remote island nation with defined and monitored borders, our location enabled an effective border closure and quarantine of all returning New Zealand nationals; and, informed by...
Using the ESCRS survey as a scaffold for its design, the survey was shortened to eight questions to maximise the response rate, and a final question allowing free-text answers let respondents leave further comments. The survey was reviewed by a clinical psychologist prior to its distribution. The survey was sent to all New Zealand-based RANZCO fellows by their professional body (the RANZCO) on 21 May, with a second reminder six weeks later, on 2 July. At the time of the survey, there were 138 New Zealand RANZCO fellows, with 117 (87%) confirmed as working either part- or full-time in the New Zealand public sector at local district health boards (DHBs). Survey access and collection utilised a self-administered anonymous Google survey form. Survey results were converted into a Microsoft Excel spreadsheet for analysis.

The following national-level administrative data were requested from the Ministry of Health for the month of April 2019 and April 2020: clinic volumes, elective theatre volumes and clinic virtual visits (VVs). This information was received on 19 August 2020 following a request under the Official Information Act. Data for months May and June (2019 and 2020) were received on 12 April 2021.

Results

A total of 59 ophthalmologists responded to the survey, with two excluded due to working only in private (ie, no public/DHB workload). The response rate was therefore 49% (57/117), with respondents representing 12 DHBs from around New Zealand (Figure 1). The median DHB job size of respondents was 0.62 full-time equivalent (Figure 1).

Elective clinic consultations reduced substantially (p<0.001) during the lockdown, with 82% of respondents seeing 75% less than their usual volume of patients (Figure 2). National-level administrative data records for the month of April indicate 2020 clinic consultation volumes were 38.2% of April 2019. Service volumes in May and June 2020 recovered to 68.9% and 107.0% respectively compared to the previous year. Clinic volumes for first specialist appointments (FSAs) experienced a more significant reduction compared to clinic follow-up appointments (Table 1).

Methods

The study survey was created in consultation with two consultant ophthalmologists using the ESCRS survey as a scaffold for its design. The survey was shortened to eight questions to maximise the response rate, and a final question allowing free-text answers let respondents leave further comments. The survey was reviewed by a clinical psychologist prior to its distribution. The survey was sent to all New Zealand-based RANZCO fellows by their professional body (the RANZCO) on 21 May, with a second reminder six weeks later, on 2 July. At the time of the survey, there were 138 New Zealand RANZCO fellows, with 117 (87%) confirmed as working either part- or full-time in the New Zealand public sector at local district health boards (DHBs). Survey access and collection utilised a self-administered anonymous Google survey form. Survey results were converted into a Microsoft Excel spreadsheet for analysis.

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The following national-level administrative data were requested from the Ministry of Health for the month of April 2019 and April 2020: clinic volumes, elective theatre volumes and clinic virtual visits (VVs). This information was received on 19 August 2020 following a request under the Official Information Act. Data for months May and June (2019 and 2020) were received on 12 April 2021.
Elective surgery essentially stopped \((p<0.001)\) during the lockdown, with 79% of respondents performing zero elective operations, and 98% performing less than 25% of their usual volume (Figure 2). National-level administrative data (which included one week of the less intense lockdown at alert level 3) confirmed elective operating reduced to 11.5% of April 2019 service volumes. The elective operating volumes in May and June 2020 recovered to 80.9% and 115.3% respectively compared to the previous year. Of interest, acute operating volumes reduced to 43.1% of usual service volumes in April. A similar pattern of recovery was demonstrated in May and June 2020, with acute operating recovering to 61.5% and 95% respectively of usual service volumes (Table 1).

VVs performed by telephone, e-mail, application and video were performed by 70% of respondents \((p<0.001)\) (Figure 3). National-level administrative data confirmed that the volume of VVs increased by 17.9 times compared to April 2019, being 19.8% of all April 2020 clinic visits. A breakdown of VVs for 2020 showed 91.3% were classified as follow-ups, with the remainder being FSAs.

The New Zealand RANZCO triaging guidelines were reported to have been followed by 58% of respondents \((p<0.001)\). Over a quarter (28%) triaged only vision/life-threatening emergencies, and 14% using clinical judgement for triaging (ie, either they were unaware of the clinical guideline or preferred to triage differently to the guideline) (Figure 3).

For ophthalmologists, the impact of the alert level 4 lockdown appeared to have had mixed impacts across the three domains (mental, social wellbeing, physical) of health. There were no reported significant mental health \((p=0.81)\) or social wellbeing \((p=0.69)\) impacts from the COVID-19 lockdown. However, there was
Table 1: Public sector ophthalmic service workload reduction by district health board (DHB) represented as a percentage (%) compared to normal (national-level administrative data for April 2020 compared to April 2019).

<table>
<thead>
<tr>
<th>DHB</th>
<th>Total clinic %</th>
<th>Clinic FSA %</th>
<th>Clinic FU %</th>
<th>Elective operating %</th>
<th>Acute operating %</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHB 1</td>
<td>26.8</td>
<td>37.2</td>
<td>26.1</td>
<td>7.6</td>
<td>37.5</td>
</tr>
<tr>
<td>DHB 2</td>
<td>45.5</td>
<td>48.2</td>
<td>44.6</td>
<td>15.1</td>
<td>35.1</td>
</tr>
<tr>
<td>DHB 3</td>
<td>87.1</td>
<td>80.9</td>
<td>89.0</td>
<td>33.3</td>
<td>100.0</td>
</tr>
<tr>
<td>DHB 4</td>
<td>80.4</td>
<td>56.2</td>
<td>90.1</td>
<td>19.5</td>
<td>40.0</td>
</tr>
<tr>
<td>DHB 5</td>
<td>25.2</td>
<td>25.6</td>
<td>25.0</td>
<td>3.2</td>
<td>86.4</td>
</tr>
<tr>
<td>DHB 6</td>
<td>19.9</td>
<td>40.0</td>
<td>16.4</td>
<td>8.1</td>
<td>n/a</td>
</tr>
<tr>
<td>DHB 7</td>
<td>26.9</td>
<td>31.7</td>
<td>24.3</td>
<td>6.6</td>
<td>14.3</td>
</tr>
<tr>
<td>DHB 8</td>
<td>96.7</td>
<td>60.7</td>
<td>84.6</td>
<td>0.0</td>
<td>n/a</td>
</tr>
<tr>
<td>DHB 9</td>
<td>26.8</td>
<td>45.8</td>
<td>29.1</td>
<td>0.0</td>
<td>150.0</td>
</tr>
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<td>DHB 10</td>
<td>26.5</td>
<td>35.9</td>
<td>24.8</td>
<td>8.8</td>
<td>0.0</td>
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<tr>
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<td>51.1</td>
<td>41.5</td>
<td>0.0</td>
<td>50.0</td>
</tr>
<tr>
<td>DHB 12</td>
<td>26.2</td>
<td>54.2</td>
<td>22.7</td>
<td>8.2</td>
<td>60.0</td>
</tr>
<tr>
<td>DHB 13</td>
<td>22.5</td>
<td>26.1</td>
<td>21.6</td>
<td>8.7</td>
<td>0.0</td>
</tr>
<tr>
<td>DHB 14</td>
<td>22.4</td>
<td>37.2</td>
<td>19.7</td>
<td>20.9</td>
<td>137.5</td>
</tr>
<tr>
<td>DHB 15</td>
<td>33.3</td>
<td>33.3</td>
<td>33.3</td>
<td>45.5</td>
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</tr>
<tr>
<td>DHB 16</td>
<td>15.9</td>
<td>11.0</td>
<td>17.9</td>
<td>0.0</td>
<td>100.0</td>
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<tr>
<td>DHB 17</td>
<td>31.0</td>
<td>37.3</td>
<td>28.8</td>
<td>7.6</td>
<td>45.8</td>
</tr>
<tr>
<td>DHB 18</td>
<td>42.2</td>
<td>19.2</td>
<td>48.9</td>
<td>0.0</td>
<td>n/a</td>
</tr>
<tr>
<td>DHB 19</td>
<td>22.7</td>
<td>9.1</td>
<td>26.1</td>
<td>3.2</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Not applicable, FSA first specialist assessment, FU follow-up.

Figure 3: Percentage of virtual visits during alert level 4 lockdown (left), and triaging method for the alert level 4 lockdown restrictions (right).
a clear physical health (p<0.001) benefit reported from the lockdown (Figure 4).

A number of key themes emerged on review of the thirteen free-text comments left by respondents. Two respondents highlighted the benefits of consultant (ie, senior medical officer) triage for managing acute referrals increasing efficiency and remote management. A few respondents appreciated the “less frenetic pace of work”; however, almost half of respondents appreciated the delays generated from lockdown have increased the “backlog of elective work”, putting a “strain on services long term”.

Discussion

The COVID-19 alert level 4 lockdown dramatically reduced the clinic and surgical workload for New Zealand’s publicly employed ophthalmologists. Our retrospective survey of practice patterns found that during the lockdown almost 80% of these ophthalmologists did not perform elective surgery, with a similar proportion reducing clinic volumes by 75%. National-level administrative data indicate clinic consultation visits and elective operating volumes reduced to 38.2% and 11.5% of normal, respectively.

The timely access to ophthalmic care has major impacts on the progression of eye conditions and their treatment outcomes. It is therefore not surprising that COVID-19 has led indirectly to increased rates of blindness from delayed diagnosis/referral of acute and chronic ocular conditions internationally. The timing of COVID-19 during VISION 2020 is ironic, given this was the year to celebrate vision. Instead a scaled back and reprioritised ophthalmic service has probably increased the risk of avoidable blindness from reduced access in the international setting.

Research to date documenting reduced clinic and elective surgical volumes during COVID-19 lockdowns have been published in both India and Europe (ESCRS survey). Nair et al found 70% of ophthalmologists in India stopped all clinical work (clinic and operating) for their nationwide lockdown. For ophthalmologists in India who continued to see patients, over 80% classified their patient encounters as emergencies (eg, endophthalmitis, retinal detachment, trauma). In Europe, the ESCR survey reported that one-third of European ophthalmologists provided emergency care only, with 11% and 58% of European ophthalmologists stopping all clinic consultations and operating, respectively.

In the New Zealand public ophthalmic sector, elective surgical volume reduced by almost 90%, which is less than European and Indian survey data by comparison. The reduction of elective clinic consultations was more modest compared to the elective surgical volumes in New Zealand. There was substantial variation between different DHBs (Table 1), which highlights a different case-mix of patients and/or different triaging strategy.

New Zealand adopted the elimination strategy towards COVID-19, as opposed to the mitigation and suppression strategies adopted by European countries. The benefit of the New Zealand approach afforded the country a relatively quick return to normal domestic activity and

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**Figure 4**: Impact of alert level 4 lockdown on mental health (left), physical health (middle) and social wellbeing (right).
routine ophthalmic clinical care.\textsuperscript{15} In principle, elimination focuses on preventing pandemic virus introduction and ending local transmission, as opposed to ongoing suppression/mitigation strategies that involve ongoing physical distancing, testing and contact tracing (and potentially repeated lockdowns).\textsuperscript{14} Public ophthalmology service volumes recovered back to normal on the second month after lockdown. Although the impact of lockdown to ophthalmic service delivery was significant, it was relatively short-lived, and this is a credit to the success of our public health elimination policy. Furthermore, although New Zealand and most European countries were in lockdown, the health systems of many European countries were overwhelmed, and they experienced potentially avoidable deaths and increased all-cause mortality.\textsuperscript{16}

Most international ophthalmology societies around the world produced triaging guidelines during the COVID-19 pandemic. There was a focus on delaying non-urgent care and following recommended safety practices to reduce infection transmission.\textsuperscript{17} The New Zealand RANZCO branch produced a triaging guideline with recommendations for various ocular presentations and ophthalmic diseases.\textsuperscript{10} These were followed by the majority of respondents in our survey, with those in a tertiary referral region being 1.9 times more likely to follow these guidelines. The variance in the triaging of care, reflected by the workload reductions across DHBs (Table 1), may have led to inequities in healthcare access and differences in ocular health outcomes between regions. Triaging care during this period was time consuming, challenging and involved many competing interests. New novel scoring algorithms\textsuperscript{18} and modelling tools\textsuperscript{19} may have a role in providing a more objective assessment in the future.

Most ophthalmologists in our survey reported physical health benefits during the lockdown, which is not surprising given the known health benefits of exercise and its promotion as an essential activity during the New Zealand lockdown.\textsuperscript{20} Previous research has shown that lockdowns generally produce negative benefits to mental health and an improved sense of community and social connectedness, but our survey results did not support these findings.\textsuperscript{21}

The use of telesophthalmology (or VVs), which provides physical distancing protections while continuing to offer care, increased 17.9-fold during the lockdown month of April. Over 90% of patient VVs were classified as follow-up consultations, and the literature has shown these patients (as opposed to first specialist assessments) are more likely to engage with this type of service delivery.\textsuperscript{22} Furthermore, the integration of acute telesophthalmology services in France and the United Kingdom was able to reduce in-person ophthalmology assessments by 73%\textsuperscript{23} and 78%\textsuperscript{24} respectively.

If New Zealand re-entered another lockdown as a result of a large outbreak from a border control failure, the application and translation of our research could help inform future ophthalmology service responses. The survey highlights the success of upscaling VVs and consultant-led triage to reduce the risk of virus transmission. This form of service delivery may have a greater role in our overburdened public health system for the future. Anecdotal unpublished reports from across New Zealand indicate a number of patients have gone blind in their only eye due to missed or delayed elective clinic appointments. Future research could calculate the visual burden attributed to delayed clinic appointments/surgery from the alert level 4 lockdown. It would be interesting to then assess whether the different ophthalmic workload reductions by DHB had any impact on the visual burden.

The combination of survey findings and national-level administrative data is a strength of our study, and we compared findings to the published literature in Europe and India. The survey response rate of 49% is in line with the online web-based survey response rate of surgical doctors.\textsuperscript{25} The survey could have been held closer to the end of lockdown to increase the accuracy of the respondents’ answers. The national-level administrative data for April also captures one week of alert level 3 restrictions, and so triaging of care may have been loosened, given the country had already stepped down from alert level 4 lockdown restrictions.
Competing interests:
Dr Hadden reports that he is the current chair of the New Zealand branch of the Royal Australian and New Zealand College of Ophthalmologists, which formulated prioritisation guidelines for ophthalmology during the pandemic.

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Addressing structural discrimination: prioritising people with mental health and addiction issues during the COVID-19 pandemic

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ABSTRACT

Structural discrimination worsens physical health inequities and significantly reduces life expectancy for people with mental health and addiction issues. Aotearoa has recently made some notable changes in health policy by formally recognising the physical health needs of people with mental health and addiction issues. The COVID-19 vaccination sequencing framework provides an important opportunity to protect and promote the health of people with addiction and mental health issues. An expert advisory group, convened as part of the Aotearoa Equally Well collaborative, considered findings of a literature review on the vulnerability of people with mental health and addiction issues of contracting and dying from COVID-19. Evidence indicates an association between mental health and addiction issues and infection risk and worse outcomes. The group concluded mental health and addiction issues should be recognised as underlying health conditions that increase COVID-19 vulnerability, and that people with these issues should be prioritised for vaccination. For too long the health system has failed to address the life expectancy gap of people with addiction and mental health issues. Now is an opportunity to change the kōrero. People with mental health and addiction issues experience significant physical health inequities. Addressing these inequities must be integral in modern health policy—including our COVID-19 pandemic response.

The recognition of mental health and addiction issues as pre-existing health conditions that place people at higher risk of serious outcomes or illness in the Ministry of Health’s vaccine rollout plan (ie, Group 3) is critical to prevent further physical health inequities for people with mental health and addiction issues.

People with mental health and addiction issues have two to three times the risk of dying before the age of 65 compared to the general population. Two-thirds of this risk is caused by preventable and treatable physical illnesses. Policy-level changes, alongside practice changes, are crucial if this significantly reduced life expectancy is to be addressed.

Over the past five years there have been notable changes in Aotearoa New Zealand’s health policy towards formally recognising the physical health inequities experienced by people with mental health and addiction issues. These include Living Well with Diabetes, the five-year plan for people at high risk of or living with diabetes, which identifies people with mental health and addiction issues as a high-risk group and priority population for routine diabetes screening. An evidence review around cardiovascular disease (CVD) risk and management in people with mental health and addiction issues informed new guidance for primary care CVD risk assessment and management.
guidance prioritises people with mental health and addiction issues for CVD risk assessment and ongoing management from the age of 25. The New Zealand Cancer Action Plan 2019–2029 has a focus on the need to improve the quality of cancer screening and treatment of people with addiction and mental health issues.

The whole of the healthcare system is consistently identified as a major factor to the physical health inequities experienced by people with mental health and addiction issues. This is particularly due to systemic issues that impact on access to, and quality of, physical healthcare. At worst, this results in the denial of preventative services and routine care. Stigma and discrimination, particularly diagnostic overshadowing (the assumption that physical health symptoms are related to a mental health or addiction diagnosis) and clinicians seeing the person as their mental health or addiction diagnosis, means people are less likely to receive the expected standard of healthcare. This leads to delayed or missed physical health screening, care and treatment. Discrimination is experienced across the health system, including but not limited to diabetes care, routine cancer screening, blood pressure and cholesterol monitoring, surgical interventions for cardiovascular diseases and vaccinations.

There is also the significant and often unrecognised intersection of ethnicity, mental health, addiction and physical health, with the largest inequities for Māori and Pasifika peoples living with mental health and addiction issues. There is an important opportunity for the Government to meet its Te Tiriti o Waitangi commitments to active protection, as described in Whakamaua Māori Health Action Plan 2020–2025.

Kia Kaha, Kia Māia, Kia Ora Aotearoa: Psychosocial and Mental Wellbeing Plan identifies people with mental health and addiction issues as a priority group in relation to the psychosocial impacts of COVID-19, and that they are more vulnerable to infection and negative outcomes from the virus. It is critical that there is formal recognition and that this recognition translates into vaccination policy and implementation, including workforce education and training.

Understanding COVID-19 vulnerability

At the end of 2020, the backbone team of the Aotearoa New Zealand Equally Well collaborative convened a group of expert advisors to appraise the available evidence on COVID-19 vulnerability and people with mental health and addiction issues and, from this appraisal, to develop a position statement. The review of the evidence was conducted by Te Pou, a national workforce centre for mental health, addiction and disability in Aotearoa New Zealand.

In January 2021, the position statement and a summary of the evidence gathered were provided to the Ministry of Health's policy team developing the COVID-19 vaccination sequencing framework. This information was also made available on the Te Pou website.

This literature review was crucial for understanding both the extent of risk of infection for COVID-19 and poorer health outcomes for people with addiction and mental health issues. It was also important to look at whether any risks were only for people with existing physical health comorbidities (such as high body mass index [BMI], hypertension, cardiovascular disease or diabetes), or whether people with mental health and addiction issues have elevated risks from COVID-19 independent of coexisting issues. If the latter is true, it is crucial that vaccination prioritisation explicitly lists mental health and addiction issues as underlying health conditions that place people at greater risk. Other countries, including the UK, Ireland, Germany and Denmark, have identified and recognised a significantly greater risk in their respective vaccination prioritisation frameworks.

Te Pou conducted the rapid literature scan in December 2020 and drew on systematic reviews, where available, and individual studies. The review sought to answer the following questions: For people with mental health and addiction issues:

• is the risk of being infected with COVID-19 higher compared to other groups?
• what is the independent risk of hospitalisation and death from COVID-19?

The review found a significant volume of high-quality research and evaluation that...
explores the relationship between COVID-19 infection and outcomes for people experiencing mental health and addiction issues. The research spans a wide range of countries and settings and consists of systematic literature reviews, quantitative survey data, qualitative narratives and retrospective cohort and case-control studies. This included large studies in the US, the UK and Europe.

The review found that the risks of infection were particularly high for people meeting diagnostic criteria for a mental health or addiction issue in the past year (including first diagnosis); people experiencing multiple mental health or addiction issues; and people accessing inpatient services. In terms of hospitalisation with COVID-19, the risk for people with experience of mental health and addiction issues is significantly higher compared to people not experiencing these issues, with the risk even higher for people who meet criteria for multiple diagnoses. The risk of dying from COVID-19 may be up to twice as high for people with experience of mental health and addiction issues, and even higher for people with certain diagnoses and more complex needs. For example, people experiencing psychosis or schizophrenia may have a risk from 2.7 to 4.4 times higher than people without these experiences.

Subsequently, even more compelling evidence has emerged. In February 2021, the Robert Koch Institute published an umbrella review of the evidence on the relative risks of hospitalisation and death for different underlying health conditions. People with ‘severe mental illnesses’ (defined as meeting diagnostic criteria for schizophrenia, depression and bi-polar disorder) had the third highest risk of hospitalisation once infected with COVID-19 compared to all other underlying health conditions [OR 2.10 (95% CI 1.2–3.7)]. Only heart failure and organ transplantations had higher risk ratios. Similarly, the risk of death for people with severe mental illnesses was higher than all other underlying health conditions [OR 2.9 (95% CI 1.3–6.6)], except for lung disease, heart failure and cancer (not in remission). The quality of the evidence was considered strong. In response to the findings of the Robert Koch Institute review, the German government have prioritised people with mental health and addiction issues within the same priority tier for vaccination as people in the general population aged 70–74. In March 2021, Toubasi and colleagues published a meta-analysis exploring the relationship between pre-diagnosis of mental health issues and COVID-19 outcomes. They found people with mental health diagnoses were more likely to become seriously ill or to die from COVID-19, an association that remained significant after adjusting for confounding variables. People with diagnoses of schizophrenia, schizotypal and delusional disorders had higher COVID-19 mortality compared to people with mood disorders. The authors recommend prioritising people with mental health and addiction issues for vaccination.

Three key findings emerged from the Te Pou literature review:

1. People with mental health and addiction issues are at higher risk of contracting COVID-19 than those without.
2. Once infected, people with mental health and addiction issues have a higher risk of severe outcomes including hospitalisation and death.
3. These risks, especially for people with ‘severe mental illness and addiction diagnoses’, are evident even once estimates are adjusted for other known risk factors for COVID-19 infection and severe outcomes. These factors include physical comorbidities, obesity and socioeconomic status.

There is also emerging evidence from a UK study that people with mental health and addiction issues are much less likely to present for COVID-19 vaccination. The authors hypothesise that this could reflect challenges in access. These experiences highlight the importance of specific information and targeted communication for people and whānau, as well as to the workforce, to support vaccination uptake and implementation.

As a result of the evidence review and their knowledge and experience of the physical health inequities experienced by people with mental health and addiction issues, the expert advisory group made the following recommendations in the position statement.
• That people with experience of mental health and addiction issues be included in the COVID-19 vaccine sequencing framework within the priority group ‘people aged under 65 with underlying health conditions and disabilities.’

• The initial priority within this group should be adults (18 years and older) currently accessing secondary mental health and addiction services and people with long-term mental health and addiction issues in continuing primary care.

• That a specific information and communication programme be developed for this population, designed with people with lived experience and cultural leaders, to support vaccination uptake and implementation.13

Prioritising the physical health of people with mental health and addiction issues

The findings of the literature review on COVID-19 vulnerability align with the established New Zealand and international evidence of the higher prevalence of a wide range of coexisting physical health issues for people with addiction and mental health issues.22–26 The reasons for these associations have not yet been fully explained, but are thought to be based on causal mechanisms and shared determinants.27 Causal mechanisms include a variety of biological, psychological, pharmacological and service delivery pathways, combined with racism and discrimination.5,28 Shared determinants include socioeconomic and environmental factors, particularly childhood adversities and generic risk factors.27,28,29

Another recent New Zealand study makes an important contribution to knowledge in this area.25 Four measures of ageing were examined across the prospective cohort of people at age 45. People with mental health and addiction issues were found to be ageing up to five years ahead of their actual age. This association between mental health and addiction issues and accelerated ageing remained after the study took account for childhood physical health, adversities, socioeconomic status, smoking and weight. Accelerated aging is an important measure as it provides a risk marker prior to the onset or diagnosis of physical illnesses, such as CVD or diabetes.

The evidence shows an independent association between infection and poor outcomes from COVID-19 for people across the range of mental health and addiction diagnoses. When this is combined with the evidence on accelerated ageing and well-established body of knowledge on coexisting physical health issues and premature mortality, the case is sadly compelling.

The evidence is clear. Mental health and addiction issues result in earlier onset of chronic physical conditions, and if vaccination prioritisation is based on physical health conditions alone, then it will exacerbate existing health inequities for people with experience of mental health and addiction issues. We need to change the kōrero. Health policy should identify people who experience mental health and addiction issues ipso facto as a priority group. An inclusive policy approach would enable people to take action at systems and practice levels to help achieve physical health equity for people experiencing mental health and addiction issues.

Supplementary note

Since this manuscript was first submitted, the Ministry of Health has taken up the recommendations of the advisory group. On 1 June 2021 the list of relevant underlying health conditions that increase the risk of worse outcomes from COVID-19 was updated. This list now includes people who “have been diagnosed with severe mental illness (which includes schizophrenia, major depressive disorder, bipolar or schizo-affective disorder, and adults currently accessing secondary and tertiary mental health and addiction services).” (Source: Ministry of Health, 2021 COVID-19 vaccine rollout groups, covid19.govt.nz.)
Competing interests:
Nil.

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How were medical students from Christchurch, New Zealand, involved in their COVID-19 response?

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ABSTRACT
Medical students from the University of Otago, Christchurch Department of Medicine were involved in their local COVID-19 response. A group of ten students helped with the assessment of individuals at community-based assessment centres or mobile testing units. They primarily helped assess and test individuals alongside experienced healthcare workers. The students gained valuable clinical and public health experience. Key learning points were the risks of pandemic involvement, identifying local barriers to healthcare and developing an appreciation for an evolving health response. Overall, students felt that preparation for future involvement could benefit further pandemic responses.

Early in the academic year of 2020, our cohort of medical students at the University of Otago in Christchurch received a lecture on the developing COVID-19 pandemic. While many felt concerned by the situation unfolding overseas, we found it difficult to conceptualise this virus in New Zealand. This changed when international classmates were prevented from returning from overseas and we soon had our first case in late February. Without a clear protocol for medical students, we were left wondering: what would our role be in this incoming pandemic?

Turning to news and social media we became aware that some overseas medical students had been part of their country’s response. In Italy, early graduation for around 10,000 final-year students helped supplement their overburdened workforce. The United Kingdom also prioritised qualification for final-year students to help the National Health Service. We experienced an early country-wide lockdown and, together with clear daily communication, avoided a large-scale outbreak. During lockdown only final-year medical students could remain in clinical settings, a decision that resulted in the cancellation of hundreds of hours of placements for remaining students. This left us with an unusual amount of free time yet a strong desire to be part of our own country’s response.

How were students involved?
Across the country many medical students volunteered their time and skills in a variety of ways. During the pandemic students helped with contact tracing, looking after children of healthcare workers and at the national health call-line. In Christchurch, a medical-student initiative formed a ‘volunteer army’ for those who wanted to help. This was utilised when a group of ten in our fifth year of medicine were asked to assist at an initial ‘pop-up’ surveillance testing location. There we initially worked to transcribe and document details alongside healthcare workers. As our involvement progressed, we were trained to perform nasopharyngeal swabs and use primary protective equipment (PPE). This gave us the ability to work on the frontline and help assess symptomatic individuals at established locations known as community-based assessment centres (CBACs). It also gave us insight to share when new protocols...
were being developed for the first time. We soon recognised that many members of the public were unable to commute to get tested. Mobile testing units were established and became one of our main roles. We worked out of vehicles alongside local general practitioners to help assess and test in the community. We found ourselves helping design new protocols for the transportation of swabs and use of PPE. Some of us were also involved in testing high-risk individuals, such as staff from the New Zealand Police, Fire and Emergency New Zealand and local rest homes. We found that, regardless of our involvement, we developed a variety of skills that built on our previous medical training (Table 1).

**Key learning points**

**Risks of involvement**

As medical students, we often find ourselves in the unique situation of observing clinical situations with reduced risk. Usually there are protocols that protect us from the risk of harm to ourselves or others. In this pandemic, many of us felt able to assist despite the unknown risk with a new virus. Our overseeing medical deans agreed that ‘immersive and experiential learning’ was crucial for student education, but only ‘in the right roles, and with appropriate supervision and support’.[3] Initially it was hard for us to conceive what this would entail and whether the risks really were known. Overseas we saw that healthcare workers were over-represented in COVID-19 cases and deaths. Knowing that our assistance might increase the chance of exposure to us and others in our living situations, we were at first apprehensive. Thankfully the more controlled situation in New Zealand made our assistance less daunting over time. We found our involvement rewarding, whether it was on the frontline or not, and the level of risk balanced well with learning opportunities. If student roles are to be explored in future responses, we suggest a range of options that can be adjusted to the level of risk.

**Barriers to testing**

Mobile testing was a novel idea and quickly became one of our key roles as students. This took us into the homes of those unable to commute to COVID-19 testing sites. We visited a wide range of locations, including quarantine facilities, support housing residencies, juvenile detention centres and even rural locations outside of Christchurch. We regularly visited individuals who lacked transport, were of an older age or had disabilities. As taught at medical school, a key social determinant of health is access to healthcare.[7] On many occasions our visit was the first contact with healthcare services for an issue that had not been previously addressed. Sometimes it became the role of the more senior health professional to provide other cares for the patient in addition to COVID-19 testing. Many houses were damp and cold. In some

**Table 1:** Summary of medical student involvement in the COVID-19 response in Christchurch, New Zealand.

<table>
<thead>
<tr>
<th>Student role</th>
<th>Skills developed</th>
</tr>
</thead>
<tbody>
<tr>
<td>History taking and documenting</td>
<td>• Acquiring patient details and establishing a symptom history</td>
</tr>
<tr>
<td></td>
<td>• Screening for symptoms associated with COVID-19 and for those in high-risk populations</td>
</tr>
<tr>
<td></td>
<td>• Communication with a range of healthcare workers</td>
</tr>
<tr>
<td>COVID-19 testing</td>
<td>• Explaining and performing a nasopharyngeal swab</td>
</tr>
<tr>
<td></td>
<td>• Application of PPE and understanding of the aseptic technique</td>
</tr>
<tr>
<td>Clinical assessment</td>
<td>• Recording and interpretation of vitals including temperature, oxygen saturations, respiratory rate, heart rate and blood pressure.</td>
</tr>
<tr>
<td>Pandemic planning</td>
<td>• Helping set up and design clinical protocols</td>
</tr>
<tr>
<td></td>
<td>• Providing feedback on the current response</td>
</tr>
</tbody>
</table>
houses there were children with respiratory symptoms likely exacerbated by their environment. These visits let us view living situations from the centre of a patient’s home. This left a lasting impact on many of us and cemented a strong reminder of how risk factors and living conditions can impact upon health.

Planning an evolving response

We observed how rapidly a public health response needed to change during a new pandemic. As the number of confirmed cases increased, the protocols for community testing had to adjust from day to day. We helped set up pop-up surveillance sites, which allowed us to think through the finer details, like ensuring the layout was efficient yet safe. One important lesson was the importance of ongoing communication. Every morning each CBAC had a briefing session about any recent changes to the criteria for testing, self-isolation advice or protocols. This reflected the evolving nature of the pandemic and response to the latest guidelines, which accounted for local area challenges. We were impressed that whenever the Ministry of Health requested the need for surveillance testing the relevant primary health organisation set up an assessment centre within 24 hours.

We quickly appreciated that working in this type of environment required communication and flexibility, skills much needed as future doctors.

Future directions

In light of our contribution, we suggest that preparing medical students for future disaster or pandemic situations may be beneficial. So far the impact of COVID-19 within New Zealand has been manageable at the hospital level. We make note that further events may occur where the health response might not match the health demand. Our involvement built on previously taught medical knowledge and, along with ad hoc training and support, we felt confident in the roles we were given. However, there was much initial uncertainty about our role, and only a small group of us were involved. Some medical schools provide a curriculum for pandemic or disaster situations to allow faster and more effective student involvement. We propose that disaster and pandemic training tailored to medical student experience would be beneficial. Furthermore, establishing local pathways for student involvement could help ease an overburden health system if, or inevitably when, future events occur.
Competing interests:
Nil.

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REFERENCES
Teleophthalmology in the post-coronavirus era
Francesc March de Ribot, Anna March de Ribot, Kelechi Ogbuehi, Ruth Large

ABSTRACT
173,766 New Zealanders suffer from visual impairment. The associated health-system costs are $523 million in total, or $3,008 per person. Yet eighty percent (80%) of blindness is avoidable if detected on time. Public health services have an increasing workload but are also limited by material and technical resources. Optometry practices continually increase referrals (up to 100% in one year) that cannot be solved on time, reducing the efficiency of the service. Teleophthalmology works by improving the efficiency of screening and monitoring and integrating eye healthcare and by decreasing referrals by up to 40%.

Offering excellent quality care to the population via our public healthcare system is one of our national priorities. To seek consultation from an ophthalmologist, patients usually make an appointment with an optometrist (or a general practitioner (GP)) before being referred. The continuously growing number of referrals from optometry practices (more than 100% in one year) increases pressure on the public service. Telemedicine systems are an opportunity to implement new solutions and optimise eye care in the post-coronavirus era.

New Zealand patients receive government-funded care from ophthalmologists in the public sector. Patients typically visit an optometrist or GP to be referred to an ophthalmologist for further consultation. In the private sector, optometry practices are increasing the pressure of the public service with a continuously growing number of referrals. In some cases, referrals increased 100% in a year, representing, in the Auckland District Health Board (DHB), more than 1,000 patients per month. There are no practical solutions for this situation, and the sustainability of the system is at risk. Because there are many referrals, it is a challenge to review all patients in a timely manner.

In 2020, before the coronavirus pandemic, more than 14,250 people within the Counties Manukau DHB were waiting to see an ophthalmologist. In some cases, referrals increased 100% in a year, representing, in the Auckland District Health Board (DHB), more than 1,000 patients per month. There are no practical solutions for this situation, and the sustainability of the system is at risk. Because there are many referrals, it is a challenge to review all patients in a timely manner.

In 2020, before the coronavirus pandemic, more than 14,250 people within the Counties Manukau DHB were waiting to see an ophthalmologist. The worst scenario is when patients are lost to follow-up, which happens in up to 38% of cases, even in high-risk-of-vision-loss conditions. This situation is particularly problematic in elderly people, diabetics with comorbidities and specific collectives, such as the Māori population, who face greater barriers to accessing the healthcare system.

Coronavirus pandemic
A large portion of ophthalmology patients are at high risk for coronavirus mortality (patients with macular degeneration aged 85 years or more, people with diabetes and patients who are immunocompromised). Consequently, ophthalmic services reduced in-person consultations to minimise potential exposure to the disease for the eye care providers and at-risk populations. A recent international survey suggests that ophthalmology has been the most affected medical specialty, with a decrease of 79% in the number of visits. For these reasons, delays in ophthalmology appointments significantly worsened, probably resulting in vision loss. It is a priority to restart our services as soon as possible. In New Zealand, because of the coronavirus pandemic, an estimate of more than 40,000 patients have had their appointments postponed.
(The estimate comes from extrapolating the effect of lockdown in the Southern DHB across the New Zealand population).

Inequalities in health and remote patients
New Zealand has a vast territory with a significant number of patients in rural and isolated areas. These people have limited access to health services, medical shortages and constrained financial resources. Receiving medical care implies travel to urban areas, which costs time and money. Isolated communities suffer complications of eye diseases more than urban populations due to inequitable access to public healthcare resources. Furthermore, there are gaps in the efficiency and quality of eye care services, creating dissatisfaction with the provision of care. Disadvantaged patients in urban areas are also isolated due to poverty, social conditions, ethnic discrimination, prejudice, cultural ethics and religion, especially Māori, Pacific people and people with lower socioeconomic status, who experience highly inequitable health outcomes.

New Zealand ophthalmology challenges
Our eye healthcare is challenged with offering equitable and efficient eye care at a sustainable cost. The Eye Health Workforce Service Review established the need to create a clinical eye network for integrating New Zealand’s clinical health services at the primary, secondary and tertiary levels. To increase access to health services, optimise workforces and develop innovative eye health roles, eye health screening should be standardised.

The way to improve our eye and vision healthcare is to integrate healthcare professionals’ services into the ophthalmologists’ practices. By offering devices to obtain and share clinical data between eye health professionals, we can deliver an optimised service to the community. New Zealand is continuously improving, and has some pioneer experiences.

What is teleophthalmology?
Teleophthalmology is the use of telecommunication and information services to remotely deliver eye healthcare. This includes telephone consultation, live video-conferencing, telemonitoring and mobile healthcare.

There are three main modalities of teleophthalmology. (1) Store and forward technology is the most common. Images and documents are taken and forwarded to the ophthalmologist for review. For example, an ophthalmologist reviews slit lamp or retina images. (2) Real-time telemedicine offers video consultation in real time, similarly to an in-person office visit. (3) Remote monitoring allows a distant follow-up.

Teleophthalmology helps with screening, diagnosing and monitoring patients, and includes, among others: (1) acute services: triage, diagnosis and treatment; (2) monitoring and follow-up on some conditions; (3) offering explanations to patients; (4) eye screening services.

A web-based application allows the user to remotely send information (eg, retinal images and patient data). Telehealth options must be implemented properly to minimise security risks. The software communication structure guarantees the protection of the data, which are secured and encrypted. The data are anonymised and they are reviewed by an ophthalmologist who looks for signs of pathology and decides the management. Analysed images and reports are forwarded to the user. Teleophthalmology can screen, refer, and monitor patient eye care while focusing on patient needs. There are different platforms available that can integrate with existing platforms for coordination with the hospital.

Teleophthalmology evidence
There is a high level of agreement between optometrists who use teleophthalmology and conventional examination. The agreement can be as high as 100% in retina disorders such as diabetic retinopathy and age-related macular degeneration, and agreement can be above 87% in cases of glaucoma. The implementation of teleophthalmology services may decrease the number of referrals to a hospital-based eye services by 40%, and the actual benefits may vary depending on a large number of factors.

Teleophthalmology could lead to significant savings in time and travel expenses. In a pilot study connecting hospital ophthalmologists with optometrists, 96%
of patients were satisfied, mainly because of a reduction in travel (96%), cost (92%) and time (92%). In addition to the eye care application, advantages of digital imaging systems include short examination time, electronic medical images and the ability of non-ophthalmologists to screen for eye diseases. Teleophthalmology provides secondary specialist advice in the diagnosis and management of difficult cases. It also supports real-time tele-mentoring and -teaching. The economic analysis supports the evidence of the cost-effectiveness of teleophthalmology for diabetic retinopathy and glaucoma. Increasing screening could improve accessibility, especially for rural and remote populations.

The impact of eye diseases
Loss of vision has a devastating effect on daily life. It is difficult to perform basic physical and social tasks and complicates the management of other conditions. Depression is 3.5 times higher in people with moderate to severe vision loss, and dementia progresses more rapidly. Loss of vision increases the risk of falls, multiples the risk of fractures by 2.5 times, creates dependence and causes 4.23 times more admissions in nurse homes.

In New Zealand, we have 173,766 New Zealanders suffering from vision loss. The disability’s healthcare costs are $523 million in total, or $3,008 per person. Most vision loss is preventable or treatable. The most common causes of blindness in New Zealand are macular degeneration (48%) and glaucoma (16%). Eighty percent (80%) of blindness is treatable and/or preventable, according to the World Health Organization. Strategies for restoring sight and preventing blindness are among the most cost-effective healthcare interventions worldwide.

Limitations
Improvements in technology-based services have decreased connectivity problems and storage limitations. Nevertheless, there are important limitations. The cost of ophthalmic imaging equipment and hardware can be prohibitive, and the spending may be inefficient. Also, teleophthalmology in the outpatient setting relies on the coordination of services to benefit from the evaluation. The current structures are already overburdened to perform additional tasks and ensure patient compliance with recommendations.

Medical perspectives must adapt to teleophthalmology services. The evaluations can be difficult; 59% of ophthalmologists reported low confidence when making decisions based only on images. The follow-up of chronic conditions can be complicated. Also, medical liability is a reason for concern.

Successful application of teleophthalmology requires the development of efficient structures and consistent training of the involved personnel. Improving image processing and integration of patient’s medical care teleophthalmology may improve results.

Conclusions
Telemedicine has the potential to increase access to care, decrease costs and improve adherence to evidence-based protocols. Teleophthalmology may optimise the referrals and help to offer a more efficient service on time. Properly implemented, we anticipate perhaps a 40% decrease in the number of referrals to public ophthalmology services in New Zealand, which would improve the workflow in ophthalmology departments of public hospitals by about 20%. Connectivity solutions can help offer better eye healthcare by exploiting the benefits of teleophthalmology for remotely screening, referring and monitoring patients and integrating the services provided by eye health professionals. Now is the moment to implement innovations so as not to leave anyone behind. As remote consultations become available, healthcare organisations and clinicians will have to re-evaluate traditional care delivery models while still ensuring that evidence-based protocols improve outcomes.
Competing interests:
Ruth Large declares: I am the Chair of the New Zealand Telehealth Leadership Group, which is advisory to the Ministry of Health unrelated to decisions regarding funding. I am the Chief Clinical Officer for Whakarongorau Aotearoa (formerly known as Homecare Medical), which supplies the Ministry of Health contracted services, such as Healthline, COVID line and 1737. There are no direct relationships to ophthalmology service supply in either of these two roles.

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COVID-19 serology: use and interpretation in New Zealand

Gary N McAuliffe, Timothy K Blackmore

ABSTRACT
Serology is now a well-established diagnostic tool for the diagnosis of COVID-19 infections in New Zealand. Using local and international experience, we provide an overview of serological response to infection and vaccination as well as the use and interpretation of antibody tests in our setting. We also discuss the potential future role of post-vaccination serology testing as a correlate of immunity. We conclude that, given the pitfalls of testing, clinical microbiologist advice is necessary for interpretation of high-consequence cases.

Nucleic acid amplification tests (NAAT), such as reverse transcriptase PCR or transcription-mediated amplification, are the most widely used tests in New Zealand for the diagnosis of acute COVID-19 infections. But serology, which detects an immune response to past SARS-CoV-2 infections or vaccination, is also now well established as a diagnostic tool.

Several types of tests are used in New Zealand diagnostic laboratories, including plate-based enzyme-linked immunosassays (ELISAs), which are labour intensive but suit low-throughput testing scenarios, and chemiluminescent assays, which are performed on higher-throughput machines with a faster sample to answer time.

New Zealand has a very low prevalence of COVID-19, and therefore, in contrast to serology tests performed in diagnostic laboratories, point-of-care or lateral flow tests have suboptimal sensitivity and specificity in our setting; since April 2020, importation of these devices has been restricted.

Serological response to infection
Following SARS-CoV-2 infection, antibodies are produced against various viral proteins including the receptor-binding domain (RBD) of the spike (S) protein and to nucleocapsid (N) (Figure 1). This antibody response involves IgA, IgM and IgG, which are detectable concurrently, and in some individuals as early as 0–5 days after symptom onset. As IgM appears around the same time as IgG and may persist for months, it is not reliable as a marker of acute versus past infection.

Antibody tests used in New Zealand’s diagnostic laboratories generally perform well for the detection of past infection, demonstrating sensitivities >90% by 14 days after onset of symptoms and specificities >99%. Antibodies wane over time and appear to decline more rapidly to different antigens, with only 54% of individuals still positive for anti-N compared with 96% to anti-S in a New Zealand cohort at or more than 125 days after infection. The strength and duration of the immune response is quite variable between individuals and also differs according to severity of disease.

Depending on the antigen to which the antibodies bind, they may be either neutralising or non-neutralising. In the case of SARS-CoV-2, antibodies to the RBD/spike are most likely to be neutralising and protective against subsequent symptomatic infection.

In New Zealand, COVID-19 serology is not centrally funded but may be funded for selected patients by district health boards. Approval for testing is usually determined by the clinical microbiologist overseeing the testing laboratory. Use is primarily as part of public health investigations, where it can confirm past infections in NAAT-negative individuals or when using paired acute and convalescent sera to differentiate acute from past infection in NAAT-positive/antibody-negative individuals. There are some countries
that require pre-departure serology testing as part of their entry requirements; this testing is undertaken as a fee for service by certain New Zealand laboratories.

Given the very low prevalence of past COVID-19 infection in the general population outside managed isolation facilities (MIF), the positive predictive value of a positive antibody test varies widely between these populations. For example, a positive pre-departure IgM has a positive predictive value approaching zero, whereas a positive total antibody from MIF is highly likely to be a true positive. Consequently, confirmation of a positive antibody result by testing on a second assay is warranted in some situations but unnecessary in others.

The pitfalls of interpretation of serology in the New Zealand context mean that discussion with a clinical microbiologist is required prior to testing for other indications, such as diagnosis of complications of COVID-19 (eg, myocarditis), and also for any positive or negative results that may have individual or public health consequence.

Serological response to vaccination
Vaccines produce an immune response against specific viral proteins, and an immunological response to vaccination can only be detected if laboratories test for these specific antibodies. For example, an individual receiving the Pfizer-BioNTech vaccine produces neutralising antibodies directed against the RBD of the S protein and will test positive for anti-S but negative for anti-N unless the individual has also had natural infection (Table 1). Some inactivated virus vaccines in use outside New Zealand (eg, Sinopharm) are expected to give a response that may include anti-N.

Preliminary studies post Pfizer-BioNTech vaccination have shown a crude correlation between positive results for anti-RBD or anti-S and neutralising antibody production. However, at this stage, the level of antibody required for immunity is not known; quantitative values between different manufacturers are highly variable; and the longevity of antibody response (and protection) is unclear.

Role of serology in assessing immunity
With these factors in mind, serology is not currently recommended to assess for immunity to COVID-19 in a vaccinated person, or to assess the need for vaccination in an unvaccinated person (for those with

Figure 1: Schematic representation of SARS-CoV-2 structure.
prior COVID-19 infection, vaccination is recommended). This may change in the future as correlates of immunity become clearer; studies looking at this are underway. New quantitative assays to detect anti-S antibodies have become available and may be useful for measuring contemporaneous immunity, but formal studies of correlates of protection are awaited.\(^4\) Dependent on these findings, future applications of serology may include testing antibody levels in certain groups after vaccination, after a COVID-19 exposure event in others, or for allowing risk-stratified quarantine decisions to be made by confirming vaccination or immunity status in travellers.

**Other immune responses to vaccination or infection**

T-cell immunity is likely to play an important role, but at present there are no commercially available or easily standardisable assays. It appears that seroconversion is associated with the development of cellular immunity, but the relative contributions of humoral and cellular immunity are unclear at present.\(^7\)

**Summary**

COVID-19 serology is currently available in diagnostic laboratories in New Zealand as a test that requires microbiologist approval. Testing may provide useful information in public health investigations or select cases of post-infectious complications and is necessary for overseas travel to some destinations. However, test reliability varies substantially according to the testing scenario. Depending on the available tests, vaccine response and natural infection can be differentiated, but the role of post-vaccination serology testing as a correlate of immunity has not yet been determined. We conclude that, given the pitfalls of testing, clinical microbiologist advice is necessary for interpretation of high-consequence cases.

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**Table 1:** Antibody response to infection or Pfizer-BioNTech vaccine.

<table>
<thead>
<tr>
<th></th>
<th>Anti-S</th>
<th>Anti-N</th>
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</thead>
<tbody>
<tr>
<td>Natural infection</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Pfizer-BioNTech vaccine response</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Prior natural infection and post-Pfizer-BioNTech vaccine</td>
<td>+</td>
<td>+ (-)*</td>
</tr>
</tbody>
</table>

Legend: *anti-N may wane faster than anti-S, and with time some infected individuals may test negative.
Competing interests:
Nil.

Acknowledgements:
Thanks to all the clinicians, scientists and researchers in New Zealand who have contributed to knowledge and discussion on this topic.

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Dangers of a single pellet
Jeong Ha, Olga Korduke, Megan Rodney, Peter Stiven

A 21-year-old man was brought in with a shotgun wound centred at the right upper thigh. He was agitated with cool peripheries. His clothing and a sheet were soaked with blood. Although his heart rate was elevated at 110bpm, he was normotensive with systolic blood pressure of 115mmHg. There was an open wound over the right medial thigh with ongoing exsanguination. A tight compression bandage was applied to the right thigh for haemostasis. The right dorsalis pedis pulse was palpable, though there appeared to be no movement and only patchy sensation below the knee. The abdomen was soft and seemingly non-tender. FAST scan of the abdomen was negative.

X-ray of the hip and pelvis showed multiple gunshot pellets in the right thigh, four pellets in the left thigh and a single pellet in the pelvis.

CT angiogram showed no major vascular injury of lower limbs. No comment was made regarding the intra-abdominal shotgun pellet, though this is visible in retrospect. The patient was taken to the operating theatre for exploratory and damage control surgery in co-operation with orthopaedic colleagues. The right thigh was debrided of all non-viable tissue. The path of damage extended to subcutaneous tissues on the contralateral side. Extensive injury to the adductor muscles was noted. The sciatic nerve was observed and intact, though this was difficult to verify.

We then performed a diagnostic laparoscopy in light of the single pellet evident on imaging. This demonstrated gas bubbles under the omentum, fibrin deposits and turbid fluids in the pelvis. A small amount of blood was evident in the left iliac fossa, suggesting the site of penetration. We converted to laparotomy to further examine the intra-abdominal contents. Five perforation sites were found in the small bowel; two loops of bowel had through-and-through perforations and the fifth perforation had a shotgun pellet still lodged within. There was a partial left bladder wall injury, near the entry site. The small bowel perforation sites and the bladder were suture repaired.

Discussion
Selective non-operative management for penetrating abdominal gunshot wounds is becoming an accepted alternative to the more traditional mandatory laparotomy.1

Figure 1: X-ray of pelvis and hip.

Figure 2: A coronal view CT angiogram of lower abdomen and thigh.
Patients with hemodynamic stability and benign abdominal findings may be kept for serial observation and have similar overall mortality outcome. However, these studies were mostly conducted in level 1–2 trauma centres in North America with high volumes of penetrating injuries related to firearms. In the rural New Zealand hospital setting, the infrequency of these cases and lack of resources after hours may lead to worse outcomes with a conservative approach. Furthermore, in our case a significant distracting injury was present, with a degree of hypovolaemic shock, making a conservative approach inappropriate. Australasian recommendations continue to lean towards laparotomy. The rate of significant intra-abdominal injury can be as high as 98% when peritoneal penetration is present and gunshot wound with a transperitoneal trajectory alone is a recommended indication for laparotomy. Although the trauma guideline from Victoria, Australia recognises that serial physical examination may be a reliable approach to detect a significant injury, this is only in an alert and orientated patient without distracting injuries.

**Conclusion**

While it remains an uncommon presentation, recent figures suggest gun violence in New Zealand may be on the rise. The challenge specific to managing shotgun injury is the wide field of damage caused by multiple pellets. It is easy to overlook a single pellet when assessing a patient with distracting injuries. However, a single pellet is capable of causing significant injuries. A clinician should be vigilant and wary of a stray innocuous appearing single pellet.

**Competing interests:**
Nil.

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Notes on a Case of “Brodie’s Abscess” or “Circumscribed Abscess” of the Lower End of the Left Femur

1921

The patient, R.A., a boy of fifteen years, was admitted to Dr. Cooper’s private hospital, Eltham, complaining of pain in the lower end of the left femur. The pain was “boring” in character, worse at night, and latterly prevented him from getting sleep.

He gave the following history:—Was an in-patient of the Wanganui Hospital for about twelve months (1916–1917), with an acute osteo-myelitis of the left femur, in the lower third of the shaft. He had a metastasis in the right humerus and still has a sinus there. No sinus was present over the femur—only a four-inch operation scar on its outer aspect, about a hand’s breadth above the knee-joint.

While under observation here he ran no temperature, and his pulse was normal. The examination showed definite tenderness on palpation all round the lower end of the left femur, and the shaft was expanded and thickened in the same situation. Part of this expansion may have been due to the previous osteo-myelitis, but as the pain was becoming much worse an abscess of the bone was suspected. There was no discoloration of the skin, and no history of a recent injury.

Operation under general anesthesia (C.E. and open ether).—A four-inch incision, a hand’s breadth above the knee-joint, was made on the outer aspect of the limb over the site of the former operation, and the scar excised. There was some little difficulty in defining the interval between the vastus externus and the biceps, owing to the scar of the previous operation. The muscles being retracted, the tissues near the bone were very oedematous, and a thin serous fluid exuded from the periosteum when it was incised. There was no subperiosteal abscess, and the periosteum separated easily. With a gouge the medullary cavity was opened over the site of the greatest oedema, and a circular opening, half an inch in diameter, made down into the medulla of the bone. There was free oozing of blood-stained fluid through this cavity, but no pus was found. On introducing a probe bent at a right angle, it could be easily passed down the medulla towards the epiphyseal line, but its upward passage was barred by a bridge of sclerosed bone. Bearing in mind that localised abscess is usually surrounded by dense bone, another opening was then made into the shaft of the bone, about one inch above the previous one. A small circumscribed abscess was opened, which contained about half a drachm of thick, yellowish pus. The abscess cavity was completely surrounded by dense, sclerosed bone, and lined with a thin granulation tissue, which was removed by curetting. No sequestrum was found in the cavity. The abscess cavity was swabbed out with ungt. bipp. and packed with iodoform gauze, and the wound closed in the usual manner below the drain. When the patient was seen later on in the day, he said that he was absolutely free from pain. No X-ray plate was taken before the operation.

This case illustrates well the condition of relapsing osteomyelitis, with chronic abscess formation, and shows how easily it would be to miss a small abscess, unless the bone

T

Notes on a Case of “Brodie’s Abscess” or “Circumscribed Abscess” of the Lower End of the Left Femur

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He gave the following history:—Was an in-patient of the Wanganui Hospital for about twelve months (1916–1917), with an acute osteo-myelitis of the left femur, in the lower third of the shaft. He had a metastasis in the right humerus and still has a sinus there. No sinus was present over the femur—only a four-inch operation scar on its outer aspect, about a hand’s breadth above the knee-joint.

While under observation here he ran no temperature, and his pulse was normal. The examination showed definite tenderness on palpation all round the lower end of the left femur, and the shaft was expanded and thickened in the same situation. Part of this expansion may have been due to the previous osteo-myelitis, but as the pain was becoming much worse an abscess of the bone was suspected. There was no discoloration of the skin, and no history of a recent injury.

Operation under general anesthesia (C.E. and open ether).—A four-inch incision, a hand’s breadth above the knee-joint, was made on the outer aspect of the limb over the site of the former operation, and the scar excised. There was some little difficulty in defining the interval between the vastus externus and the biceps, owing to the scar of the previous operation. The muscles being retracted, the tissues near the bone were very oedematous, and a thin serous fluid exuded from the periosteum when it was incised. There was no subperiosteal abscess, and the periosteum separated easily. With a gouge the medullary cavity was opened over the site of the greatest oedema, and a circular opening, half an inch in diameter, made down into the medulla of the bone. There was free oozing of blood-stained fluid through this cavity, but no pus was found. On introducing a probe bent at a right angle, it could be easily passed down the medulla towards the epiphyseal line, but its upward passage was barred by a bridge of sclerosed bone. Bearing in mind that localised abscess is usually surrounded by dense bone, another opening was then made into the shaft of the bone, about one inch above the previous one. A small circumscribed abscess was opened, which contained about half a drachm of thick, yellowish pus. The abscess cavity was completely surrounded by dense, sclerosed bone, and lined with a thin granulation tissue, which was removed by curetting. No sequestrum was found in the cavity. The abscess cavity was swabbed out with ungt. bipp. and packed with iodoform gauze, and the wound closed in the usual manner below the drain. When the patient was seen later on in the day, he said that he was absolutely free from pain. No X-ray plate was taken before the operation.

This case illustrates well the condition of relapsing osteomyelitis, with chronic abscess formation, and shows how easily it would be to miss a small abscess, unless the bone
suspected is explored in all directions.

I have to thank Dr. H. A. Cooper, of Eltham, who performed the operation, for permission to publish the notes of this case.

Dr. Cooper adds the following points of interest:—(1) The sudden exacerbation of the patient's symptoms after the long quiescent period of five years. (2) The small amount of pus in its confined space, giving rise to such acute symptoms. (3) The complete obliteration of the medullary canal, with a considerable increase in the girth of the bone. (4) The importance of carefully exploring the bone when symptoms point to a bone infection, more especially when an acute periostitis is exposed. In this particular case the abscess could quite easily have been missed, the case diagnosed as one of acute localised periostitis, and the patient sent back to bed without any relief from his symptoms. When a probe could not be passed up the shaft of the femur, in the medullary canal, it was surmised that the opening had been made below the abscess. The second opening proved this to be so. (5) The almost immediate relief of pain when the abscess was opened.

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